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The state-of-the-art of preconditioners for sparse linear least-squares problems: the complete results

NIM Gould, JA Scott

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The state-of-the-art of preconditioners for sparse linear least-squares problems: the complete results

Nicholas I. M. Gould[1] and Jennifer A. Scott[1]

ABSTRACT

We provide complete results for our companion paper (N. I. M. Gould and J. A. Scott, "The state-of-the-art of preconditioners for sparse linear least-squares problems", Preprint RAL-P-2015-010), in which preconditioned iterative and direct methods are used to solve sparse linear least-squares problems.

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[1] Scientific Computing Department, Rutherford Appleton Laboratory,
Chilton, Oxfordshire, OX11 0QX, UK.
nick.gould@stfc.ac.uk and jennifer.scott@stfc.ac.uk.
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26 October 2015

1 Introduction

In our companion paper (N. I. M. Gould and J. A. Scott, "The state-of-the-art of preconditioners for sparse linear least-squares problems", Preprint RAL-P-2015-010) we consider using a variety of direct and iterative methods to solve a set of sparse linear least-squares problems. In this report, we provide complete data and results from which the performance profiles in the main paper are built.

The problem we are solving is the linear least-squares problem,

$$\min_x \|b - Ax\|_2,$$

where $A \in \mathbb{R}^{m \times n}$ is large and sparse and $b \in \mathbb{R}^m$. In our tests, the matrix A is always cleaned (that is, null rows and/or columns are removed). If after such removal the resulting "cleaned" matrix has more columns than rows, it is transposed (so that $m \geq n$ is satisfied). In the following tables, m, n and $nz(A)$ are the row and column counts and the number of nonzeros in (the cleaned) A. The estimated deficiency in the rank of the cleaned matrix as computed by the sparse direct solver `HSL_MA97` is the reported "nullity" and "density" is the largest ratio of the number of nonzeros in a row to n over all rows. A $-$ denotes we were unable to compute the statistic. The columns headed "iter" and "time" give the numbers of iterations taken and the elapsed time (in seconds) required to achieve the required accuracy (as discussed in Section 2.2 of the main paper). $\|r\|$ is the computed value of the Euclidean norm of the residual $r = Ax - b$.

A status value of 0 indicates that the run was successful; the meanings of other non-zero status values are as follows:

9: error returned when computing an ordering (`HSL_MA97` only).

10: error returned when computing the preconditioner (or factorization).

15: too much additional space to store vectors for reorthogonalization (`HSL_MI30` with GMRES only).

16: the preconditioned system is reportedly too ill conditioned to solve.

17: the residuals are clearly wrong (occurs only for the solver SPQR).

18: the iteration limit of 100,000 has been reached.

19: the elapsed time limit of 600 seconds has been reached.

2 Complete test set results

In Table 2.1, we provide statistics for the performance of LSQR and in Tables 2.2 to 2.5 for LSMR with the re-othogonalization parameter `localsize` set to 0, 10, 100 and 1000. No preconditioning is used and the results are for our complete set of 921 CUTEst and UF Sparse Matrix Collection examples. Any problem whose elapsed time using LSMR(10) exceeds 10 seconds or that reaches the 100,000 iteration limit will be included in the subset of "difficult" problems for the subsequent experiments, and is flagged by (S); exceptionally, only single members of the similar `DELF0*` and `LARGE0*` classes are included, while `beause` `c8_mat11_I` and `f855_mat9_I` are removed as they very closely resemble `beaflw` `c8_mat11` and `f855_mat9`.

Table 2.1: Complete LSQR results for all problems with no preconditioning.

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
CUTEst examples									
25FV47	1876	820	10705	1	0.0256	2.0432E+01	5536	0.58	0
80BAU3B	11934	2262	23264	0	0.0053	8.2705E+01	134	0.04	0
AA01	8904	823	72965	15	0.0182	1.9002E+01	280	0.16	0
AA03	8627	825	70806	25	0.0206	1.9090E+01	292	0.16	0
AA3	8627	825	70806	27	0.0206	1.9090E+01	292	0.17	0
AA4	7195	426	52121	10	0.0329	1.5866E+01	174	0.07	0
AA5	8308	801	65953	22	0.0187	1.8653E+01	275	0.14	0
AA6	7292	646	51728	14	0.0217	1.6804E+01	216	0.09	0
ADLITTL2	138	56	424	0	0.1964	7.3997E+00	57	0.00	0
ADLITTLE	138	56	424	0	0.1964	7.3997E+00	57	0.00	0
AFIRO	51	27	102	0	0.1481	5.2189E+00	22	0.00	0
AFIROE	24	8	34	0	0.2500	4.1055E+00	9	0.00	0
AGG	615	488	2862	0	0.0881	1.1455E+01	166	0.01	0
AGG2	758	516	4740	0	0.0833	1.3214E+01	165	0.01	0
AGG3	758	516	4756	0	0.0833	1.3214E+01	208	0.01	0
AIR02	6774	50	61555	0	0.3400	1.5416E+01	30	0.02	0
AIR03	10757	124	91028	0	0.1129	1.7479E+01	176	0.12	0
AIR04	8904	823	72965	23	0.0182	1.9002E+01	280	0.16	0
AIR05	7195	426	52121	11	0.0329	1.5866E+01	174	0.07	0
AIR06	8627	825	70806	30	0.0206	1.9090E+01	292	0.16	0
AIR	7517	3754	20267	0	0.2001	8.6603E+01	18	0.00	0
ALLINLP	687500	250000	687500	0	0.0000	7.0711E+02	3	0.05	0
BANDM	472	305	2494	0	0.0721	9.8785E+00	2274	0.06	0
BAS1LP (S)	9825	5411	587775	0	0.0675	5.5447E+01	20226	83.72	0
BAXTER (S)	30733	27441	111576	2993	0.0017	-	>100000	>127.35	18
BCDOUT (S)	7078	5412	67344	2	0.1554	-	>100000	>59.55	18
BEACONFD	295	173	3408	0	0.1561	5.5647E+00	239	0.01	0
BGDBG1	629	348	1662	0	0.0460	1.9660E+01	38	0.00	0
BGETAM	816	400	2537	0	0.0200	1.6322E+01	909	0.03	0
BGINDY	10880	2671	66266	0	0.0060	3.6010E+01	347	0.20	0
BGPRTR	40	20	70	0	0.2000	3.1175E+00	21	0.00	0
BLEND	114	74	522	0	0.2162	6.0635E+00	176	0.00	0
BNL1	1586	642	5532	1	0.0125	2.0313E+01	1577	0.10	0
BNL2	4486	2324	14996	0	0.0034	3.7869E+01	4017	0.66	0
BOEING1	726	351	3827	0	0.0912	1.3035E+01	1001	0.04	0
BOEING2	305	166	1358	0	0.1386	7.3877E+00	317	0.01	0
BORE3D	334	233	1448	2	0.1202	8.0347E+00	972	0.02	0
BOX1	261	231	651	1	0.0216	1.5955E+01	29	0.00	0
BRANDY	303	193	2202	27	0.1503	8.7556E+00	652	0.02	0
CAPRI	482	271	1896	0	0.0923	1.3828E+01	1107	0.03	0
CAR4	33052	16384	63724	0	0.0067	1.8158E+02	5	0.00	0
CARI	1200	400	152800	0	0.9500	2.8997E+01	2	0.00	0
CEP1	4769	1521	8233	0	0.1440	6.1852E+01	13	0.00	0
CERIA3D	4400	3576	21178	0	0.2704	3.0961E+01	66	0.02	0
CH	8291	3700	24102	0	0.0038	5.7926E+01	943	0.24	0
CHEMCOM	744	288	1590	0	0.0208	1.8078E+01	29	0.00	0
CO5	12325	5774	57993	0	0.0048	6.5536E+01	22952	12.90	0
CO9 (S)	22924	10789	109651	0	0.0026	8.9188E+01	42116	44.54	0
COMPLEX	1408	1023	46463	0	0.5005	3.1883E+01	7	0.00	0
CONT1	161589	160792	521181	-	0.5025	4.0197E+02	10	0.08	0
CONT11	201587	160792	521181	0	0.0000	3.0775E+02	12	0.09	0
CONT11_L (S)	1961394	1468599	5382999	0	0.0000	8.0916E+02	3523	257.46	0
CONT1_L	1921596	1918399	7031999	-	0.6672	1.3862E+03	4	0.38	0
CONT4	161589	160792	519589	-	0.5025	4.0197E+02	10	0.07	0
CPLEX1	5224	3005	10947	0	0.4995	4.6078E+01	91	0.01	0
CPLEX2	378	224	1215	0	0.0357	2.5454E+00	107	0.00	0
CQ5	11748	5048	51571	0	0.0048	6.1448E+01	2607	1.32	0
CQ9	21534	9278	96653	0	0.0026	8.3008E+01	3246	3.01	0
CR42	1513	905	6614	0	0.3337	3.8739E+01	28	0.00	0

Table 2.1: Complete LSQR results for all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
CRE_A_PRE	6382	2684	15739	1	0.0060	5.2407E+01	12204	2.30	0
CRE_B_PRE	36222	5176	111434	2	0.0033	8.4734E+01	13657	14.73	0
CRE_C_PRE	5293	2257	13078	1	0.0062	4.9627E+01	11580	1.84	0
CRE_D_PRE	28489	3990	86144	2	0.0043	7.5197E+01	18110	15.21	0
CREW1	6469	135	46950	0	0.1185	4.7500E+00	64	0.02	0
CYCLE	3371	1890	21234	28	0.0148	-	>100000	>21.51	18
CZPROB	3562	929	10708	0	0.0043	3.3275E+00	90	0.01	0
D2Q06C (S)	5831	2171	33081	0	0.0157	3.4934E+01	91445	29.27	0
D6CUBE	6184	404	37704	11	0.0248	2.8696E+01	159	0.05	0
DANO3MIP	15851	3202	81633	0	0.1952	3.6615E+01	2625	1.87	0
DBIC1	226317	43200	1081843	0	0.0009	2.2467E+02	538	6.71	0
DBIR1 (S)	45775	18804	1077025	103	0.0119	1.6711E+02	1974	16.33	0
DBIR2 (S)	45877	18906	1158159	101	0.0123	-	>67929	>600.00	19
DE063155	1596	852	4913	0	0.0141	3.7897E+01	17687	0.92	0
DE063157	1656	936	5119	0	0.0128	4.0603E+01	13	0.00	0
DE080285	1656	936	5082	0	0.0128	-	>100000	>5.39	18
DEGEN2	757	444	4201	0	0.0495	8.7769E+00	249	0.01	0
DEGEN3	2604	1503	25432	0	0.0326	1.9246E+01	1042	0.22	0
DEGENLPA	20	15	82	0	0.4000	8.1996E-01	27	0.00	0
DEGENLPB	20	15	82	0	0.4000	8.1996E-01	27	0.00	0
DEGME	659415	185501	8127528	0	0.0001	3.4604E+02	30	2.20	0
DELF000 (S)	5543	3128	13741	0	0.0029	-	>100000	>15.61	18
DELF001	5514	3098	14322	0	0.0032	-	>100000	>15.86	18
DELF002	5549	3135	14432	0	0.0032	-	>100000	>16.08	18
DELF003	5478	3065	14343	0	0.0033	-	>100000	>15.98	18
DELF004	5558	3142	14696	0	0.0032	-	>100000	>16.28	18
DELF005	5519	3103	14605	0	0.0032	-	>100000	>16.12	18
DELF006	5563	3147	14754	0	0.0032	-	>100000	>16.29	18
DELF007	5555	3137	14898	0	0.0032	-	>100000	>16.43	18
DELF008	5566	3148	14971	0	0.0032	-	>100000	>16.43	18
DELF009	5554	3135	14888	0	0.0032	-	>100000	>16.35	18
DELF010	5566	3147	14952	0	0.0032	-	>100000	>16.49	18
DELF011	5553	3134	14915	0	0.0032	-	>100000	>16.48	18
DELF012	5570	3151	14948	0	0.0032	-	>100000	>16.47	18
DELF013	5535	3116	14928	0	0.0032	-	>100000	>16.59	18
DELF014	5586	3170	15036	0	0.0032	-	>100000	>16.64	18
DELF015	5573	3161	14951	0	0.0032	-	>100000	>16.59	18
DELF017	5587	3176	14904	0	0.0031	-	>100000	>16.43	18
DELF018	5604	3196	14963	0	0.0031	-	>100000	>16.50	18
DELF019	5592	3185	14939	0	0.0031	-	>100000	>16.53	18
DELF020	5616	3213	15270	0	0.0031	-	>100000	>16.69	18
DELF021	5610	3208	15263	0	0.0031	-	>100000	>16.67	18
DELF022	5616	3214	15260	0	0.0031	-	>100000	>16.65	18
DELF023	5616	3214	15298	0	0.0031	-	>100000	>16.66	18
DELF024	5610	3207	15656	0	0.0034	-	>100000	>17.03	18
DELF025	5608	3197	15647	0	0.0034	-	>100000	>17.03	18
DELF026	5606	3190	15420	0	0.0031	-	>100000	>16.85	18
DELF027	5601	3187	15400	0	0.0031	-	>100000	>16.82	18
DELF028	5596	3177	15602	0	0.0035	-	>100000	>17.01	18
DELF029	5598	3179	15602	0	0.0035	-	>100000	>16.95	18
DELF030	5613	3199	15462	0	0.0034	-	>100000	>16.87	18
DELF031	5599	3176	15405	0	0.0035	-	>100000	>16.72	18
DELF032	5611	3196	15451	0	0.0034	-	>100000	>16.80	18
DELF033	5595	3173	15400	0	0.0035	-	>100000	>16.88	18
DELF034	5594	3175	15403	0	0.0035	-	>100000	>16.74	18
DELF035	5607	3193	15479	0	0.0034	-	>100000	>16.82	18
DELF036	5598	3170	15397	0	0.0035	-	>100000	>16.68	18
DETER0	5468	1923	11173	0	0.0099	5.7052E+01	207	0.03	0
DETER1	15737	5527	32187	0	0.0096	9.8357E+01	318	0.11	0
DETER2	17313	6095	35731	0	0.0133	1.0199E+02	284	0.11	0
DETER3	21777	7647	44547	0	0.0095	1.2196E+02	340	0.17	0

Table 2.1: Complete LSQR results for all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
DETER4	9133	3235	19231	0	0.0219	7.4270E+01	175	0.04	0
DETER5	14529	5103	29715	0	0.0096	9.8117E+01	285	0.10	0
DETER6	12113	4255	24771	0	0.0096	8.9066E+01	268	0.07	0
DETER7	18153	6375	37131	0	0.0096	1.1073E+02	329	0.14	0
DETER8	10905	3831	22299	0	0.0097	8.4952E+01	246	0.06	0
DF2177	10358	630	22336	0	0.0127	5.4305E+01	10	0.00	0
DFL001	12230	6071	35632	0	0.0023	5.5173E+01	853	0.44	0
DISP3	3990	2182	8541	0	0.0027	4.6507E+01	50	0.01	0
DSBMIP	2667	1182	8156	0	0.0068	2.6846E+01	1541	0.14	0
E18	38601	24617	156466	0	0.0040	1.1944E+02	15	0.02	0
E226	472	223	2768	0	0.0942	1.3971E+01	618	0.02	0
ETAMACRO	816	400	2537	0	0.0200	1.6322E+01	893	0.03	0
EX2STA1	17516	17443	68779	0	0.0026	3.5780E+00	5252	3.91	0
EX72A	215	197	467	1	0.0152	1.3687E+01	97	0.00	0
EX73A	211	193	457	1	0.0155	1.3619E+01	95	0.00	0
FARM	17	7	41	0	0.5714	2.6080E+00	10	0.00	0
FFFFF800	1028	524	6401	0	0.0954	1.0663E+01	8385	0.48	0
FINNIS	1064	497	2760	0	0.0282	2.1406E+01	306	0.01	0
FIT1D	1049	24	13427	0	0.7500	3.0717E+01	55	0.01	0
FIT1P	1677	627	9868	0	1.0000	4.0153E+01	80	0.01	0
FIT2D	10524	25	129042	0	0.6800	1.0026E+02	51	0.05	0
FIT2P	13525	3000	50284	0	1.0000	1.1051E+02	72	0.04	0
FOME11	24460	12142	71264	0	0.0012	7.8027E+01	845	0.87	0
FOME12	48920	24284	142528	0	0.0006	1.1035E+02	846	1.75	0
FOME13	97840	48568	285056	1	0.0003	1.5605E+02	853	3.61	0
FOME20	108175	33798	232647	77	0.0001	8.8731E+01	313	1.00	0
FOME21	216350	67596	465294	152	0.0000	1.2549E+02	313	2.17	0
FOREST	131	66	246	0	0.0455	5.8417E+00	19	0.00	0
FORPLAN	492	161	4634	0	0.2174	7.4845E+00	138	0.01	0
FXM2_16	7335	3900	32972	0	0.0092	5.0100E+01	1898	0.60	0
FXM2_6	2845	1520	12812	0	0.0158	3.1221E+01	1880	0.23	0
FXM3_16	85575	41340	392252	0	0.0009	1.7544E+02	1911	7.22	0
FXM3_6	12625	6200	57722	0	0.0039	6.6994E+01	1917	1.03	0
FXM4_6	47185	22400	265442	0	0.0011	1.4533E+02	1878	4.33	0
GALENET	14	8	22	0	0.2500	3.6515E+00	2	0.00	0
GAMS10A	171	114	407	0	0.0614	8.8742E+00	10	0.00	0
GAMS10AM	171	114	407	0	0.0614	8.1798E+00	10	0.00	0
GAMS30A	531	354	1287	0	0.0198	1.3857E+01	19	0.00	0
GAMS30AM	531	354	1287	0	0.0198	1.2209E+01	19	0.00	0
GAMS60AM	1071	714	2607	0	0.0098	1.6497E+01	29	0.00	0
GANGES	1706	1309	6937	0	0.0099	1.4580E+01	120	0.01	0
GAS11	860	459	2166	0	0.0261	1.7482E+01	38493	1.19	0
GE (S)	16369	10099	44825	0	0.0036	-	>100000	>57.61	18
GEN	2561	769	63086	0	0.0858	2.5015E+00	72	0.04	0
GEN1	2561	769	63086	0	0.0858	2.5015E+00	72	0.03	0
GEN2	3264	1121	81855	0	0.0937	1.6054E+00	67	0.04	0
GEN4	4298	1537	107103	0	0.0625	2.8739E+00	57	0.05	0
GFRD-PNC	1160	616	2445	0	0.0049	2.8248E+01	117	0.01	0
GOFFIN	101	50	2600	0	1.0000	9.8528E+00	2	0.00	0
GOSH	13455	3790	99953	2	0.0045	5.0199E+01	16556	13.38	0
GRAN	2604	2525	20111	471	0.0341	-	>100000	>16.91	18
GREENBEA	5598	2389	31070	3	0.0100	3.1909E+01	2241	0.68	0
GREENBEB	5598	2389	31070	3	0.0100	3.1909E+01	2241	0.69	0
GREENBEI	5596	2390	31074	3	0.0100	3.1810E+01	2371	0.72	0
GROW15	645	300	5620	0	0.0667	2.1646E+01	34	0.00	0
GROW22	946	440	8252	0	0.0455	2.5881E+01	36	0.00	0
GROW7	301	140	2612	0	0.1429	1.5322E+01	29	0.00	0
IIASA	3639	669	7317	0	0.0105	2.9786E+01	31	0.00	0
IPROB	3001	3001	9000	0	0.9997	4.2779E+01	4	0.00	0
ISRAEL	316	174	2443	0	0.7816	1.0905E+01	448	0.01	0
ITEST2	13	9	26	0	0.5556	3.1920E+00	6	0.00	0

Table 2.1: Complete LSQR results for all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
ITEST6	17	11	29	0	0.4545	3.6023E+00	10	0.00	0
JENDREC1	4228	2109	89608	0	0.9886	6.4699E+01	133	0.09	0
KARTED	133115	46502	1770349	0	0.0005	1.1284E+02	45	0.74	0
KB2	68	43	313	0	0.3256	5.7141E+00	110	0.00	0
KEN_07_PRE	2033	887	4354	0	0.0034	2.4960E+01	36	0.00	0
KEN_11_PRE	11984	5511	26538	3	0.0005	7.1971E+01	92	0.03	0
KEN_13_PRE	24818	10962	57238	18	0.0004	9.7208E+01	112	0.07	0
KEN_18_PRE	89439	39867	208594	1	0.0001	1.5484E+02	149	0.35	0
KENT	47920	31300	216010	0	0.0006	7.5567E+01	815	1.72	0
KL02	36699	71	212536	0	0.1127	1.2477E-06	44	0.07	0
KLEEMIN3	6	3	9	0	1.0000	1.4281E+00	4	0.00	0
KLEEMIN4	8	4	14	0	1.0000	1.4351E+00	5	0.00	0
KLEEMIN5	10	5	20	0	1.0000	1.4419E+00	6	0.00	0
KLEEMIN6	12	6	27	0	1.0000	1.4488E+00	7	0.00	0
KLEEMIN7	14	7	35	0	1.0000	1.5536E+00	4	0.00	0
KLEEMIN8	16	8	44	0	1.0000	3.8442E+00	2	0.00	0
KLEIN1	108	54	750	0	0.3889	8.3196E+00	208	0.00	0
KLEIN2	531	477	5062	0	0.3438	1.5237E+01	288	0.02	0
KLEIN3	1082	994	13101	0	0.2767	2.1013E+01	891	0.11	0
L30	16281	2701	52070	0	0.0030	1.2489E+02	233	0.11	0
L9	1483	244	4659	0	0.0328	3.7508E+01	84	0.00	0
LARGE000	7253	4239	18313	0	0.0024	6.1464E+01	69263	14.37	0
LARGE001 (S)	7176	4162	18887	0	0.0026	-	>100000	>21.03	18
LARGE002	7260	4249	20075	0	0.0028	-	>100000	>22.11	18
LARGE003	7216	4200	19717	0	0.0029	-	>100000	>21.85	18
LARGE004	7266	4250	19489	0	0.0028	-	>100000	>21.71	18
LARGE005	7256	4237	19314	0	0.0026	-	>100000	>21.61	18
LARGE006	7267	4249	19637	0	0.0026	-	>100000	>21.79	18
LARGE007	7255	4236	19595	0	0.0026	-	>100000	>21.75	18
LARGE008	7267	4248	19648	0	0.0026	-	>100000	>21.71	18
LARGE009	7256	4237	19617	0	0.0026	-	>100000	>21.74	18
LARGE010	7267	4247	19637	0	0.0026	-	>100000	>21.74	18
LARGE011	7256	4236	19617	0	0.0026	-	>100000	>21.70	18
LARGE012	7273	4253	19674	0	0.0026	-	>100000	>21.72	18
LARGE013	7265	4248	19688	0	0.0026	-	>100000	>21.83	18
LARGE014	7288	4271	19749	0	0.0026	-	>100000	>21.83	18
LARGE015	7278	4265	19717	0	0.0026	-	>100000	>21.77	18
LARGE016	7298	4287	19809	0	0.0026	-	>100000	>21.92	18
LARGE017	7288	4277	19754	0	0.0026	-	>100000	>21.92	18
LARGE018	7305	4297	19579	0	0.0026	-	>100000	>21.92	18
LARGE019	7304	4300	19574	0	0.0026	-	>100000	>21.89	18
LARGE020	7317	4315	19936	0	0.0025	-	>100000	>21.97	18
LARGE021	7313	4311	19952	0	0.0026	-	>100000	>21.99	18
LARGE022	7314	4312	19904	0	0.0026	-	>100000	>21.99	18
LARGE023	7304	4302	19912	0	0.0026	-	>100000	>21.99	18
LARGE024	7311	4292	20399	0	0.0028	6.0044E+01	90635	20.22	0
LARGE025	7312	4297	20543	0	0.0028	6.0312E+01	96759	21.70	0
LARGE026	7304	4284	20431	0	0.0028	6.0287E+01	97406	21.84	0
LARGE027	7301	4275	20362	0	0.0028	6.0456E+01	90415	20.19	0
LARGE028	7313	4302	20686	0	0.0028	6.0604E+01	87286	19.78	0
LARGE029	7312	4301	20752	0	0.0028	6.0619E+01	88157	19.88	0
LARGE030	7303	4285	20643	0	0.0028	6.1126E+01	92368	20.83	0
LARGE031	7306	4294	20667	0	0.0028	6.1080E+01	86541	19.51	0
LARGE032	7307	4292	20650	0	0.0028	6.1068E+01	88924	20.01	0
LARGE033	7292	4273	20586	0	0.0028	6.0612E+01	89801	20.21	0
LARGE034	7306	4294	20650	0	0.0028	6.0502E+01	89884	20.21	0
LARGE035	7304	4293	20676	0	0.0028	6.0474E+01	84086	18.97	0
LARGE036	7297	4282	20635	0	0.0028	6.0430E+01	87368	19.62	0
LINSPANH	97	33	194	0	0.0606	4.6238E+00	21	0.00	0
LOTFI	366	153	1136	0	0.0654	9.7186E+00	382	0.01	0
LP22	16392	2958	68518	0	0.0132	6.2250E+01	110	0.07	0

Table 2.1: Complete LSQR results for all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
LPL1 (S)	129959	39951	386218	44	0.0004	7.0878E+01	36804	159.95	0
LPL2	10881	3294	32232	5	0.0009	5.7537E+01	89	0.03	0
LPL3	33686	10828	100525	1	0.0003	9.4797E+01	118	0.12	0
LSQPROB	138	56	424	0	0.1964	7.3997E+00	57	0.00	0
LSQROB	138	56	424	0	0.1964	7.3997E+00	57	0.00	0
MAKELA4	61	40	120	0	1.0000	6.6155E+00	3	0.00	0
MAROS-R7	9408	3136	144848	0	0.0147	8.2622E+01	12	0.01	0
MAROS	1966	846	10137	0	0.0236	2.4535E+01	40677	4.01	0
MOD2 (S)	66409	34774	199810	0	0.0005	1.3872E+02	12814	27.98	0
MODEL	80	38	136	0	0.1579	-	>100000	>0.30	18
MODEL1	798	362	3028	0	0.0442	9.6897E+00	73	0.00	0
MODEL10 (S)	16819	4400	150372	0	0.0039	5.3554E+01	59337	71.62	0
MODEL11	20464	7056	58035	0	0.0028	1.2316E+02	85	0.05	0
MODEL2	1321	379	7607	2	0.0369	1.5308E+01	4008	0.26	0
MODEL3	4565	1609	23974	0	0.0149	3.5842E+01	6305	1.42	0
MODEL4	4962	1337	45753	0	0.0127	2.7593E+01	23913	8.69	0
MODEL5	11802	1744	89925	144	0.0097	3.3983E+01	4181	2.98	0
MODEL6	5289	2094	27628	2	0.0124	2.5143E+01	6158	1.65	0
MODEL7	9560	3358	51027	0	0.0071	5.1243E+01	12613	6.14	0
MODEL8	6464	2896	25277	0	0.0055	1.7963E+01	298	0.08	0
MODEL9	10939	2787	55956	92	0.0068	6.9788E+01	3448	1.74	0
MODSZK1	1620	686	3168	1	0.0335	3.3236E+01	70	0.00	0
MONDOU2	604	312	1208	0	0.0064	2.2419E+01	141	0.00	0
MPSBCD03 (S)	7078	5412	66210	2	0.1554	-	>100000	>59.19	18
MULTI	160	61	1019	0	0.2131	5.6174E+00	31	0.00	0
NEMSAFM	2348	334	2826	0	0.0120	4.5918E+01	29	0.00	0
NEMSCEM	1712	651	3840	0	0.0061	2.3126E+01	114	0.01	0
NEMSEMM1	75310	3945	1053986	0	0.0352	8.7388E+01	1247	9.79	0
NEMSEMM2	48878	6943	182012	0	0.0058	1.0617E+02	1169	1.89	0
NEMSPMM1	8903	2362	55867	10	0.0258	4.7766E+01	16992	8.08	0
NEMSPMM2	8734	2301	68225	0	0.0278	3.8809E+01	18622	10.39	0
NEMSWRLD	28550	6647	192283	491	0.0078	6.0760E+01	1424	2.26	0
NEOS	515905	479119	1526794	0	0.0339	4.9938E+02	351	7.43	0
NEOS1	133473	131581	599590	0	0.0275	3.5694E+02	132	0.87	0
NEOS2	134128	132568	685087	0	0.0330	3.5375E+02	212	1.52	0
NEOS3	518832	512209	2055024	0	0.0005	2.0785E+01	8	0.23	0
NESM	3105	662	13470	0	0.0151	4.1883E+01	202	0.03	0
EMSDZ	15325	7039	47035	0	0.0021	7.5844E+01	6910	3.54	0
NSCT1	37461	22901	678739	287	0.0269	1.8366E+02	1407	7.42	0
NSCT2 (S)	37563	23003	697738	287	0.0273	1.8393E+02	65818	357.59	0
NSIC1	883	451	3273	0	0.0599	2.5158E+01	138	0.01	0
NSIC2	897	465	3449	0	0.0581	2.5435E+01	1209	0.05	0
NSIR1	10011	4407	143249	0	0.0517	8.0262E+01	1112	1.25	0
NSIR2 (S)	10057	4453	154939	0	0.0528	8.0548E+01	35402	41.61	0
NUG05	225	210	1050	3	0.0476	4.4409E-15	3	0.00	0
NUG06	486	372	2232	1	0.0323	5.8263E-15	3	0.00	0
NUG07	931	602	4214	0	0.0233	1.3382E-14	3	0.00	0
NUG08	1632	912	7296	0	0.0175	0.0000E+00	3	0.00	0
NUG12	8856	3192	38304	0	0.0075	1.0363E-14	3	0.00	0
NUG15	22275	6330	94950	0	0.0047	7.1124E-14	3	0.00	0
NUG20	72600	15240	304800	1	0.0026	3.2286E-13	3	0.01	0
NUG30	379350	52260	1567800	0	0.0011	5.4898E-13	3	0.06	0
NW14	123409	73	904910	0	0.1507	3.8730E+01	110	0.85	0
OET1	1005	1002	4006	0	1.0000	3.1671E+01	3	0.00	0
OET3	1006	1002	5006	0	1.0000	3.1670E+01	4	0.00	0
ORNA1	1764	882	3990	0	0.0170	1.1814E+01	21658	1.11	0
ORNA2	1764	882	3990	0	0.0170	1.2116E+01	21203	1.09	0
ORNA3	1764	882	3990	0	0.0170	1.2142E+01	21319	1.11	0
ORNA4	1764	882	3990	0	0.0170	1.2217E+01	21226	1.08	0
ORNA7	1764	882	3990	0	0.0170	1.2142E+01	21420	1.09	0
ORSWQ2	160	80	344	0	0.1250	8.7296E+00	31	0.00	0

Table 2.1: Complete LSQR results for all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
OSA_07_PRE	24062	1047	63037	0	0.0038	4.3640E+01	41	0.02	0
OSA_14_PRE	52723	2266	139136	0	0.0018	6.3861E+01	45	0.06	0
OSA_30_PRE	100396	4279	267149	0	0.0009	8.7145E+01	59	0.15	0
OSA_60_PRE	234334	10209	594462	0	0.0004	1.3992E+02	53	0.34	0
P0033	48	15	113	0	0.3333	3.9213E+00	30	0.00	0
P0040	63	23	133	0	0.1304	2.5204E+00	6	0.00	0
P10	19090	10090	118000	0	0.0020	9.8334E+01	168	0.18	0
P0201	334	133	2056	0	0.1053	6.5816E+00	39	0.00	0
P0282	523	241	2207	0	0.4647	2.1966E+01	76	0.00	0
P0291	543	252	2283	0	0.4167	2.1565E+01	52	0.00	0
P05	9590	5090	59045	0	0.0039	7.0494E+01	149	0.08	0
P0548	724	176	1887	0	0.0284	2.0066E+01	96	0.00	0
P19	851	284	5570	0	0.0458	1.0707E+01	49	0.00	0
P2756	3511	755	9692	0	0.0212	4.7567E+01	250	0.03	0
P6000	7947	2095	19826	0	0.0029	6.5525E+01	6	0.00	0
P80BAU3B	10613	1984	21000	0	0.0055	7.6989E+01	158	0.04	0
PANG	741	361	2933	0	0.0831	1.5294E+01	488	0.02	0
PCB1000	2820	1565	20463	0	0.0166	1.7326E+01	450	0.09	0
PCB3000	7732	3960	57479	0	0.0071	2.7109E+01	730	0.42	0
PDE1 (S)	271792	270595	990587	-	0.6696	3.0302E+02	10638	127.20	0
PDE2	361491	270595	990587	0	0.0000	3.4879E+02	7872	99.33	0
PDS_02_PRE	3056	877	7484	1	0.0057	2.2013E+01	59	0.01	0
PDS_06_PRE	18530	2972	42304	0	0.0020	4.2161E+01	155	0.07	0
PDS_10_PRE	33270	4725	76307	1	0.0013	5.3829E+01	189	0.16	0
PDS_20_PRE	81224	10214	184176	0	0.0006	8.0747E+01	233	0.52	0
PDS-100 (S)	514577	156016	1096002	227	0.0000	2.8489E+02	771	12.74	0
PDS-20	108175	33798	232647	76	0.0001	8.8731E+01	313	1.00	0
PDS-30	158489	49788	340635	156	0.0001	1.2041E+02	404	2.00	0
PDS-40	217531	66641	466800	203	0.0000	1.5176E+02	486	3.45	0
PDS-50	275814	82837	590833	223	0.0000	1.8065E+02	557	4.96	0
PDS-60	336421	99204	719557	227	0.0000	2.0695E+02	605	7.55	0
PDS-70	390005	114717	833465	227	0.0000	2.3001E+02	639	7.97	0
PDS-80	434580	128954	927826	227	0.0000	2.5040E+02	681	9.60	0
PDS-90 (S)	475448	142596	1014136	227	0.0000	2.6847E+02	722	11.17	0
PEROLD	1506	625	6148	0	0.0256	2.8418E+01	42910	2.47	0
PF2177	9908	9728	30984	42	0.0038	9.4105E-01	126	0.05	0
PGP2	13254	4034	22474	0	0.1433	9.9046E+01	6	0.00	0
PILOT-JA (S)	2267	940	14977	0	0.0585	-	>100000	>12.63	18
PILOT-WE	2928	722	9265	0	0.0166	2.7738E+01	50602	4.42	0
PILOT	4860	1441	44375	0	0.0840	4.4917E+01	2225	0.82	0
PILOT4	1123	410	5264	0	0.0659	2.5518E+01	6385	0.31	0
PILOT4I	1123	410	5264	0	0.0659	2.5512E+01	6358	0.31	0
PILOT87	6680	2030	74949	0	0.0473	5.2250E+01	4727	2.81	0
PILOTNOV (S)	2446	975	13331	0	0.0410	-	>100000	>11.67	18
PLDD000B	5049	3069	10762	0	0.0029	4.8552E+01	1695	0.23	0
PLDD001B	5049	3069	10763	0	0.0029	4.8535E+01	1692	0.23	0
PLDD002B	5049	3069	10764	0	0.0029	4.8527E+01	1690	0.23	0
PLDD003B	5049	3069	10765	0	0.0029	4.8524E+01	1689	0.23	0
PLDD004B	5049	3069	10766	0	0.0029	4.8521E+01	1692	0.23	0
PLDD005B	5049	3069	10767	0	0.0029	4.8519E+01	1689	0.23	0
PLDD006B	5049	3069	10768	0	0.0029	4.8517E+01	1689	0.22	0
PLDD007B	5049	3069	10769	0	0.0029	4.8514E+01	1689	0.23	0
PLDD008B	5049	3069	10829	0	0.0029	4.8248E+01	1689	0.23	0
PLDD009B	5049	3069	10832	0	0.0029	4.8240E+01	1687	0.23	0
PLDD010B	5049	3069	10835	0	0.0029	4.8233E+01	1687	0.23	0
PLDD011B	5049	3069	10837	0	0.0029	4.8229E+01	1689	0.23	0
PLDD012B	5049	3069	10839	0	0.0029	4.8224E+01	1687	0.23	0
PLTEXPA2-1	4540	1726	9233	0	0.0104	3.8985E+01	45	0.01	0
PLTEXPA2-6	1820	686	3703	0	0.0117	2.4377E+01	44	0.00	0
PLTEXPA3_1	74172	28350	150801	0	0.0006	1.5888E+02	48	0.08	0
PLTEXPA3_6	11612	4430	23611	0	0.0018	6.2691E+01	47	0.01	0

Table 2.1: Complete LSQR results for all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
PLTEXPA4_6	70364	26894	143059	0	0.0003	1.5475E+02	51	0.08	0
PRESOLVE	932	428	5224	0	0.0911	1.3960E+01	4164	0.20	0
PRIMAGAZ	10836	1554	21665	0	0.0013	3.6793E-13	4	0.00	0
PROBLEM	46	12	86	0	0.1667	6.7823E+00	0	0.00	0
PROGAS	1900	1650	8897	0	0.0085	2.4611E+01	8414	0.74	0
PT	503	501	1503	0	1.0000	2.2405E+01	3	0.00	0
QAP12	8856	3192	38304	0	0.0075	1.3505E-14	3	0.00	0
QAP15	22275	6330	94950	0	0.0047	1.5173E-13	3	0.00	0
QAP8	1632	912	7296	0	0.0175	1.1213E-15	3	0.00	0
QIU	1900	1192	4492	0	0.0092	1.3884E+01	46	0.00	0
QPBD_OUT	442	211	2589	0	0.0995	1.3154E+01	715	0.02	0
QUAL	464	323	1646	0	0.0960	1.1182E+01	3584	0.07	0
R05	9690	5190	104145	0	0.0058	7.0877E+01	169	0.16	0
RAIL2586 (S)	923269	2586	8011362	0	0.0046	1.4113E+02	1160	102.61	0
RAIL4284 (S)	1096894	4284	11284032	0	0.0028	1.6948E+02	1100	174.55	0
RAIL507	63516	507	409856	0	0.0237	4.7606E+01	349	1.13	0
RAIL516	47827	516	315412	0	0.0233	3.7721E+01	325	0.83	0
RAIL582	56097	582	402290	0	0.0206	4.5502E+01	365	1.19	0
RAT1	9408	3136	88267	0	0.0086	9.1651E+01	7	0.01	0
RAT5	9408	3136	137413	0	0.0137	9.1537E+01	7	0.01	0
RAT7A	9408	3136	268908	0	0.0281	9.0828E+01	7	0.01	0
REACTOR	808	318	2591	0	0.0314	1.5909E+01	77	0.00	0
READING2	6003	4000	16000	0	0.0010	7.5465E+01	2001	0.38	0
RECIPELP	204	91	687	0	0.1099	1.1855E+01	128	0.00	0
REFINE	62	29	153	0	0.1724	5.2566E+00	33	0.00	0
REFINERY	464	323	1626	0	0.0960	1.1271E+01	3283	0.07	0
RLFDDD	61521	4050	264627	0	0.0119	1.5612E+02	110	0.24	0
RLFDUAL	74970	8052	282031	0	0.0055	1.9310E+02	105	0.26	0
RLFPRIM	62712	58866	320591	78	0.0034	1.1503E+02	3167	10.18	0
ROSEN1	1544	520	23794	0	0.0462	2.4644E+01	149	0.03	0
ROSEN10	6152	2056	64192	0	0.0078	5.2010E+01	220	0.11	0
ROSEN2	3080	1032	47536	0	0.0233	3.4740E+01	174	0.07	0
ROSEN7	776	264	8034	0	0.0606	1.8542E+01	148	0.01	0
ROSEN8	1544	520	16058	0	0.0308	2.6097E+01	187	0.03	0
ROUTE	43019	20894	206782	31	0.0021	1.4276E+02	95	0.19	0
S277-280	8	4	20	0	1.0000	2.6966E+00	4	0.00	0
SC105	163	105	340	0	0.0476	8.8268E+00	61	0.00	0
SC2052R100	3923	2213	7739	0	0.0461	5.5573E+01	38	0.00	0
SC2052R16	647	365	1271	0	0.0493	2.2439E+01	30	0.00	0
SC2052R160	62423	35213	123239	0	0.0455	2.2195E+02	44	0.07	0
SC2052R200	7823	4413	15439	0	0.0458	7.8527E+01	38	0.01	0
SC2052R27	1076	607	2118	0	0.0478	2.9013E+01	33	0.00	0
SC2052R32	1271	717	2503	0	0.0474	3.1553E+01	33	0.00	0
SC2052R4	179	101	347	0	0.0594	1.1656E+01	27	0.00	0
SC2052R400	15623	8813	30839	0	0.0456	1.1101E+02	40	0.02	0
SC2052R50	1973	1113	3889	0	0.0467	3.9364E+01	33	0.00	0
SC2052R64	2519	1421	4967	0	0.0464	4.4501E+01	35	0.00	0
SC2052R8	335	189	655	0	0.0529	1.6062E+01	28	0.00	0
SC2052R800	31223	17613	61639	0	0.0455	1.5696E+02	41	0.03	0
SC205	317	205	665	0	0.0244	1.0407E+01	109	0.00	0
SC50A	78	50	160	0	0.1000	7.2153E+00	36	0.00	0
SC50B	78	50	148	0	0.0800	6.5537E+00	37	0.00	0
SCAGR25	671	471	1725	0	0.0191	1.3015E+01	136	0.00	0
SCAGR7CX	887	623	2285	0	0.1814	1.7437E+01	67	0.00	0
SCAGR7AX	239	167	605	0	0.1737	8.2088E+00	55	0.00	0
SCAGR7GX	13847	9743	35885	0	0.1840	7.2243E+01	108	0.05	0
SCAGR7CQ	887	623	2285	0	0.1814	1.7437E+01	67	0.00	0
SCAGR7AQ	239	167	605	0	0.1737	8.2088E+00	55	0.00	0
SCAGR7GQ	3479	2447	9005	0	0.1835	3.5822E+01	84	0.01	0
SCAGR7HH	5855	4119	15057	0	0.1838	4.6739E+01	93	0.02	0
SCAGR7CH	887	623	2285	0	0.1814	1.7437E+01	67	0.00	0

Table 2.1: Complete LSQR results for all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
SCAGR7IH	11687	8223	30069	0	0.1840	6.6324E+01	107	0.04	0
SCAGR7DH	1481	1041	3825	0	0.1825	2.2963E+01	72	0.01	0
SCAGR7EH	1751	1231	4525	0	0.1828	2.5083E+01	78	0.00	0
SCAGR7AH	239	167	605	0	0.1737	8.2088E+00	55	0.00	0
SCAGR7JH	23351	16431	60093	0	0.1841	9.3970E+01	114	0.08	0
SCAGR7FH	2939	2067	7605	0	0.1834	3.2843E+01	80	0.01	0
SCAGR7GH	3479	2447	9005	0	0.1835	3.5822E+01	84	0.01	0
SCAGR7BH	455	319	1165	0	0.1787	1.2004E+01	60	0.00	0
SCAGR7KH	46679	32847	120141	0	0.1842	1.3303E+02	129	0.18	0
SCAGR7	185	129	465	0	0.0698	6.4363E+00	77	0.00	0
SCALED	27	15	53	0	0.2667	3.9671E+00	12	0.00	0
SCFXM1B16	4263	2460	14508	0	0.0146	3.3662E+01	578	0.09	0
SCFXM1B4	1179	684	4164	0	0.0322	1.8003E+01	515	0.02	0
SCFXM1B64	33047	19036	111052	0	0.0137	9.3268E+01	651	0.75	0
SCFXM1C4	1179	684	4164	0	0.0322	1.8003E+01	515	0.02	0
SCFXM1R128	33047	19036	111052	0	0.0137	9.3268E+01	651	0.74	0
SCFXM1R16	4263	2460	14508	0	0.0146	3.3662E+01	578	0.09	0
SCFXM1R256	65943	37980	221388	0	0.0136	1.3171E+02	667	1.49	0
SCFXM1R27	7090	4088	23990	0	0.0142	4.3313E+01	581	0.14	0
SCFXM1R32	8375	4828	28300	0	0.0141	4.7050E+01	603	0.18	0
SCFXM1R4	1179	684	4164	0	0.0322	1.8003E+01	515	0.02	0
SCFXM1R64	16599	9564	55884	0	0.0138	6.6147E+01	629	0.36	0
SCFXM1R8	2207	1276	7612	0	0.0204	2.4358E+01	524	0.04	0
SCFXM1R96	24823	14300	83468	0	0.0137	8.0853E+01	653	0.56	0
SCFXM1	600	330	2732	0	0.0606	1.4494E+01	1827	0.07	0
SCFXM2	1200	660	5469	0	0.0303	2.0433E+01	2693	0.15	0
SCFXM3	1800	990	8206	0	0.0202	2.4998E+01	2738	0.22	0
SCORPION	466	388	1534	29	0.0180	1.6015E+01	146	0.00	0
SCRS8CX	907	476	1895	0	0.1429	2.2078E+01	84	0.00	0
SCRS8AX	259	140	527	0	0.1429	1.1308E+01	77	0.00	0
SCRS8	3499	1820	7367	0	0.1429	4.4681E+01	111	0.01	0
SCRS8CQ	907	476	1895	0	0.1429	2.2078E+01	84	0.00	0
SCRS8EQ	1771	924	3719	0	0.1429	3.1356E+01	91	0.01	0
SCRS8AQ	259	140	527	0	0.1429	1.1308E+01	77	0.00	0
SCRS8FQ	3499	1820	7367	0	0.1429	4.4681E+01	111	0.01	0
SCRS8BQ	475	252	983	0	0.1429	1.5667E+01	81	0.00	0
SCRS8GH	6955	3612	14663	0	0.1429	6.3717E+01	130	0.02	0
SCRS8CH	907	476	1895	0	0.1429	2.2078E+01	84	0.00	0
SCRS8HH	13867	7196	29255	0	0.1429	9.0764E+01	139	0.05	0
SCRS8DH	1501	784	3149	0	0.1429	2.8760E+01	88	0.00	0
SCRS8EH	1771	924	3719	0	0.1429	3.1356E+01	91	0.00	0
SCRS8AH	259	140	527	0	0.1429	1.1308E+01	77	0.00	0
SCRS8IH	27691	14364	58439	0	0.1429	1.2903E+02	151	0.10	0
SCRS8FH	3499	1820	7367	0	0.1429	4.4681E+01	111	0.01	0
SCRS8FHH	3499	1820	7367	0	0.1429	4.4681E+01	111	0.01	0
SCRS8BH	475	252	983	0	0.1429	1.5667E+01	81	0.00	0
SCRS8	1275	490	3288	0	0.0163	1.7596E+01	3117	0.12	0
SCSD1	760	77	2388	0	0.0519	2.7568E+01	0	0.00	0
SCSD6	1350	147	4316	0	0.0272	3.6742E+01	0	0.00	0
SCSD8CX	2310	330	7170	0	0.1030	4.8051E+01	37	0.00	0
SCSD8AX	630	90	1890	0	0.1111	2.5085E+01	30	0.00	0
SCSD8GX	35910	5130	112770	0	0.1002	1.8950E+02	51	0.05	0
SCSD8CQ	2310	330	7170	0	0.1030	4.8051E+01	37	0.00	0
SCSD8AQ	630	90	1890	0	0.1111	2.5085E+01	30	0.00	0
SCSD8GQ	35910	5130	112770	0	0.1002	1.8950E+02	51	0.05	0
SCSD8HH	15190	2170	47650	0	0.1005	1.2324E+02	47	0.02	0
SCSD8CH	2310	330	7170	0	0.1030	4.8051E+01	37	0.00	0
SCSD8IH	30310	4330	95170	0	0.1002	1.7409E+02	50	0.05	0
SCSD8DH	3850	550	12010	0	0.1018	6.2039E+01	40	0.01	0
SCSD8EH	4550	650	14210	0	0.1015	6.7444E+01	42	0.01	0
SCSD8AH	630	90	1890	0	0.1111	2.5085E+01	30	0.00	0

Table 2.1: Complete LSQR results for all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
SCSD8JH	60550	8650	190210	0	0.1001	2.4607E+02	55	0.10	0
SCSD8FH	7630	1090	23890	0	0.1009	8.7342E+01	44	0.01	0
SCSD8GH	9030	1290	28290	0	0.1008	9.5019E+01	46	0.02	0
SCSD8BH	1190	170	3650	0	0.1059	3.4483E+01	35	0.00	0
SCSD8BHH	1190	170	3650	0	0.1059	3.4483E+01	35	0.00	0
SCSD8	2750	397	8584	0	0.0101	5.2440E+01	0	0.00	0
SCTAP1B16	2178	990	6334	0	0.0515	3.1038E+01	123	0.01	0
SCTAP1B4	594	270	1678	0	0.0556	1.6082E+01	119	0.00	0
SCTAP1B64	33858	15390	99454	0	0.0501	1.2367E+02	192	0.19	0
SCTAP1C16	2178	990	6334	0	0.0515	3.1038E+01	123	0.01	0
SCTAP1C4	594	270	1678	0	0.0556	1.6082E+01	119	0.00	0
SCTAP1C64	7458	3390	21854	0	0.0504	5.7784E+01	118	0.03	0
SCTAP1R108	14322	6510	42030	0	0.0502	8.0267E+01	154	0.07	0
SCTAP1R16	2178	990	6334	0	0.0515	3.1038E+01	123	0.01	0
SCTAP1R216	28578	12990	83934	0	0.0501	1.1358E+02	184	0.16	0
SCTAP1R27	3630	1650	10602	0	0.0509	4.0178E+01	128	0.02	0
SCTAP1R32	4290	1950	12542	0	0.0508	4.3714E+01	134	0.02	0
SCTAP1R4	594	270	1678	0	0.0556	1.6082E+01	119	0.00	0
SCTAP1R480	63426	28830	186366	0	0.0501	1.6941E+02	215	0.40	0
SCTAP1R54	7194	3270	21078	0	0.0505	5.6743E+01	137	0.03	0
SCTAP1R64	8514	3870	24958	0	0.0504	6.1773E+01	141	0.04	0
SCTAP1R8	1122	510	3230	0	0.0529	2.2195E+01	125	0.01	0
SCTAP1R8B	1122	510	3230	0	0.0529	2.2195E+01	125	0.01	0
SCTAP1	660	300	1872	0	0.0200	1.6745E+01	333	0.01	0
SCTAP2	2500	1090	7334	0	0.0055	3.1937E+01	616	0.05	0
SCTAP3	3340	1480	9734	0	0.0041	3.7029E+01	650	0.07	0
SEBA	1036	515	4360	0	0.4466	1.7950E+01	142	0.01	0
SELF	7364	960	1148845	0	1.0000	1.2263E+01	301	2.40	0
SEYMOUR	6316	4944	38493	0	0.0552	7.3269E+01	118	0.05	0
SGPF5Y6	312540	246077	831976	0	0.0000	2.5234E+02	64	0.73	0
SHARE1B	253	117	1179	0	0.0855	6.9154E+00	3282	0.05	0
SHARE2B	162	96	777	0	0.1250	6.7659E+00	445	0.00	0
SHELL	1777	536	3558	0	0.0056	2.1346E+01	78	0.01	0
SHIP04L	2166	360	6380	42	0.0167	1.4125E+01	67	0.01	0
SHIP04S	1506	360	4400	42	0.0167	1.4038E+01	87	0.01	0
SHIP08L	4363	712	12882	66	0.0084	1.9832E+01	114	0.01	0
SHIP08S	2467	712	7194	66	0.0084	1.9707E+01	154	0.01	0
SHIP12L	5533	1042	16276	109	0.0058	2.4097E+01	81	0.01	0
SHIP12S	2869	1042	8284	109	0.0058	2.4018E+01	106	0.01	0
SIERRA	2735	1227	8001	2	0.0033	3.9049E+01	66	0.01	0
SIPOW1	2002	2000	6000	0	1.0000	4.4699E-02	3	0.00	0
SIPOW1M	2002	2000	6000	0	1.0000	4.4699E-02	3	0.00	0
SIPOW2	2002	2000	5000	0	1.0000	2.5837E+01	4	0.00	0
SIPOW2M	2002	2000	5000	0	1.0000	2.5837E+01	4	0.00	0
SIPOW3	2004	2000	7992	0	1.0000	4.4733E+01	4	0.00	0
SIPOW4	2004	2000	9000	0	1.0000	4.4733E+01	4	0.00	0
SLP-TSK	3347	2861	72465	0	0.3100	5.6689E+01	161	0.09	0
SMALL000	1215	709	3044	0	0.0141	2.5410E+01	5517	0.20	0
SMALL001	1193	687	3144	0	0.0160	2.4818E+01	9229	0.33	0
SMALL002	1220	713	3246	0	0.0154	2.5267E+01	11356	0.43	0
SMALL003	1215	711	3240	0	0.0155	2.4846E+01	12462	0.46	0
SMALL004	1220	717	3283	0	0.0153	2.5025E+01	10573	0.40	0
SMALL005	1220	717	3317	0	0.0153	2.5454E+01	6988	0.27	0
SMALL006	1213	710	3319	0	0.0169	2.5049E+01	10017	0.38	0
SMALL007	1212	711	3374	0	0.0169	2.4788E+01	11414	0.44	0
SMALL008	1214	712	3342	0	0.0169	2.4944E+01	12078	0.46	0
SMALL009	1213	710	3328	0	0.0169	2.4944E+01	12226	0.46	0
SMALL010	1213	711	3322	0	0.0169	2.5197E+01	9813	0.37	0
SMALL011	1208	705	3300	0	0.0170	2.5488E+01	6988	0.27	0
SMALL012	1209	706	3309	0	0.0170	2.5477E+01	6708	0.25	0
SMALL013	1204	701	3282	0	0.0171	2.5472E+01	6953	0.26	0

Table 2.1: Complete LSQR results for all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
SMALL014	1190	687	3207	0	0.0160	2.5325E+01	6568	0.24	0
SMALL015	1186	683	3243	0	0.0161	2.5269E+01	7058	0.26	0
SMALL016	1180	677	3207	0	0.0162	2.5180E+01	7102	0.26	0
SOUTHERN1	36321	18425	112398	0	0.9509	1.8807E+02	275	0.32	0
SPAL_004 (S)	321696	10203	46168124	0	0.0165	-	>1448	>600.00	19
SSEBLIN	218	72	336	0	0.0278	1.2971E+01	18	0.00	0
STAIR	614	356	4003	0	0.0955	1.3875E+01	125	0.01	0
STANDATA	1274	359	3230	0	0.0279	1.3676E+01	182	0.01	0
STANDGUB	1382	360	3338	1	0.0278	1.4397E+01	185	0.01	0
STANDMPS	1274	467	3878	0	0.0214	1.2022E+01	335	0.01	0
STAT96V1	197472	5995	588798	0	0.0030	4.4182E+02	708	3.77	0
STAT96V2 (S)	957432	29089	2852184	0	0.0004	9.7273E+02	1200	31.64	0
STAT96V3 (S)	1113780	33841	3317736	0	0.0004	1.0492E+03	1292	39.79	0
STAT96V4 (S)	63076	3173	491336	0	0.0028	1.2052E+02	4479	16.65	0
STAT96V5	75779	2305	233921	2	0.3336	2.7479E+02	23	0.05	0
STOCFOR1	165	117	501	0	0.0513	5.2802E+00	82	0.00	0
STOCFOR2	3045	2157	9357	0	0.0046	2.6098E+01	287	0.03	0
STOCFOR3	23541	16675	72721	0	0.0011	7.3946E+01	704	0.55	0
STORMG2125	172431	65935	433256	250	0.0021	3.1685E+02	1033	5.27	0
STORMG227	37485	14387	94274	54	0.0028	1.4714E+02	870	0.89	0
STORMG28	11322	4393	28553	16	0.0048	7.9906E+01	735	0.24	0
STORMG21K (S)	1377306	526185	3459881	0	0.0019	8.9636E+02	1430	63.46	0
STP3D	336283	159488	793531	0	0.0000	4.8623E+02	235	2.83	0
SWS	26775	14310	107325	0	0.0008	5.4263E+01	77	0.08	0
T0331-4L	46915	664	430982	0	0.0346	7.3313E+01	613	2.12	0
SC205	31223	17613	61639	0	0.0455	1.4370E+02	41	0.03	0
TESTDECK	27	15	53	0	0.2667	3.6108E+00	10	0.00	0
TFI2	104	101	402	0	1.0000	9.9037E+00	4	0.00	0
MPD	1014301	142752	11537419	0	0.0001	3.5588E+02	18	1.96	0
TRUSS	8806	1000	27836	0	0.0040	9.3840E+01	0	0.00	0
TS-PALKO	47235	22002	1076903	0	0.0016	6.1241E+01	48	0.44	0
TUFF	628	302	4561	31	0.0828	1.0262E+01	730	0.03	0
ULEVMIN	46937	6590	164538	0	0.0041	1.0191E+02	62	0.10	0
US04	28016	163	297538	8	0.1104	2.6748E+01	199	0.45	0
VOL1	464	323	1646	0	0.0960	1.1182E+01	3584	0.07	0
VTP-BASE	346	198	1051	0	0.0606	8.1710E+00	1939	0.04	0
WATSON_1 (S)	386992	201155	1055093	0	0.0000	2.5495E+02	2605	33.70	0
WATSON_2 (S)	677224	352013	1846391	0	0.0000	3.3569E+02	2148	50.79	0
WOOD1P	2595	244	70216	0	0.1148	1.7252E+00	88	0.05	0
WOODINFE	89	35	140	0	0.0571	8.0289E+00	15	0.00	0
WOODW	8418	1098	37487	0	0.0191	4.0983E+00	693	0.22	0
WORLD (S)	67147	34506	198883	0	0.0005	1.4068E+02	11875	25.74	0
ZED	142	116	666	0	0.4138	9.0308E+00	95	0.00	0
UF Sparse Matrix Collection examples									
12month1 (S)	872622	12471	22624727	-	0.2742	-	>2478	>600.00	19
130bit	584	567	6120	1	0.0247	3.6512E+00	2653	0.15	0
145bit	1002	966	11315	2	0.0155	6.8952E+00	8610	0.90	0
162bit (S)	3606	3476	37118	16	0.0040	1.1771E+01	42665	16.63	0
176bit (S)	7441	7150	82270	40	0.0022	-	>100000	>84.88	18
192bit (S)	13691	13093	154303	82	0.0012	-	>100000	>159.41	18
208bit (S)	24430	23191	299756	199	0.0008	-	>100000	>311.12	18
abb313	313	176	1557	0	0.0341	1.1495E+01	60	0.00	0
abtaha1	14596	209	51307	0	0.0191	8.5472E+01	61	0.04	0
abtaha2	37932	331	137228	0	0.0121	1.3963E+02	40	0.05	0
ash219	219	85	438	0	0.0235	1.2360E+01	31	0.00	0
ash331	331	104	662	0	0.0192	1.5722E+01	36	0.00	0
ash608	608	188	1216	0	0.0106	2.0993E+01	33	0.00	0
ash958	958	292	1916	0	0.0068	2.6425E+01	36	0.00	0
beacxc	489	449	50409	0	0.5635	8.5830E-03	31493	10.97	0
beaflw (S)	500	492	53403	4	0.8130	-	>100000	>36.88	18

Table 2.1: Complete LSQR results for all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
beause	505	492	44551	3	0.8130	-	>100000	>31.05	18
bibd_11_5	462	55	4620	0	0.1818	2.0126E+01	14	0.00	0
bibd_12_4	495	66	2970	0	0.0909	2.0677E+01	14	0.00	0
bibd_12_5	792	66	7920	0	0.1515	2.6743E+01	12	0.00	0
bibd_13_6	1716	78	25740	0	0.1923	4.0221E+01	10	0.00	0
bibd_14_7	3432	91	72072	0	0.2308	5.7912E+01	9	0.01	0
bibd_15_3	455	105	1365	0	0.0286	1.8238E+01	20	0.00	0
bibd_15_7	6435	105	135135	0	0.2000	7.9658E+01	8	0.01	0
bibd_16_8	12870	120	360360	0	0.2333	1.1286E+02	7	0.02	0
bibd_17_3	680	136	2040	0	0.0221	2.3567E+01	18	0.00	0
bibd_17_4b	2380	136	14280	0	0.0441	4.7340E+01	11	0.00	0
bibd_17_4	2380	136	14280	0	0.0441	4.7340E+01	11	0.00	0
bibd_17_8	24310	136	680680	0	0.2059	1.5546E+02	7	0.03	0
bibd_18_9	48620	153	1750320	0	0.2353	2.2010E+02	6	0.08	0
bibd_19_9	92378	171	3325608	0	0.2105	3.0364E+02	6	0.16	0
bibd_20_10	184756	190	8314020	0	0.2368	4.2958E+02	6	0.38	0
bibd_22_8	319770	231	8953560	0	0.1212	5.6528E+02	5	0.36	0
bibd_49_3	18424	1176	55272	0	0.0026	1.3141E+02	12	0.01	0
bibd_81_3	85320	3240	255960	0	0.0009	2.8646E+02	11	0.03	0
bibd_9_3	84	36	252	0	0.0833	6.5585E+00	24	0.00	0
bibd_9_5	126	36	1260	0	0.2778	9.5326E+00	19	0.00	0
c8_mat11_I	5761	4562	2462970	0	0.5298	-	>34552	>600.00	19
c8_mat11 (S)	5761	4562	2462970	0	0.5298	-	>35336	>600.00	19
cat_ears_2_4	2689	1009	7982	0	0.0030	4.1328E+01	122	0.02	0
cat_ears_3_1	204	181	542	4	0.0331	5.2776E+00	290	0.00	0
cat_ears_3_4	13271	5226	39592	0	0.0006	8.9890E+01	403	0.20	0
cat_ears_4_1	377	313	938	4	0.0192	9.1810E+00	507	0.01	0
cat_ears_4_4	44448	19020	132888	0	0.0002	1.5904E+02	461	0.77	0
ch3-3-b1	18	9	36	0	0.2222	1.6997E+00	3	0.00	0
ch3-3-b2	18	6	18	0	0.1667	4.0000E+00	2	0.00	0
ch4-4-b1	72	16	144	0	0.1250	4.2328E+00	3	0.00	0
ch4-4-b2	96	72	288	1	0.0417	1.3510E-15	5	0.00	0
ch4-4-b3	96	24	96	0	0.0417	9.7980E+00	0	0.00	0
ch5-5-b1	200	25	400	0	0.0800	7.3194E+00	3	0.00	0
ch5-5-b2	600	200	1800	0	0.0150	2.7821E-15	5	0.00	0
ch5-5-b4	600	120	600	0	0.0083	2.4000E+01	2	0.00	0
ch6-6-b1	450	36	900	0	0.0556	1.1160E+01	3	0.00	0
ch6-6-b2	2400	450	7200	0	0.0067	1.0289E-14	5	0.00	0
ch6-6-b3	5400	2400	21600	0	0.0017	2.3959E+01	10	0.00	0
ch6-6-b4	5400	4320	21600	19	0.0009	6.9478E+01	11	0.00	0
ch6-6-b5	4320	720	4320	0	0.0014	6.5727E+01	0	0.00	0
ch7-6-b1	630	42	1260	0	0.0476	1.3254E+01	4	0.00	0
ch7-6-b2	4200	630	12600	0	0.0048	7.6431E-15	9	0.00	0
ch7-6-b3	12600	4200	50400	0	0.0010	3.8393E+01	11	0.01	0
ch7-6-b4	15120	12600	75600	0	0.0004	2.0287E-14	18	0.01	0
ch7-6-b5	15120	5040	30240	0	0.0004	1.2296E+02	0	0.00	0
ch7-7-b1	882	49	1764	0	0.0408	1.5793E+01	3	0.00	0
ch7-7-b2	7350	882	22050	0	0.0034	2.3716E-14	5	0.00	0
ch7-7-b5	52920	35280	211680	-	0.0001	2.3004E+02	0	0.00	0
ch7-8-b1	1176	56	2352	0	0.0357	1.8284E+01	4	0.00	0
ch7-8-b2	11760	1176	35280	0	0.0026	3.1533E-14	9	0.00	0
ch7-8-b3	58800	11760	235200	0	0.0003	8.7888E+01	10	0.02	0
ch7-8-b4	141120	58800	705600	-	0.0001	2.0518E-06	16	0.11	0
ch7-9-b1	1512	63	3024	0	0.0317	2.0709E+01	4	0.00	0
ch7-9-b2	17640	1512	52920	0	0.0020	2.6249E-14	8	0.00	0
ch7-9-b3	105840	17640	423360	0	0.0002	1.1794E+02	10	0.04	0
ch7-9-b4	317520	105840	1587600	-	0.0000	3.1951E-06	15	0.23	0
ch7-9-b5	423360	317520	2540160	-	0.0000	1.3659E+02	20	0.52	0
ch8-8-b1	1568	64	3136	0	0.0312	2.1231E+01	3	0.00	0
ch8-8-b2	18816	1568	56448	0	0.0019	1.6555E-14	5	0.00	0
ch8-8-b3	117600	18816	470400	0	0.0002	1.2701E+02	9	0.04	0

Table 2.1: Complete LSQR results for all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
ch8-8-b4	376320	117600	1881600	-	0.0000	3.2299E-06	13	0.23	0
ch8-8-b5	564480	376320	3386880	-	0.0000	1.7776E+02	16	0.53	0
Chem97Zt	31022	2541	62044	0	0.0008	1.6859E+02	3791	2.47	0
cis-n4c6-b13	25605	6300	88200	0	0.0013	1.6002E+02	0	0.00	0
cis-n4c6-b14	6300	920	13800	1	0.0065	7.9018E+01	9	0.00	0
cis-n4c6-b15	920	60	960	0	0.0500	3.0332E+01	0	0.00	0
cis-n4c6-b1	210	21	420	0	0.0952	7.9582E+00	2	0.00	0
cis-n4c6-b2	1330	210	3990	0	0.0143	1.0800E-14	2	0.00	0
cis-n4c6-b3	5970	1330	23880	0	0.0030	3.0996E+01	3	0.00	0
cis-n4c6-b4	20058	5970	100290	0	0.0008	1.1363E-06	9	0.01	0
Cities	55	46	1342	0	0.9783	6.4485E-01	80	0.00	0
connectus (S)	394707	458	1127525	0	0.1594	6.2791E+02	1812	21.58	0
D_10	814	459	7614	7	0.0283	2.1638E+01	67	0.01	0
D_11	457	169	2952	1	0.0710	1.7019E+01	37	0.00	0
D_5	430	114	1832	1	0.0702	1.8623E+01	27	0.00	0
D6-6	50760	18660	146520	1417	0.0003	2.1290E+02	24	0.04	0
D_6	967	433	6491	1	0.0300	2.5961E+01	48	0.00	0
D_7	1270	970	12714	4	0.0206	2.6062E+01	64	0.01	0
D_8	1266	1126	14966	7	0.0187	2.4223E+01	34	0.01	0
D_9	1129	814	12395	28	0.0197	2.3798E+01	39	0.01	0
deltaX	68600	21961	247424	0	0.0038	2.7677E+01	1468	4.07	0
divorce	50	9	225	0	1.0000	6.6094E+00	10	0.00	0
ESOC (S)	327062	37349	6019939	0	0.0005	-	>10196	>600.00	19
EternityII_A_b	358	1	358	0	1.0000	1.8917E+01	2	0.00	0
EternityII_A	150638	7362	782087	0	0.0008	3.8544E-06	677	5.97	0
EternityII_E_b	513	1	513	0	1.0000	2.2645E+01	2	0.00	0
EternityII_E	262144	11077	1503732	0	0.0006	4.7604E-06	106	2.05	0
EternityII_Etilde_ b	512	1	512	0	1.0000	2.2623E+01	2	0.00	0
EternityII_Etilde (S)	204304	10054	1170516	0	0.0007	4.5050E-06	1301	17.33	0
f855_mat9_I	2511	2456	171214	0	0.3375	-	>100000	>121.15	18
f855_mat9 (S)	2511	2456	171214	0	0.3375	-	>100000	>122.19	18
flower_4_1	129	121	386	0	0.0248	2.7316E+00	348	0.00	0
flower_4_4	5529	1837	16466	0	0.0016	6.0690E+01	114	0.02	0
flower_5_1	211	201	602	4	0.0249	3.6716E+00	472	0.01	0
flower_5_4	14721	5226	43942	0	0.0006	9.7567E+01	158	0.09	0
flower_7_1	463	393	1178	4	0.0127	9.0402E+00	771	0.01	0
flower_7_4	67593	27693	202218	0	0.0001	1.9933E+02	677	1.71	0
flower_8_1	625	513	1538	5	0.0097	1.1543E+01	910	0.02	0
flower_8_4	125361	55081	375266	0	0.0001	2.6505E+02	1030	4.99	0
Franz10	19588	4164	97508	0	0.0012	2.7180E-11	15	0.01	0
Franz11	47104	30144	329728	-	0.0002	7.4095E-14	5	0.01	0
Franz1	2240	768	5120	1	0.0052	2.6503E+01	11	0.00	0
Franz2	4480	4032	21504	375	0.0015	4.9227E+01	23	0.01	0
Franz3	2800	1280	11520	0	0.0250	5.0596E+01	5	0.00	0
Franz4	6784	5252	46528	1049	0.0013	4.4759E-13	10	0.00	0
Franz5	7382	2882	44056	0	0.0021	1.6623E+01	13	0.01	0
Franz6	7576	3016	45456	1	0.0020	1.8468E+01	13	0.01	0
Franz7	10160	1740	40424	0	0.0023	1.8573E+01	11	0.00	0
Franz8	16728	7176	100368	0	0.0008	2.7319E+01	14	0.01	0
Franz9	19588	4164	97508	0	0.0012	2.0819E-11	15	0.01	0
gemat1	10595	4929	46591	0	0.0057	-	>100000	>48.27	18
GL6_D_10	339	162	2053	5	0.0741	1.4334E+01	36	0.00	0
GL6_D_6	465	199	2526	1	0.0553	1.8285E+01	27	0.00	0
GL6_D_7	636	469	5378	4	0.0341	1.8138E+01	45	0.01	0
GL6_D_8	632	542	6153	32	0.0277	1.7407E+01	29	0.00	0
GL6_D_9	542	339	4349	25	0.0413	1.7578E+01	28	0.00	0
GL7d10	8	1	8	0	1.0000	2.7912E+00	2	0.00	0
GL7d11	783	60	1513	1	0.1333	2.6905E+01	24	0.00	0
GL7d12	8769	1019	37519	0	0.0128	8.7516E+01	48	0.02	0
GL7d13	47221	8899	356232	13	0.0016	1.9394E+02	57	0.19	0
GL7d14	171369	47268	1831183	-	0.0005	3.5107E+02	52	1.41	0

Table 2.1: Complete LSQR results for all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
GL7d15	460259	171373	6080381	-	0.0002	5.4847E+02	69	6.81	0
GL7d16 (S)	955127	460260	14488881	-	0.0001	7.4875E+02	62	16.25	0
GL7d17 (S)	1548649	955127	25978098	-	0.0001	8.9897E+02	59	38.85	0
GL7d18 (S)	1955309	1548645	35590540	-	0.0000	9.3184E+02	80	76.77	0
GL7d19 (S)	1955296	1911130	37322725	-	0.0000	1.0426E+03	201	200.84	0
GL7d20 (S)	1911124	1437546	29893084	-	0.0000	1.0916E+03	134	105.10	0
GL7d21 (S)	1437546	822922	18174775	-	0.0000	1.0029E+03	142	60.25	0
GL7d22 (S)	822906	349443	8251000	-	0.0001	7.8940E+02	240	37.42	0
GL7d23 (S)	349443	105054	2695430	-	0.0002	5.3569E+02	339	15.31	0
GL7d24	105049	21074	593892	-	0.0006	3.0259E+02	224	1.79	0
GL7d25	21013	2798	81671	6	0.0029	1.3888E+02	88	0.08	0
GL7d26	2748	303	7412	1	0.0132	5.0381E+01	92	0.01	0
graphics (S)	29493	11822	117954	0	0.0003	-	>100000	>119.86	18
HFE18_96_in (S)	2372	2371	933343	0	0.5065	4.9063E-01	31209	199.05	0
IG5-10	652	527	10273	0	0.1347	1.0425E+01	2238	0.19	0
IG5-11	1227	902	22110	0	0.1231	1.5923E+01	1868	0.35	0
IG5-12	2296	1578	46260	0	0.0741	2.3085E+01	3833	1.43	0
IG5-13	3994	2532	91209	0	0.0470	3.1249E+01	3981	2.82	0
IG5-14	6735	3906	173337	0	0.0307	4.1470E+01	4425	5.86	0
IG5-15 (S)	11369	6146	323509	0	0.0195	5.4855E+01	8487	21.04	0
IG5-16 (S)	18846	9519	588326	0	0.0126	7.1509E+01	14890	67.34	0
IG5-17 (S)	30162	14060	1035008	0	0.0085	9.1038E+01	11411	93.67	0
IG5-18 (S)	47894	20818	1790490	0	0.0058	1.1518E+02	18528	290.31	0
IG5-6	43	30	251	0	0.5333	1.1332E+00	50	0.00	0
IG5-7	75	62	549	0	0.3871	1.8887E+00	154	0.00	0
IG5-8	158	156	1711	2	0.3141	2.6588E-01	977	0.02	0
IG5-9	342	310	4570	0	0.1871	5.9084E+00	1670	0.08	0
illc1033	1033	320	4719	0	0.0156	2.2534E+03	3062	0.15	0
illc1850	1850	712	8636	0	0.0070	1.0300E+03	1429	0.14	0
image_interp	232485	120000	711683	0	0.0000	0.0000E+00	0	0.01	0
IMDB (S)	896302	303617	3782463	-	0.0052	-	>6280	>600.00	19
Kemelmacher	28452	9693	100875	0	0.0007	1.1394E+02	3318	3.07	0
klein-b1	30	10	60	0	0.2000	2.8271E+00	10	0.00	0
klein-b2	30	20	60	0	0.1000	4.7876E+00	20	0.00	0
kneser_10_4_1 (S)	349651	330751	992252	-	0.0000	-	>28788	>600.00	19
kneser_6_2_1	676	601	2027	0	0.0050	8.5632E+00	1881	0.06	0
kneser_8_3_1	15737	15681	47042	449	0.0007	2.9040E+01	12750	7.24	0
landmark (S)	71952	2673	1146848	2	0.0060	1.1535E-05	24063	201.51	0
LargeRegFile (S)	2111154	801374	4944201	0	0.0000	4.4422E+02	795	65.20	0
lutz30-23-b6	3003	1716	12012	0	0.0035	5.2529E+01	93	0.02	0
Maragal_1	32	14	234	1	1.0000	1.0249E+00	11	0.00	0
Maragal_2	536	260	4357	81	0.3000	3.0681E+00	349	0.02	0
Maragal_3	1682	858	18391	127	0.5455	4.2081E+00	1153	0.20	0
Maragal_4	1964	1027	26719	110	0.5706	5.7947E+00	775	0.18	0
Maragal_5	4654	3296	93091	610	0.4524	9.1202E+00	3886	2.95	0
Maragal_6 (S)	21251	10144	537694	516	0.5857	1.0686E+01	21689	87.54	0
Maragal_7 (S)	46845	26525	1200537	2046	0.3604	1.3690E+01	8143	81.88	0
Maragal_8 (S)	60845	33093	1308415	7107	0.0503	-	>52072	>600.00	19
mesh_deform_D	234023	234023	234023	0	0.0000	4.7447E-06	502	3.12	0
mesh_deform	234023	9393	853829	0	0.0004	0.0000E+00	0	0.00	0
mk10-b1	630	45	1260	0	0.0444	1.2596E+01	3	0.00	0
mk10-b2	3150	630	9450	0	0.0048	7.0235E-15	5	0.00	0
mk10-b3	4725	3150	18900	0	0.0013	1.6323E+01	8	0.00	0
mk10-b4	4725	945	4725	0	0.0011	6.7350E+01	2	0.00	0
mk11-b1	990	55	1980	0	0.0364	1.5977E+01	3	0.00	0
mk11-b2	6930	990	20790	0	0.0030	1.1280E-14	5	0.00	0
mk11-b3	17325	6930	69300	0	0.0006	3.7435E+01	7	0.00	0
mk11-b4b	17325	9450	47250	0	0.0003	1.2667E+02	10	0.01	0
mk11-b4	17325	10395	51975	0	0.0003	1.2634E+02	9	0.01	0
mk12-b1	1485	66	2970	1	0.0303	1.9758E+01	3	0.00	0
mk12-b2	13860	1485	41580	0	0.0020	1.7602E-14	5	0.00	0

Table 2.1: Complete LSQR results for all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
mk12-b3	51975	13860	207900	0	0.0003	7.0503E+01	8	0.02	0
mk12-b4	62370	51975	311850	-	0.0001	4.2145E-14	12	0.04	0
mk12-b5	62370	10395	62370	0	0.0001	2.4974E+02	0	0.00	0
mk13-b5	270270	135135	810810	-	0.0000	5.1987E+02	0	0.01	0
mk9-b1	378	36	756	0	0.0556	9.6367E+00	3	0.00	0
mk9-b2	1260	378	3780	0	0.0079	4.1415E-15	5	0.00	0
mk9-b3	1260	945	3780	0	0.0032	3.5496E+01	0	0.00	0
mri1 (S)	114637	65536	589824	603	0.0037	-	>87635	>600.00	19
mri2 (S)	104597	63240	569160	-	0.0660	-	>100000	>562.25	18
n2c6-b10	306	30	330	0	0.1667	1.7423E+01	3	0.00	0
n2c6-b1	105	15	210	0	0.1333	5.5076E+00	2	0.00	0
n2c6-b2	455	105	1365	0	0.0286	2.0085E-15	2	0.00	0
n2c6-b3	1365	455	5460	0	0.0088	1.4149E+01	2	0.00	0
n2c6-b4	3003	1365	15015	0	0.0037	4.6914E-15	2	0.00	0
n2c6-b5	4945	3003	29670	0	0.0020	2.0512E+01	3	0.00	0
n2c6-b6	5715	4945	40005	27	0.0014	2.8986E-07	19	0.01	0
n2c6-b7	5715	3990	31920	9	0.0020	7.5598E+01	0	0.00	0
n2c6-b8	3990	1470	13230	1	0.0048	6.2175E+01	7	0.00	0
n2c6-b9	1410	306	3060	1	0.0196	3.7550E+01	0	0.00	0
n3c4-b1	15	6	30	1	0.3333	1.8257E+00	2	0.00	0
n3c4-b2	20	15	60	2	0.2000	1.3800E-15	2	0.00	0
n3c4-b3	20	15	60	2	0.2000	4.4721E+00	0	0.00	0
n3c4-b4	15	6	30	1	0.3333	3.7417E+00	2	0.00	0
n3c5-b1	45	10	90	0	0.2000	3.4641E+00	2	0.00	0
n3c5-b2	120	45	360	0	0.0667	1.1144E-15	2	0.00	0
n3c5-b3	210	120	840	0	0.0333	5.0200E+00	2	0.00	0
n3c5-b4	252	210	1260	0	0.0238	3.3295E-15	2	0.00	0
n3c5-b5	252	210	1260	0	0.0238	1.5875E+01	0	0.00	0
n3c5-b6	210	120	840	0	0.0333	1.4071E+01	2	0.00	0
n3c5-b7	120	30	240	0	0.1000	1.0954E+01	0	0.00	0
n3c6-b10	2511	675	7425	0	0.0074	4.9539E+01	16	0.00	0
n3c6-b11	630	60	720	0	0.0667	2.5100E+01	0	0.00	0
n3c6-b2	455	105	1365	0	0.0286	2.0085E-15	2	0.00	0
n3c6-b3	1365	455	5460	0	0.0088	1.4149E+01	2	0.00	0
n3c6-b4	3003	1365	15015	0	0.0037	4.6914E-15	2	0.00	0
n3c6-b5	5005	3003	30030	0	0.0020	2.0712E+01	2	0.00	0
n3c6-b6	6435	5005	45045	0	0.0014	1.5472E-14	2	0.00	0
n3c6-b8	6435	4935	44415	0	0.0014	7.8111E+01	3	0.00	0
n3c6-b9	4935	2511	25110	0	0.0024	7.0250E+01	0	0.00	0
n4c5-b10	630	120	1320	2	0.0333	2.4902E+01	6	0.00	0
n4c5-b11	120	10	120	0	0.1000	1.0954E+01	0	0.00	0
n4c5-b1	105	15	210	0	0.1333	5.5076E+00	2	0.00	0
n4c5-b2	455	105	1365	0	0.0286	2.0085E-15	2	0.00	0
n4c5-b3	1350	455	5400	0	0.0088	1.3972E+01	5	0.00	0
n4c5-b4	2852	1350	14260	0	0.0037	2.9100E-07	11	0.00	0
n4c5-b5	4340	2852	26040	1	0.0021	1.8576E+01	10	0.00	0
n4c5-b6	4735	4340	33145	57	0.0016	4.2082E-07	15	0.01	0
n4c5-b7	4735	3635	29080	26	0.0022	6.8811E+01	0	0.00	0
n4c5-b8	3635	1895	17055	0	0.0037	5.9042E+01	14	0.00	0
n4c5-b9	1895	630	6300	0	0.0095	4.3532E+01	0	0.00	0
n4c6-b10	186558	132402	1456422	-	0.0001	4.2339E+02	14	0.18	0
n4c6-b11	132402	69235	830820	-	0.0001	3.6387E+02	0	0.00	0
n4c6-b12	69235	25605	332865	0	0.0004	2.6025E+02	13	0.04	0
n4c6-b13	25605	6300	88200	0	0.0013	1.6002E+02	0	0.00	0
n4c6-b14	6300	920	13800	1	0.0065	7.9018E+01	9	0.00	0
n4c6-b15	920	60	960	0	0.0500	3.0332E+01	0	0.00	0
n4c6-b1	210	21	420	0	0.0952	7.9582E+00	2	0.00	0
n4c6-b2	1330	210	3990	0	0.0143	1.0800E-14	2	0.00	0
n4c6-b3	5970	1330	23880	0	0.0030	3.0996E+01	3	0.00	0
n4c6-b4	20058	5970	100290	0	0.0008	1.1363E-06	9	0.01	0
n4c6-b5	51813	20058	310878	0	0.0003	7.1632E+01	9	0.03	0

Table 2.1: Complete LSQR results for all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
n4c6-b6	104115	51813	728805	-	0.0001	2.5249E-06	12	0.08	0
n4c6-b7	163215	104115	1305720	-	0.0001	1.0147E+02	11	0.14	0
n4c6-b8	198895	163215	1790055	-	0.0001	3.4586E-06	15	0.27	0
n4c6-b9	198895	186558	1865580	-	0.0001	4.4598E+02	0	0.01	0
NotreDame_actors (S)	383640	127823	1470404	-	0.0051	-	>23008	>600.00	19
Pd_rhs	5804	4371	6323	0	0.0069	3.4807E+01	18449	2.41	0
photogrammetry2	4472	936	37056	7	0.0096	3.0388E+02	158	0.06	0
photogrammetry	1388	390	11816	7	0.0231	9.0895E+01	878	0.10	0
psse0 (S)	26722	11028	102432	0	0.0004	-	>100000	>115.30	18
psse1 (S)	14318	11028	57376	0	0.0016	-	>100000	>82.19	18
psse2 (S)	28634	11028	115262	0	0.0025	-	>100000	>129.64	18
QRpivot_b	391	1	391	0	1.0000	1.9764E+01	2	0.00	0
QRpivot	749	660	3808	0	0.0152	1.5593E+01	966	0.04	0
rel3	6	3	18	2	1.0000	5.4390E-16	2	0.00	0
rel4	28	10	104	5	0.4000	8.9443E-01	6	0.00	0
rel5	172	33	656	2	0.1212	5.3439E+00	24	0.00	0
rel6	1300	155	5101	2	0.0258	1.8073E+01	53	0.00	0
rel7	12770	1043	50636	2	0.0038	6.4132E+01	71	0.03	0
rel8	206040	12345	821839	2	0.0003	2.7707E+02	97	1.05	0
rel9 (S)	5921786	274667	23667183	-	0.0000	1.5416E+03	116	77.93	0
relat3	8	3	24	2	1.0000	2.4495E+00	2	0.00	0
relat4	46	10	172	5	0.4000	5.7613E+00	6	0.00	0
relat5	276	33	1058	2	0.1212	1.4900E+01	23	0.00	0
relat6	2063	155	8108	2	0.0258	4.1070E+01	44	0.01	0
relat7b	20500	1043	81355	1	0.0038	1.3429E+02	56	0.05	0
relat7	20500	1043	81355	1	0.0038	1.3429E+02	56	0.05	0
relat8	334362	12345	1334038	1	0.0003	5.5522E+02	77	1.42	0
relat9 (S)	9746232	274667	38955420	-	0.0000	3.0561E+03	92	110.27	0
rkat7_mat5	738	694	38114	0	0.3703	8.8256E+00	12280	3.37	0
robot24c1_mat5_J	404	302	15118	0	0.3013	6.4681E+00	1043	0.12	0
robot24c1_mat5	404	302	15118	0	0.3013	6.4681E+00	1042	0.12	0
Rucci1 (S)	1977885	109900	7791168	0	0.0000	-	>6839	>600.00	19
Sandi_sandi	360	314	613	66	0.0191	1.1104E+01	440	0.00	0
shar_te2-b1	17160	286	34320	0	0.0070	6.1422E+01	4	0.00	0
shar_te2-b2	200200	17160	600600	0	0.0002	7.9125E-14	11	0.08	0
sls (S)	1748122	62729	6804304	0	0.0001	1.2935E-05	613	65.41	0
TF10	106	99	622	0	0.0909	1.0179E-07	277	0.00	0
TF11	235	216	1607	0	0.0463	1.4948E-07	904	0.02	0
TF12	551	488	4231	0	0.0225	2.2573E-07	3102	0.13	0
TF13	1301	1121	11185	0	0.0107	3.5791E-07	10043	1.15	0
TF14 (S)	3159	2644	29862	0	0.0049	5.6025E-07	33351	9.97	0
TF15 (S)	7741	6334	80057	0	0.0022	-	>100000	>77.44	18
TF16 (S)	19320	15437	216173	0	0.0010	-	>100000	>202.40	18
TF17 (S)	48629	38132	586218	-	0.0004	-	>100000	>556.29	18
TF18 (S)	123867	95368	1597545	-	0.0002	-	>37282	>600.00	19
TF19 (S)	317955	241029	4370721	-	0.0001	-	>12847	>600.00	19
tomographic1 (S)	59360	45908	647495	3436	0.0003	-	>90683	>600.00	19
Trec10	475	106	8612	0	0.7453	1.6372E+01	199	0.02	0
Trec11	1136	235	35705	0	0.7617	2.6544E+01	446	0.13	0
Trec12	2724	551	151219	0	0.7586	4.3372E+01	1419	1.47	0
Trec13	6560	1301	654517	0	0.7656	6.9694E+01	2806	12.67	0
Trec14 (S)	15904	3159	2872265	0	0.7914	1.1217E+02	6504	134.21	0
Trec3	1	1	1	0	1.0000	1.1102E-16	2	0.00	0
Trec4	2	2	3	0	1.0000	1.2671E-15	3	0.00	0
Trec5	6	3	12	0	1.0000	6.6169E-01	4	0.00	0
Trec6	14	6	40	0	0.8333	1.8236E+00	7	0.00	0
Trec7	35	11	147	0	0.8182	2.9715E+00	12	0.00	0
Trec8	83	23	549	0	0.7826	5.8826E+00	31	0.00	0
Trec9	200	47	2147	0	0.7660	9.7112E+00	68	0.00	0
well1033	1033	320	4732	0	0.0156	2.2534E+03	137	0.01	0
well1850	1850	712	8755	0	0.0070	1.0300E+03	395	0.05	0

Table 2.1: Complete LSQR results for all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
wheel_3_1	25	21	74	0	0.1429	2.2738E+00	23	0.00	0
wheel_4_1	41	36	122	0	0.0833	1.5091E+00	41	0.00	0
wheel_5_1	61	57	182	0	0.0526	1.1067E+00	108	0.00	0
wheel_601 (S)	902103	723605	2170814	-	0.0008	-	>11247	>600.00	19
wheel_6_1	85	83	254	2	0.0361	2.5685E+00	128	0.00	0
wheel_7_1	114	113	338	4	0.0708	2.3883E+00	229	0.00	0
wm1	260	207	2909	0	0.2415	8.1946E+00	162	0.00	0
wm2	259	207	2942	0	0.2415	8.4071E+00	204	0.01	0
wm3	259	207	2948	0	0.2705	8.1940E+00	206	0.01	0
WorldCities	313	100	7518	0	0.9900	5.3353E+00	63	0.00	0

Table 2.2: Complete LSMR(0) results for all problems with no preconditioning.

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
CUTEst examples									
25FV47	1876	820	10705	1	0.0256	2.0432E+01	4740	0.24	0
80BAU3B	11934	2262	23264	0	0.0053	8.2705E+01	135	0.02	0
AA01	8904	823	72965	15	0.0182	1.9002E+01	238	0.06	0
AA03	8627	825	70806	25	0.0206	1.9090E+01	253	0.07	0
AA3	8627	825	70806	27	0.0206	1.9090E+01	253	0.06	0
AA4	7195	426	52121	10	0.0329	1.5866E+01	164	0.03	0
AA5	8308	801	65953	22	0.0187	1.8653E+01	231	0.06	0
AA6	7292	646	51728	14	0.0217	1.6804E+01	195	0.04	0
ADLITTL2	138	56	424	0	0.1964	7.3997E+00	57	0.00	0
ADLITTLE	138	56	424	0	0.1964	7.3997E+00	57	0.00	0
AFIRO	51	27	102	0	0.1481	5.2189E+00	22	0.00	0
AFIROE	24	8	34	0	0.2500	4.1055E+00	9	0.00	0
AGG	615	488	2862	0	0.0881	1.1455E+01	165	0.00	0
AGG2	758	516	4740	0	0.0833	1.3214E+01	172	0.00	0
AGG3	758	516	4756	0	0.0833	1.3214E+01	216	0.00	0
AIR02	6774	50	61555	0	0.3400	1.5416E+01	30	0.00	0
AIR03	10757	124	91028	0	0.1129	1.7479E+01	172	0.05	0
AIR04	8904	823	72965	23	0.0182	1.9002E+01	238	0.06	0
AIR05	7195	426	52121	11	0.0329	1.5866E+01	164	0.03	0
AIR06	8627	825	70806	30	0.0206	1.9090E+01	253	0.07	0
AIR	7517	3754	20267	0	0.2001	8.6603E+01	19	0.00	0
ALLINLP	687500	250000	687500	0	0.0000	7.0711E+02	3	0.03	0
BANDM	472	305	2494	0	0.0721	9.8785E+00	2108	0.03	0
BAS1LP (S)	9825	5411	587775	0	0.0675	5.5448E+01	14870	27.18	0
BAXTER (S)	30733	27441	111576	2993	0.0017	-	>100000	>67.29	18
BCDOUT (S)	7078	5412	67344	2	0.1554	-	>100000	>28.51	18
BEACONFD	295	173	3408	0	0.1561	5.5647E+00	243	0.01	0
BGDBG1	629	348	1662	0	0.0460	1.9660E+01	38	0.00	0
BGETAM	816	400	2537	0	0.0200	1.6322E+01	878	0.01	0
BGINDY	10880	2671	66266	0	0.0060	3.6010E+01	352	0.10	0
BGPRTR	40	20	70	0	0.2000	3.1175E+00	21	0.00	0
BLEND	114	74	522	0	0.2162	6.0635E+00	178	0.00	0
BNL1	1586	642	5532	1	0.0125	2.0313E+01	1372	0.04	0
BNL2	4486	2324	14996	0	0.0034	3.7869E+01	3627	0.30	0
BOEING1	726	351	3827	0	0.0912	1.3035E+01	880	0.01	0
BOEING2	305	166	1358	0	0.1386	7.3877E+00	345	0.00	0
BORE3D	334	233	1448	2	0.1202	8.0348E+00	918	0.00	0
BOX1	261	231	651	1	0.0216	1.5955E+01	30	0.00	0
BRANDY	303	193	2202	27	0.1503	8.7556E+00	647	0.00	0
CAPRI	482	271	1896	0	0.0923	1.3828E+01	904	0.01	0
CAR4	33052	16384	63724	0	0.0067	1.8158E+02	5	0.00	0
CARI	1200	400	152800	0	0.9500	2.8997E+01	2	0.00	0
CEP1	4769	1521	8233	0	0.1440	6.1852E+01	12	0.00	0
CERIA3D	4400	3576	21178	0	0.2704	3.0961E+01	66	0.01	0
CH	8291	3700	24102	0	0.0038	5.7926E+01	808	0.10	0
CHEMCOM	744	288	1590	0	0.0208	1.8078E+01	29	0.00	0
CO5	12325	5774	57993	0	0.0048	6.5536E+01	11474	3.06	0
CO9 (S)	22924	10789	109651	0	0.0026	8.9188E+01	24925	12.93	0
COMPLEX	1408	1023	46463	0	0.5005	3.1883E+01	7	0.00	0
CONT1	161589	160792	521181	-	0.5025	4.0197E+02	10	0.04	0
CONT11	201587	160792	521181	0	0.0000	3.0775E+02	12	0.05	0
CONT11_L (S)	1961394	1468599	5382999	0	0.0000	8.0916E+02	206	8.47	0
CONT1_L	1921596	1918399	7031999	-	0.6672	1.3862E+03	4	0.26	0
CONT4	161589	160792	519589	-	0.5025	4.0197E+02	10	0.04	0
CPLEX1	5224	3005	10947	0	0.4995	4.6078E+01	92	0.01	0
CPLEX2	378	224	1215	0	0.0357	2.5454E+00	106	0.00	0
CQ5	11748	5048	51571	0	0.0048	6.1448E+01	1548	0.38	0
CQ9	21534	9278	96653	0	0.0026	8.3008E+01	2118	0.95	0
CR42	1513	905	6614	0	0.3337	3.8739E+01	28	0.00	0

Table 2.2: Complete results for LSMR(0) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
CRE_A_PRE	6382	2684	15739	1	0.0060	5.2407E+01	8431	0.79	0
CRE_B_PRE	36222	5176	111434	2	0.0033	8.4734E+01	9583	4.58	0
CRE_C_PRE	5293	2257	13078	1	0.0062	4.9627E+01	8051	0.63	0
CRE_D_PRE	28489	3990	86144	2	0.0043	7.5197E+01	11457	4.34	0
CREW1	6469	135	46950	0	0.1185	4.7500E+00	63	0.01	0
CYCLE	3371	1890	21234	28	0.0148	2.7738E+01	41589	4.36	0
CZPROB	3562	929	10708	0	0.0043	3.3275E+00	91	0.01	0
D2Q06C (S)	5831	2171	33081	0	0.0157	3.4935E+01	58936	8.87	0
D6CUBE	6184	404	37704	11	0.0248	2.8696E+01	159	0.02	0
DANO3MIP	15851	3202	81633	0	0.1952	3.6615E+01	2627	0.85	0
DBIC1	226317	43200	1081843	0	0.0009	2.2487E+02	400	2.51	0
DBIR1 (S)	45775	18804	1077025	103	0.0119	1.6711E+02	1451	5.44	0
DBIR2 (S)	45877	18906	1158159	101	0.0123	1.6746E+02	19090	82.11	0
DE063155	1596	852	4913	0	0.0141	3.8032E+01	12700	0.33	0
DE063157	1656	936	5119	0	0.0128	4.0603E+01	13	0.00	0
DE080285	1656	936	5082	0	0.0128	2.9637E+01	91643	2.34	0
DEGEN2	757	444	4201	0	0.0495	8.7769E+00	242	0.01	0
DEGEN3	2604	1503	25432	0	0.0326	1.9246E+01	987	0.10	0
DEGENLPA	20	15	82	0	0.4000	8.1996E-01	26	0.00	0
DEGENLPB	20	15	82	0	0.4000	8.1996E-01	26	0.00	0
DEGME	659415	185501	8127528	0	0.0001	3.4604E+02	25	1.03	0
DELF000 (S)	5543	3128	13741	0	0.0029	-	>100000	>7.77	18
DELF001	5514	3098	14322	0	0.0032	-	>100000	>7.88	18
DELF002	5549	3135	14432	0	0.0032	-	>100000	>7.81	18
DELF003	5478	3065	14343	0	0.0033	-	>100000	>8.00	18
DELF004	5558	3142	14696	0	0.0032	-	>100000	>8.15	18
DELF005	5519	3103	14605	0	0.0032	-	>100000	>8.07	18
DELF006	5563	3147	14754	0	0.0032	-	>100000	>8.14	18
DELF007	5555	3137	14898	0	0.0032	-	>100000	>8.18	18
DELF008	5566	3148	14971	0	0.0032	-	>100000	>8.20	18
DELF009	5554	3135	14888	0	0.0032	-	>100000	>8.29	18
DELF010	5566	3147	14952	0	0.0032	-	>100000	>8.19	18
DELF011	5553	3134	14915	0	0.0032	-	>100000	>8.17	18
DELF012	5570	3151	14948	0	0.0032	-	>100000	>8.16	18
DELF013	5535	3116	14928	0	0.0032	-	>100000	>8.15	18
DELF014	5586	3170	15036	0	0.0032	-	>100000	>8.21	18
DELF015	5573	3161	14951	0	0.0032	-	>100000	>8.34	18
DELF017	5587	3176	14904	0	0.0031	-	>100000	>8.09	18
DELF018	5604	3196	14963	0	0.0031	-	>100000	>8.15	18
DELF019	5592	3185	14939	0	0.0031	-	>100000	>8.19	18
DELF020	5616	3213	15270	0	0.0031	-	>100000	>8.34	18
DELF021	5610	3208	15263	0	0.0031	-	>100000	>8.33	18
DELF022	5616	3214	15260	0	0.0031	-	>100000	>8.27	18
DELF023	5616	3214	15298	0	0.0031	-	>100000	>8.39	18
DELF024	5610	3207	15656	0	0.0034	-	>100000	>8.48	18
DELF025	5608	3197	15647	0	0.0034	-	>100000	>8.39	18
DELF026	5606	3190	15420	0	0.0031	-	>100000	>8.45	18
DELF027	5601	3187	15400	0	0.0031	-	>100000	>8.34	18
DELF028	5596	3177	15602	0	0.0035	-	>100000	>8.38	18
DELF029	5598	3179	15602	0	0.0035	-	>100000	>8.38	18
DELF030	5613	3199	15462	0	0.0034	-	>100000	>8.35	18
DELF031	5599	3176	15405	0	0.0035	-	>100000	>8.35	18
DELF032	5611	3196	15451	0	0.0034	-	>100000	>8.35	18
DELF033	5595	3173	15400	0	0.0035	-	>100000	>8.26	18
DELF034	5594	3175	15403	0	0.0035	-	>100000	>8.31	18
DELF035	5607	3193	15479	0	0.0034	-	>100000	>8.37	18
DELF036	5598	3170	15397	0	0.0035	-	>100000	>8.30	18
DETER0	5468	1923	11173	0	0.0099	5.7052E+01	192	0.01	0
DETER1	15737	5527	32187	0	0.0096	9.8357E+01	294	0.05	0
DETER2	17313	6095	35731	0	0.0133	1.0199E+02	282	0.05	0
DETER3	21777	7647	44547	0	0.0095	1.2196E+02	314	0.10	0

Table 2.2: Complete results for LSMR(0) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
DETER4	9133	3235	19231	0	0.0219	7.4270E+01	172	0.02	0
DETER5	14529	5103	29715	0	0.0096	9.8117E+01	286	0.05	0
DETER6	12113	4255	24771	0	0.0096	8.9066E+01	264	0.05	0
DETER7	18153	6375	37131	0	0.0096	1.1073E+02	303	0.06	0
DETER8	10905	3831	22299	0	0.0097	8.4952E+01	247	0.03	0
DF2177	10358	630	22336	0	0.0127	5.4305E+01	10	0.00	0
DFL001	12230	6071	35632	0	0.0023	5.5173E+01	792	0.24	0
DISP3	3990	2182	8541	0	0.0027	4.6507E+01	50	0.00	0
DSBMIP	2667	1182	8156	0	0.0068	2.6848E+01	1132	0.05	0
E18	38601	24617	156466	0	0.0040	1.1964E+02	9	0.01	0
E226	472	223	2768	0	0.0942	1.3971E+01	597	0.01	0
ETAMACRO	816	400	2537	0	0.0200	1.6322E+01	882	0.01	0
EX2STA1	17516	17443	68779	0	0.0026	3.5780E+00	4553	1.83	0
EX72A	215	197	467	1	0.0152	1.3687E+01	96	0.00	0
EX73A	211	193	457	1	0.0155	1.3619E+01	93	0.00	0
FARM	17	7	41	0	0.5714	2.6080E+00	11	0.00	0
FFFFF800	1028	524	6401	0	0.0954	1.0704E+01	4242	0.13	0
FINNIS	1064	497	2760	0	0.0282	2.1406E+01	306	0.01	0
FIT1D	1049	24	13427	0	0.7500	3.0717E+01	55	0.00	0
FIT1P	1677	627	9868	0	1.0000	4.0153E+01	87	0.00	0
FIT2D	10524	25	129042	0	0.6800	1.0026E+02	51	0.02	0
FIT2P	13525	3000	50284	0	1.0000	1.1051E+02	78	0.02	0
FOME11	24460	12142	71264	0	0.0012	7.8027E+01	798	0.43	0
FOME12	48920	24284	142528	0	0.0006	1.1035E+02	796	0.82	0
FOME13	97840	48568	285056	1	0.0003	1.5605E+02	800	1.69	0
FOME20	108175	33798	232647	77	0.0001	8.8731E+01	273	0.45	0
FOME21	216350	67596	465294	152	0.0000	1.2549E+02	273	0.94	0
FOREST	131	66	246	0	0.0455	5.8417E+00	19	0.00	0
FORPLAN	492	161	4634	0	0.2174	7.4845E+00	134	0.00	0
FXM2_16	7335	3900	32972	0	0.0092	5.0100E+01	1713	0.26	0
FXM2_6	2845	1520	12812	0	0.0158	3.1221E+01	1620	0.10	0
FXM3_16	85575	41340	392252	0	0.0009	1.7544E+02	1830	3.37	0
FXM3_6	12625	6200	57722	0	0.0039	6.6994E+01	1649	0.42	0
FXM4_6	47185	22400	265442	0	0.0011	1.4534E+02	1661	1.80	0
GALENET	14	8	22	0	0.2500	3.7417E+00	1	0.00	0
GAMS10A	171	114	407	0	0.0614	8.8742E+00	10	0.00	0
GAMS10AM	171	114	407	0	0.0614	8.1798E+00	10	0.00	0
GAMS30A	531	354	1287	0	0.0198	1.3857E+01	19	0.00	0
GAMS30AM	531	354	1287	0	0.0198	1.2209E+01	19	0.00	0
GAMS60AM	1071	714	2607	0	0.0098	1.6497E+01	28	0.00	0
GANGES	1706	1309	6937	0	0.0099	1.4580E+01	118	0.00	0
GAS11	860	459	2166	0	0.0261	1.7536E+01	16313	0.20	0
GE (S)	16369	10099	44825	0	0.0036	7.2589E+01	69445	20.64	0
GEN	2561	769	63086	0	0.0858	2.5015E+00	69	0.01	0
GEN1	2561	769	63086	0	0.0858	2.5015E+00	69	0.02	0
GEN2	3264	1121	81855	0	0.0937	1.6054E+00	65	0.02	0
GEN4	4298	1537	107103	0	0.0625	2.8739E+00	55	0.02	0
GFRD-PNC	1160	616	2445	0	0.0049	2.8248E+01	108	0.00	0
GOFFIN	101	50	2600	0	1.0000	9.8528E+00	2	0.00	0
GOSH	13455	3790	99953	2	0.0045	5.0199E+01	11741	4.31	0
GRAN	2604	2525	20111	471	0.0341	2.1249E+01	75230	6.79	0
GREENBEA	5598	2389	31070	3	0.0100	3.1909E+01	2022	0.28	0
GREENBEB	5598	2389	31070	3	0.0100	3.1909E+01	2022	0.30	0
GREENBEI	5596	2390	31074	3	0.0100	3.1810E+01	2023	0.29	0
GROW15	645	300	5620	0	0.0667	2.1646E+01	34	0.00	0
GROW22	946	440	8252	0	0.0455	2.5881E+01	35	0.00	0
GROW7	301	140	2612	0	0.1429	1.5322E+01	29	0.00	0
IIASA	3639	669	7317	0	0.0105	2.9786E+01	32	0.00	0
IPROB	3001	3001	9000	0	0.9997	2.2177E+01	3	0.00	0
ISRAEL	316	174	2443	0	0.7816	1.0905E+01	493	0.01	0
ITEST2	13	9	26	0	0.5556	3.1920E+00	6	0.00	0

Table 2.2: Complete results for LSMR(0) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
ITEST6	17	11	29	0	0.4545	3.6023E+00	10	0.00	0
JENDREC1	4228	2109	89608	0	0.9886	6.4699E+01	134	0.05	0
KARTED	133115	46502	1770349	0	0.0005	1.1284E+02	43	0.32	0
KB2	68	43	313	0	0.3256	5.7141E+00	111	0.00	0
KEN_07_PRE	2033	887	4354	0	0.0034	2.4960E+01	36	0.00	0
KEN_11_PRE	11984	5511	26538	3	0.0005	7.1971E+01	91	0.01	0
KEN_13_PRE	24818	10962	57238	18	0.0004	9.7208E+01	112	0.04	0
KEN_18_PRE	89439	39867	208594	1	0.0001	1.5484E+02	147	0.18	0
KENT	47920	31300	216010	0	0.0006	7.5567E+01	843	0.87	0
KL02	36699	71	212536	0	0.1127	1.3910E-06	44	0.03	0
KLEEMIN3	6	3	9	0	1.0000	1.4281E+00	4	0.00	0
KLEEMIN4	8	4	14	0	1.0000	1.4351E+00	5	0.00	0
KLEEMIN5	10	5	20	0	1.0000	1.4422E+00	6	0.00	0
KLEEMIN6	12	6	27	0	1.0000	1.4488E+00	7	0.00	0
KLEEMIN7	14	7	35	0	1.0000	1.5542E+00	4	0.00	0
KLEEMIN8	16	8	44	0	1.0000	3.8442E+00	2	0.00	0
KLEIN1	108	54	750	0	0.3889	8.3196E+00	214	0.00	0
KLEIN2	531	477	5062	0	0.3438	1.5237E+01	302	0.01	0
KLEIN3	1082	994	13101	0	0.2767	2.1013E+01	949	0.08	0
L30	16281	2701	52070	0	0.0030	1.2489E+02	232	0.05	0
L9	1483	244	4659	0	0.0328	3.7508E+01	86	0.00	0
LARGE000	7253	4239	18313	0	0.0024	6.1470E+01	38260	4.00	0
LARGE001 (S)	7176	4162	18887	0	0.0026	6.0689E+01	52505	5.55	0
LARGE002	7260	4249	20075	0	0.0028	5.9736E+01	69195	7.76	0
LARGE003	7216	4200	19717	0	0.0029	6.1237E+01	67946	7.48	0
LARGE004	7266	4250	19489	0	0.0028	6.0729E+01	64606	7.11	0
LARGE005	7256	4237	19314	0	0.0026	6.0714E+01	65212	7.05	0
LARGE006	7267	4249	19637	0	0.0026	6.0400E+01	66109	7.12	0
LARGE007	7255	4236	19595	0	0.0026	6.0316E+01	70265	7.55	0
LARGE008	7267	4248	19648	0	0.0026	6.0334E+01	71875	7.79	0
LARGE009	7256	4237	19617	0	0.0026	6.0292E+01	72554	7.92	0
LARGE010	7267	4247	19637	0	0.0026	6.0325E+01	72606	7.74	0
LARGE011	7256	4236	19617	0	0.0026	6.0318E+01	71586	7.90	0
LARGE012	7273	4253	19674	0	0.0026	6.0332E+01	71342	7.75	0
LARGE013	7265	4248	19688	0	0.0026	5.9904E+01	74175	8.08	0
LARGE014	7288	4271	19749	0	0.0026	6.0703E+01	67697	7.39	0
LARGE015	7278	4265	19717	0	0.0026	6.0682E+01	67310	7.43	0
LARGE016	7298	4287	19809	0	0.0026	6.0739E+01	67401	7.33	0
LARGE017	7288	4277	19754	0	0.0026	6.0762E+01	66001	7.24	0
LARGE018	7305	4297	19579	0	0.0026	6.0632E+01	66820	7.44	0
LARGE019	7304	4300	19574	0	0.0026	5.9969E+01	70556	7.71	0
LARGE020	7317	4315	19936	0	0.0025	5.9599E+01	72732	7.95	0
LARGE021	7313	4311	19952	0	0.0026	5.9658E+01	70831	7.87	0
LARGE022	7314	4312	19904	0	0.0026	5.9679E+01	67404	7.47	0
LARGE023	7304	4302	19912	0	0.0026	5.9857E+01	61217	6.75	0
LARGE024	7311	4292	20399	0	0.0028	6.0055E+01	45392	5.22	0
LARGE025	7312	4297	20543	0	0.0028	6.0323E+01	49417	5.60	0
LARGE026	7304	4284	20431	0	0.0028	6.0300E+01	48500	5.45	0
LARGE027	7301	4275	20362	0	0.0028	6.0470E+01	43778	4.88	0
LARGE028	7313	4302	20686	0	0.0028	6.0616E+01	47058	5.32	0
LARGE029	7312	4301	20752	0	0.0028	6.0631E+01	48742	5.49	0
LARGE030	7303	4285	20643	0	0.0028	6.1137E+01	49143	5.40	0
LARGE031	7306	4294	20667	0	0.0028	6.1091E+01	48968	5.54	0
LARGE032	7307	4292	20650	0	0.0028	6.1080E+01	48946	5.50	0
LARGE033	7292	4273	20586	0	0.0028	6.0623E+01	49060	5.56	0
LARGE034	7306	4294	20650	0	0.0028	6.0513E+01	48616	5.47	0
LARGE035	7304	4293	20676	0	0.0028	6.0485E+01	49379	5.60	0
LARGE036	7297	4282	20635	0	0.0028	6.0441E+01	50153	5.59	0
LINSPANH	97	33	194	0	0.0606	4.6238E+00	21	0.00	0
LOTFI	366	153	1136	0	0.0654	9.7312E+00	280	0.00	0
LP22	16392	2958	68518	0	0.0132	6.2250E+01	106	0.04	0

Table 2.2: Complete results for LSMR(0) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
LPL1 (S)	129959	39951	386218	44	0.0004	7.0878E+01	30201	65.54	0
LPL2	10881	3294	32232	5	0.0009	5.7537E+01	87	0.02	0
LPL3	33686	10828	100525	1	0.0003	9.4797E+01	110	0.05	0
LSQPROB	138	56	424	0	0.1964	7.3997E+00	58	0.00	0
LSQROB	138	56	424	0	0.1964	7.3997E+00	58	0.00	0
MAKELA4	61	40	120	0	1.0000	6.6155E+00	3	0.00	0
MAROS-R7	9408	3136	144848	0	0.0147	8.2622E+01	12	0.01	0
MAROS	1966	846	10137	0	0.0236	2.4629E+01	12099	0.58	0
MOD2 (S)	66409	34774	199810	0	0.0005	1.3872E+02	10664	11.92	0
MODEL	80	38	136	0	0.1579	6.7703E+00	366	0.00	0
MODEL1	798	362	3028	0	0.0442	9.6897E+00	73	0.00	0
MODEL10 (S)	16819	4400	150372	0	0.0039	5.3558E+01	34369	18.64	0
MODEL11	20464	7056	58035	0	0.0028	1.2316E+02	84	0.02	0
MODEL2	1321	379	7607	2	0.0369	1.5367E+01	1707	0.05	0
MODEL3	4565	1609	23974	0	0.0149	3.5843E+01	4875	0.51	0
MODEL4	4962	1337	45753	0	0.0127	2.7593E+01	20275	3.34	0
MODEL5	11802	1744	89925	144	0.0097	3.3983E+01	3588	1.14	0
MODEL6	5289	2094	27628	2	0.0124	2.5143E+01	5827	0.75	0
MODEL7	9560	3358	51027	0	0.0071	5.1244E+01	10036	2.25	0
MODEL8	6464	2896	25277	0	0.0055	1.7963E+01	270	0.03	0
MODEL9	10939	2787	55956	92	0.0068	6.9788E+01	2713	0.64	0
MODSZK1	1620	686	3168	1	0.0335	3.3236E+01	69	0.00	0
MONDOU2	604	312	1208	0	0.0064	2.2419E+01	138	0.00	0
MPSBCD03 (S)	7078	5412	66210	2	0.1554	-	>100000	>28.30	18
MULTI	160	61	1019	0	0.2131	5.6174E+00	32	0.00	0
NEMSAFM	2348	334	2826	0	0.0120	4.5918E+01	29	0.00	0
NEMSCEM	1712	651	3840	0	0.0061	2.3126E+01	109	0.00	0
NEMSEMM1	75310	3945	1053986	0	0.0352	8.7388E+01	1203	4.12	0
NEMSEMM2	48878	6943	182012	0	0.0058	1.0617E+02	1150	0.84	0
NEMSPMM1	8903	2362	55867	10	0.0258	4.7785E+01	10522	2.31	0
NEMSPMM2	8734	2301	68225	0	0.0278	3.8814E+01	13110	3.33	0
NEMSWRLD	28550	6647	192283	491	0.0078	6.0760E+01	1229	0.87	0
NEOS	515905	479119	1526794	0	0.0339	4.9938E+02	345	4.26	0
NEOS1	133473	131581	599590	0	0.0275	3.5694E+02	132	0.48	0
NEOS2	134128	132568	685087	0	0.0330	3.5375E+02	215	0.80	0
NEOS3	518832	512209	2055024	0	0.0005	2.0785E+01	8	0.12	0
NESM	3105	662	13470	0	0.0151	4.1883E+01	190	0.01	0
EMSDZ	15325	7039	47035	0	0.0021	7.5844E+01	5021	1.28	0
NSCT1	37461	22901	678739	287	0.0269	1.8366E+02	1147	2.82	0
NSCT2 (S)	37563	23003	697738	287	0.0273	1.8394E+02	9991	25.19	0
NSIC1	883	451	3273	0	0.0599	2.5158E+01	132	0.00	0
NSIC2	897	465	3449	0	0.0581	2.5435E+01	1155	0.02	0
NSIR1	10011	4407	143249	0	0.0517	8.0262E+01	939	0.49	0
NSIR2 (S)	10057	4453	154939	0	0.0528	8.0556E+01	9611	5.12	0
NUG05	225	210	1050	3	0.0476	1.5622E-14	3	0.00	0
NUG06	486	372	2232	1	0.0323	1.9624E-13	3	0.00	0
NUG07	931	602	4214	0	0.0233	4.3610E-13	3	0.00	0
NUG08	1632	912	7296	0	0.0175	2.9177E-14	3	0.00	0
NUG12	8856	3192	38304	0	0.0075	3.4725E-11	3	0.00	0
NUG15	22275	6330	94950	0	0.0047	4.6654E-11	3	0.00	0
NUG20	72600	15240	304800	1	0.0026	9.6894E-11	3	0.00	0
NUG30	379350	52260	1567800	0	0.0011	4.9153E-09	3	0.04	0
NW14	123409	73	904910	0	0.1507	3.8730E+01	110	0.35	0
OET1	1005	1002	4006	0	1.0000	3.1671E+01	3	0.00	0
OET3	1006	1002	5006	0	1.0000	3.1670E+01	4	0.00	0
ORNA1	1764	882	3990	0	0.0170	1.1814E+01	20755	0.53	0
ORNA2	1764	882	3990	0	0.0170	1.2116E+01	21162	0.54	0
ORNA3	1764	882	3990	0	0.0170	1.2142E+01	21027	0.53	0
ORNA4	1764	882	3990	0	0.0170	1.2217E+01	21035	0.53	0
ORNA7	1764	882	3990	0	0.0170	1.2142E+01	21054	0.56	0
ORSWQ2	160	80	344	0	0.1250	8.7296E+00	31	0.00	0

Table 2.2: Complete results for LSMR(0) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
OSA_07_PRE	24062	1047	63037	0	0.0038	4.3640E+01	43	0.01	0
OSA_14_PRE	52723	2266	139136	0	0.0018	6.3861E+01	45	0.03	0
OSA_30_PRE	100396	4279	267149	0	0.0009	8.7145E+01	61	0.07	0
OSA_60_PRE	234334	10209	594462	0	0.0004	1.3992E+02	55	0.17	0
P0033	48	15	113	0	0.3333	3.9213E+00	31	0.00	0
P0040	63	23	133	0	0.1304	2.5204E+00	6	0.00	0
P10	19090	10090	118000	0	0.0020	9.8334E+01	169	0.09	0
P0201	334	133	2056	0	0.1053	6.5816E+00	39	0.00	0
P0282	523	241	2207	0	0.4647	2.1966E+01	81	0.00	0
P0291	543	252	2283	0	0.4167	2.1565E+01	54	0.00	0
P05	9590	5090	59045	0	0.0039	7.0494E+01	150	0.06	0
P0548	724	176	1887	0	0.0284	2.0066E+01	96	0.00	0
P19	851	284	5570	0	0.0458	1.0707E+01	49	0.00	0
P2756	3511	755	9692	0	0.0212	4.7567E+01	231	0.01	0
P6000	7947	2095	19826	0	0.0029	6.5556E+01	6	0.00	0
P80BAU3B	10613	1984	21000	0	0.0055	7.6989E+01	152	0.02	0
PANG	741	361	2933	0	0.0831	1.5295E+01	458	0.01	0
PCB1000	2820	1565	20463	0	0.0166	1.7326E+01	397	0.04	0
PCB3000	7732	3960	57479	0	0.0071	2.7109E+01	651	0.18	0
PDE1 (S)	271792	270595	990587	-	0.6696	3.0302E+02	906	6.27	0
PDE2	361491	270595	990587	0	0.0000	3.4879E+02	655	4.71	0
PDS_02_PRE	3056	877	7484	1	0.0057	2.2013E+01	58	0.00	0
PDS_06_PRE	18530	2972	42304	0	0.0020	4.2161E+01	147	0.04	0
PDS_10_PRE	33270	4725	76307	1	0.0013	5.3829E+01	177	0.08	0
PDS_20_PRE	81224	10214	184176	0	0.0006	8.0747E+01	211	0.24	0
PDS-100 (S)	514577	156016	1096002	227	0.0000	2.8489E+02	681	6.08	0
PDS-20	108175	33798	232647	76	0.0001	8.8731E+01	273	0.45	0
PDS-30	158489	49788	340635	156	0.0001	1.2041E+02	352	0.91	0
PDS-40	217531	66641	466800	203	0.0000	1.5176E+02	448	1.83	0
PDS-50	275814	82837	590833	223	0.0000	1.8065E+02	495	2.22	0
PDS-60	336421	99204	719557	227	0.0000	2.0695E+02	533	3.52	0
PDS-70	390005	114717	833465	227	0.0000	2.3001E+02	566	3.72	0
PDS-80	434580	128954	927826	227	0.0000	2.5040E+02	596	4.45	0
PDS-90 (S)	475448	142596	1014136	227	0.0000	2.6847E+02	639	5.18	0
PEROLD	1506	625	6148	0	0.0256	2.8421E+01	22357	0.60	0
PF2177	9908	9728	30984	42	0.0038	9.4105E-01	121	0.02	0
PGP2	13254	4034	22474	0	0.1433	9.9046E+01	7	0.00	0
PILOT-JA (S)	2267	940	14977	0	0.0585	-	>100000	>5.76	18
PILOT-WE	2928	722	9265	0	0.0166	2.7742E+01	27710	1.10	0
PILOT	4860	1441	44375	0	0.0840	4.4917E+01	2247	0.37	0
PILOT4	1123	410	5264	0	0.0659	2.5521E+01	5442	0.13	0
PILOT4I	1123	410	5264	0	0.0659	2.5516E+01	5417	0.13	0
PILOT87	6680	2030	74949	0	0.0473	5.2250E+01	4626	1.28	0
PILOTNOV (S)	2446	975	13331	0	0.0410	3.5044E+01	83448	4.47	0
PLDD000B	5049	3069	10762	0	0.0029	4.8552E+01	1654	0.12	0
PLDD001B	5049	3069	10763	0	0.0029	4.8535E+01	1651	0.11	0
PLDD002B	5049	3069	10764	0	0.0029	4.8527E+01	1643	0.12	0
PLDD003B	5049	3069	10765	0	0.0029	4.8524E+01	1640	0.13	0
PLDD004B	5049	3069	10766	0	0.0029	4.8521E+01	1640	0.11	0
PLDD005B	5049	3069	10767	0	0.0029	4.8519E+01	1640	0.11	0
PLDD006B	5049	3069	10768	0	0.0029	4.8517E+01	1640	0.11	0
PLDD007B	5049	3069	10769	0	0.0029	4.8514E+01	1640	0.12	0
PLDD008B	5049	3069	10829	0	0.0029	4.8248E+01	1640	0.12	0
PLDD009B	5049	3069	10832	0	0.0029	4.8240E+01	1637	0.11	0
PLDD010B	5049	3069	10835	0	0.0029	4.8233E+01	1637	0.12	0
PLDD011B	5049	3069	10837	0	0.0029	4.8229E+01	1637	0.12	0
PLDD012B	5049	3069	10839	0	0.0029	4.8224E+01	1637	0.11	0
PLTEXPA2-1	4540	1726	9233	0	0.0104	3.8985E+01	49	0.00	0
PLTEXPA2-6	1820	686	3703	0	0.0117	2.4377E+01	46	0.00	0
PLTEXPA3_1	74172	28350	150801	0	0.0006	1.5888E+02	52	0.05	0
PLTEXPA3_6	11612	4430	23611	0	0.0018	6.2691E+01	51	0.01	0

Table 2.2: Complete results for LSMR(0) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
PLTEXPA4_6	70364	26894	143059	0	0.0003	1.5475E+02	54	0.05	0
PRESOLVE	932	428	5224	0	0.0911	1.3968E+01	2944	0.09	0
PRIMAGAZ	10836	1554	21665	0	0.0013	1.4825E-06	3	0.00	0
PROBLEM	46	12	86	0	0.1667	6.7823E+00	0	0.00	0
PROGAS	1900	1650	8897	0	0.0085	2.4639E+01	3506	0.16	0
PT	503	501	1503	0	1.0000	2.2414E+01	2	0.00	0
QAP12	8856	3192	38304	0	0.0075	3.6530E-11	3	0.00	0
QAP15	22275	6330	94950	0	0.0047	8.5625E-11	3	0.00	0
QAP8	1632	912	7296	0	0.0175	5.3446E-13	3	0.00	0
QIU	1900	1192	4492	0	0.0092	1.3884E+01	45	0.00	0
QPBD_OUT	442	211	2589	0	0.0995	1.3154E+01	739	0.01	0
QUAL	464	323	1646	0	0.0960	1.1182E+01	3370	0.04	0
R05	9690	5190	104145	0	0.0058	7.0877E+01	171	0.07	0
RAIL2586 (S)	923269	2586	8011362	0	0.0046	1.4113E+02	919	40.50	0
RAIL4284 (S)	1096894	4284	11284032	0	0.0028	1.6948E+02	887	70.04	0
RAIL507	63516	507	409856	0	0.0237	4.7606E+01	301	0.48	0
RAIL516	47827	516	315412	0	0.0233	3.7721E+01	291	0.35	0
RAIL582	56097	582	402290	0	0.0206	4.5502E+01	319	0.47	0
RAT1	9408	3136	88267	0	0.0086	9.1651E+01	7	0.00	0
RAT5	9408	3136	137413	0	0.0137	9.1537E+01	7	0.00	0
RAT7A	9408	3136	268908	0	0.0281	9.0828E+01	7	0.01	0
REACTOR	808	318	2591	0	0.0314	1.5910E+01	71	0.00	0
READING2	6003	4000	16000	0	0.0010	7.5465E+01	2000	0.19	0
RECIPELP	204	91	687	0	0.1099	1.1855E+01	134	0.00	0
REFINE	62	29	153	0	0.1724	5.2566E+00	33	0.00	0
REFINERY	464	323	1626	0	0.0960	1.1271E+01	3219	0.03	0
RLFDDD	61521	4050	264627	0	0.0119	1.5612E+02	101	0.10	0
RLFDUAL	74970	8052	282031	0	0.0055	1.9310E+02	99	0.12	0
RLFPRIM	62712	58866	320591	78	0.0034	1.1503E+02	2571	4.30	0
ROSEN1	1544	520	23794	0	0.0462	2.4644E+01	142	0.01	0
ROSEN10	6152	2056	64192	0	0.0078	5.2010E+01	210	0.05	0
ROSEN2	3080	1032	47536	0	0.0233	3.4740E+01	172	0.03	0
ROSEN7	776	264	8034	0	0.0606	1.8542E+01	146	0.01	0
ROSEN8	1544	520	16058	0	0.0308	2.6097E+01	176	0.01	0
ROUTE	43019	20894	206782	31	0.0021	1.4276E+02	96	0.09	0
S277-280	8	4	20	0	1.0000	2.6966E+00	4	0.00	0
SC105	163	105	340	0	0.0476	8.8268E+00	61	0.00	0
SC2052R100	3923	2213	7739	0	0.0461	5.5573E+01	39	0.00	0
SC2052R16	647	365	1271	0	0.0493	2.2439E+01	31	0.00	0
SC2052R160	62423	35213	123239	0	0.0455	2.2195E+02	44	0.04	0
SC2052R200	7823	4413	15439	0	0.0458	7.8527E+01	41	0.00	0
SC2052R27	1076	607	2118	0	0.0478	2.9013E+01	33	0.00	0
SC2052R32	1271	717	2503	0	0.0474	3.1553E+01	34	0.00	0
SC2052R4	179	101	347	0	0.0594	1.1656E+01	27	0.00	0
SC2052R400	15623	8813	30839	0	0.0456	1.1101E+02	41	0.01	0
SC2052R50	1973	1113	3889	0	0.0467	3.9364E+01	36	0.00	0
SC2052R64	2519	1421	4967	0	0.0464	4.4501E+01	37	0.00	0
SC2052R8	335	189	655	0	0.0529	1.6062E+01	27	0.00	0
SC2052R800	31223	17613	61639	0	0.0455	1.5696E+02	43	0.02	0
SC205	317	205	665	0	0.0244	1.0407E+01	109	0.00	0
SC50A	78	50	160	0	0.1000	7.2153E+00	36	0.00	0
SC50B	78	50	148	0	0.0800	6.5537E+00	38	0.00	0
SCAGR25	671	471	1725	0	0.0191	1.3015E+01	130	0.00	0
SCAGR7CX	887	623	2285	0	0.1814	1.7437E+01	70	0.00	0
SCAGR7AX	239	167	605	0	0.1737	8.2088E+00	55	0.00	0
SCAGR7GX	13847	9743	35885	0	0.1840	7.2243E+01	112	0.03	0
SCAGR7CQ	887	623	2285	0	0.1814	1.7437E+01	70	0.00	0
SCAGR7AQ	239	167	605	0	0.1737	8.2088E+00	55	0.00	0
SCAGR7GQ	3479	2447	9005	0	0.1835	3.5822E+01	89	0.01	0
SCAGR7HH	5855	4119	15057	0	0.1838	4.6739E+01	98	0.01	0
SCAGR7CH	887	623	2285	0	0.1814	1.7437E+01	70	0.00	0

Table 2.2: Complete results for LSMR(0) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
SCAGR7IH	11687	8223	30069	0	0.1840	6.6324E+01	112	0.02	0
SCAGR7DH	1481	1041	3825	0	0.1825	2.2963E+01	77	0.00	0
SCAGR7EH	1751	1231	4525	0	0.1828	2.5083E+01	79	0.00	0
SCAGR7AH	239	167	605	0	0.1737	8.2088E+00	55	0.00	0
SCAGR7JH	23351	16431	60093	0	0.1841	9.3970E+01	120	0.05	0
SCAGR7FH	2939	2067	7605	0	0.1834	3.2843E+01	86	0.01	0
SCAGR7GH	3479	2447	9005	0	0.1835	3.5822E+01	89	0.00	0
SCAGR7BH	455	319	1165	0	0.1787	1.2004E+01	63	0.00	0
SCAGR7KH	46679	32847	120141	0	0.1842	1.3303E+02	137	0.10	0
SCAGR7	185	129	465	0	0.0698	6.4363E+00	77	0.00	0
SCALED	27	15	53	0	0.2667	3.9671E+00	12	0.00	0
SCFXM1B16	4263	2460	14508	0	0.0146	3.3662E+01	595	0.04	0
SCFXM1B4	1179	684	4164	0	0.0322	1.8003E+01	536	0.01	0
SCFXM1B64	33047	19036	111052	0	0.0137	9.3268E+01	669	0.38	0
SCFXM1C4	1179	684	4164	0	0.0322	1.8003E+01	536	0.01	0
SCFXM1R128	33047	19036	111052	0	0.0137	9.3268E+01	669	0.36	0
SCFXM1R16	4263	2460	14508	0	0.0146	3.3662E+01	595	0.04	0
SCFXM1R256	65943	37980	221388	0	0.0136	1.3171E+02	689	0.77	0
SCFXM1R27	7090	4088	23990	0	0.0142	4.3313E+01	615	0.07	0
SCFXM1R32	8375	4828	28300	0	0.0141	4.7050E+01	621	0.09	0
SCFXM1R4	1179	684	4164	0	0.0322	1.8003E+01	536	0.01	0
SCFXM1R64	16599	9564	55884	0	0.0138	6.6147E+01	645	0.18	0
SCFXM1R8	2207	1276	7612	0	0.0204	2.4358E+01	552	0.02	0
SCFXM1R96	24823	14300	83468	0	0.0137	8.0853E+01	666	0.28	0
SCFXM1	600	330	2732	0	0.0606	1.4494E+01	1498	0.02	0
SCFXM2	1200	660	5469	0	0.0303	2.0433E+01	1875	0.05	0
SCFXM3	1800	990	8206	0	0.0202	2.4998E+01	1919	0.07	0
SCORPION	466	388	1534	29	0.0180	1.6015E+01	120	0.00	0
SCRS8CX	907	476	1895	0	0.1429	2.2078E+01	92	0.00	0
SCRS8AX	259	140	527	0	0.1429	1.1308E+01	82	0.00	0
SCRS8	3499	1820	7367	0	0.1429	4.4681E+01	127	0.00	0
SCRS8CQ	907	476	1895	0	0.1429	2.2078E+01	92	0.00	0
SCRS8EQ	1771	924	3719	0	0.1429	3.1356E+01	103	0.00	0
SCRS8AQ	259	140	527	0	0.1429	1.1308E+01	82	0.00	0
SCRS8FQ	3499	1820	7367	0	0.1429	4.4681E+01	127	0.00	0
SCRS8BQ	475	252	983	0	0.1429	1.5667E+01	89	0.00	0
SCRS8GH	6955	3612	14663	0	0.1429	6.3717E+01	148	0.02	0
SCRS8CH	907	476	1895	0	0.1429	2.2078E+01	92	0.00	0
SCRS8HH	13867	7196	29255	0	0.1429	9.0764E+01	157	0.03	0
SCRS8DH	1501	784	3149	0	0.1429	2.8760E+01	101	0.00	0
SCRS8EH	1771	924	3719	0	0.1429	3.1356E+01	103	0.00	0
SCRS8AH	259	140	527	0	0.1429	1.1308E+01	82	0.00	0
SCRS8IH	27691	14364	58439	0	0.1429	1.2903E+02	182	0.07	0
SCRS8FH	3499	1820	7367	0	0.1429	4.4681E+01	127	0.01	0
SCRS8FHH	3499	1820	7367	0	0.1429	4.4681E+01	127	0.00	0
SCRS8BH	475	252	983	0	0.1429	1.5667E+01	89	0.00	0
SCRS8	1275	490	3288	0	0.0163	1.7598E+01	3011	0.05	0
SCSD1	760	77	2388	0	0.0519	2.7568E+01	0	0.00	0
SCSD6	1350	147	4316	0	0.0272	3.6742E+01	0	0.00	0
SCSD8CX	2310	330	7170	0	0.1030	4.8051E+01	38	0.00	0
SCSD8AX	630	90	1890	0	0.1111	2.5085E+01	30	0.00	0
SCSD8GX	35910	5130	112770	0	0.1002	1.8950E+02	55	0.02	0
SCSD8CQ	2310	330	7170	0	0.1030	4.8051E+01	38	0.00	0
SCSD8AQ	630	90	1890	0	0.1111	2.5085E+01	30	0.00	0
SCSD8GQ	35910	5130	112770	0	0.1002	1.8950E+02	55	0.03	0
SCSD8HH	15190	2170	47650	0	0.1005	1.2324E+02	48	0.01	0
SCSD8CH	2310	330	7170	0	0.1030	4.8051E+01	38	0.00	0
SCSD8IH	30310	4330	95170	0	0.1002	1.7409E+02	55	0.02	0
SCSD8DH	3850	550	12010	0	0.1018	6.2039E+01	42	0.00	0
SCSD8EH	4550	650	14210	0	0.1015	6.7444E+01	44	0.00	0
SCSD8AH	630	90	1890	0	0.1111	2.5085E+01	30	0.00	0

Table 2.2: Complete results for LSMR(0) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
SCSD8JH	60550	8650	190210	0	0.1001	2.4607E+02	58	0.05	0
SCSD8FH	7630	1090	23890	0	0.1009	8.7342E+01	46	0.01	0
SCSD8GH	9030	1290	28290	0	0.1008	9.5019E+01	47	0.01	0
SCSD8BH	1190	170	3650	0	0.1059	3.4483E+01	36	0.00	0
SCSD8BHH	1190	170	3650	0	0.1059	3.4483E+01	36	0.00	0
SCSD8	2750	397	8584	0	0.0101	5.2440E+01	0	0.00	0
SCTAP1B16	2178	990	6334	0	0.0515	3.1038E+01	129	0.00	0
SCTAP1B4	594	270	1678	0	0.0556	1.6082E+01	126	0.00	0
SCTAP1B64	33858	15390	99454	0	0.0501	1.2367E+02	217	0.11	0
SCTAP1C16	2178	990	6334	0	0.0515	3.1038E+01	129	0.00	0
SCTAP1C4	594	270	1678	0	0.0556	1.6082E+01	126	0.00	0
SCTAP1C64	7458	3390	21854	0	0.0504	5.7784E+01	137	0.02	0
SCTAP1R108	14322	6510	42030	0	0.0502	8.0267E+01	179	0.04	0
SCTAP1R16	2178	990	6334	0	0.0515	3.1038E+01	129	0.00	0
SCTAP1R216	28578	12990	83934	0	0.0501	1.1358E+02	211	0.09	0
SCTAP1R27	3630	1650	10602	0	0.0509	4.0178E+01	124	0.01	0
SCTAP1R32	4290	1950	12542	0	0.0508	4.3714E+01	127	0.01	0
SCTAP1R4	594	270	1678	0	0.0556	1.6082E+01	126	0.00	0
SCTAP1R480	63426	28830	186366	0	0.0501	1.6941E+02	248	0.24	0
SCTAP1R54	7194	3270	21078	0	0.0505	5.6743E+01	136	0.02	0
SCTAP1R64	8514	3870	24958	0	0.0504	6.1773E+01	139	0.02	0
SCTAP1R8	1122	510	3230	0	0.0529	2.2195E+01	132	0.00	0
SCTAP1R8B	1122	510	3230	0	0.0529	2.2195E+01	132	0.00	0
SCTAP1	660	300	1872	0	0.0200	1.6745E+01	324	0.01	0
SCTAP2	2500	1090	7334	0	0.0055	3.1937E+01	565	0.02	0
SCTAP3	3340	1480	9734	0	0.0041	3.7029E+01	603	0.03	0
SEBA	1036	515	4360	0	0.4466	1.7950E+01	147	0.00	0
SELF	7364	960	1148845	0	1.0000	1.2263E+01	277	1.00	0
SEYMOUR	6316	4944	38493	0	0.0552	7.3269E+01	114	0.03	0
SGPF5Y6	312540	246077	831976	0	0.0000	2.5234E+02	63	0.44	0
SHARE1B	253	117	1179	0	0.0855	6.9162E+00	3028	0.02	0
SHARE2B	162	96	777	0	0.1250	6.7659E+00	440	0.00	0
SHELL	1777	536	3558	0	0.0056	2.1346E+01	76	0.00	0
SHIP04L	2166	360	6380	42	0.0167	1.4125E+01	68	0.00	0
SHIP04S	1506	360	4400	42	0.0167	1.4038E+01	86	0.00	0
SHIP08L	4363	712	12882	66	0.0084	1.9832E+01	102	0.01	0
SHIP08S	2467	712	7194	66	0.0084	1.9707E+01	146	0.01	0
SHIP12L	5533	1042	16276	109	0.0058	2.4097E+01	80	0.00	0
SHIP12S	2869	1042	8284	109	0.0058	2.4018E+01	106	0.00	0
SIERRA	2735	1227	8001	2	0.0033	3.9102E+01	57	0.00	0
SIPOW1	2002	2000	6000	0	1.0000	4.4699E-02	3	0.00	0
SIPOW1M	2002	2000	6000	0	1.0000	4.4699E-02	3	0.00	0
SIPOW2	2002	2000	5000	0	1.0000	2.5837E+01	4	0.00	0
SIPOW2M	2002	2000	5000	0	1.0000	2.5837E+01	4	0.00	0
SIPOW3	2004	2000	7992	0	1.0000	4.4733E+01	4	0.00	0
SIPOW4	2004	2000	9000	0	1.0000	4.4733E+01	4	0.00	0
SLP-TSK	3347	2861	72465	0	0.3100	5.6689E+01	165	0.04	0
SMALL000	1215	709	3044	0	0.0141	2.5413E+01	3771	0.09	0
SMALL001	1193	687	3144	0	0.0160	2.4820E+01	6322	0.12	0
SMALL002	1220	713	3246	0	0.0154	2.5271E+01	7767	0.16	0
SMALL003	1215	711	3240	0	0.0155	2.4850E+01	8611	0.17	0
SMALL004	1220	717	3283	0	0.0153	2.5028E+01	7777	0.14	0
SMALL005	1220	717	3317	0	0.0153	2.5458E+01	4415	0.08	0
SMALL006	1213	710	3319	0	0.0169	2.5059E+01	8037	0.15	0
SMALL007	1212	711	3374	0	0.0169	2.4794E+01	9177	0.18	0
SMALL008	1214	712	3342	0	0.0169	2.4952E+01	8138	0.16	0
SMALL009	1213	710	3328	0	0.0169	2.4952E+01	7662	0.14	0
SMALL010	1213	711	3322	0	0.0169	2.5206E+01	7179	0.13	0
SMALL011	1208	705	3300	0	0.0170	2.5491E+01	4425	0.08	0
SMALL012	1209	706	3309	0	0.0170	2.5481E+01	4333	0.09	0
SMALL013	1204	701	3282	0	0.0171	2.5476E+01	4402	0.08	0

Table 2.2: Complete results for LSMR(0) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
SMALL014	1190	687	3207	0	0.0160	2.5330E+01	4452	0.08	0
SMALL015	1186	683	3243	0	0.0161	2.5276E+01	4618	0.09	0
SMALL016	1180	677	3207	0	0.0162	2.5187E+01	4837	0.11	0
SOUTHERN1	36321	18425	112398	0	0.9509	1.8807E+02	263	0.16	0
SPAL_004 (S)	321696	10203	46168124	0	0.0165	-	>2572	>600.00	19
SSEBLIN	218	72	336	0	0.0278	1.2971E+01	18	0.00	0
STAIR	614	356	4003	0	0.0955	1.3875E+01	123	0.00	0
STANDATA	1274	359	3230	0	0.0279	1.3676E+01	179	0.00	0
STANDGUB	1382	360	3338	1	0.0278	1.4397E+01	180	0.00	0
STANDMPS	1274	467	3878	0	0.0214	1.2022E+01	316	0.01	0
STAT96V1	197472	5995	588798	0	0.0030	4.4182E+02	665	1.56	0
STAT96V2 (S)	957432	29089	2852184	0	0.0004	9.7273E+02	986	11.18	0
STAT96V3 (S)	1113780	33841	3317736	0	0.0004	1.0492E+03	1055	13.93	0
STAT96V4 (S)	63076	3173	491336	0	0.0028	1.2052E+02	4144	6.63	0
STAT96V5	75779	2305	233921	2	0.3336	2.7479E+02	22	0.02	0
STOCFOR1	165	117	501	0	0.0513	5.2802E+00	82	0.00	0
STOCFOR2	3045	2157	9357	0	0.0046	2.6098E+01	226	0.01	0
STOCFOR3	23541	16675	72721	0	0.0011	7.3948E+01	503	0.21	0
STORMG2125	172431	65935	433256	250	0.0021	3.1685E+02	1024	2.56	0
STORMG227	37485	14387	94274	54	0.0028	1.4714E+02	882	0.44	0
STORMG28	11322	4393	28553	16	0.0048	7.9906E+01	717	0.13	0
STORMG21K (S)	1377306	526185	3459881	0	0.0019	8.9636E+02	1383	30.85	0
STP3D	336283	159488	793531	0	0.0000	4.8623E+02	212	1.37	0
SWS	26775	14310	107325	0	0.0008	5.4263E+01	81	0.04	0
T0331-4L	46915	664	430982	0	0.0346	7.3313E+01	476	0.79	0
SC205	31223	17613	61639	0	0.0455	1.4370E+02	45	0.02	0
TESTDECK	27	15	53	0	0.2667	3.6108E+00	10	0.00	0
TFI2	104	101	402	0	1.0000	9.9037E+00	4	0.00	0
MPD	1014301	142752	11537419	0	0.0001	3.5588E+02	18	1.14	0
TRUSS	8806	1000	27836	0	0.0040	9.3840E+01	0	0.00	0
TS-PALKO	47235	22002	1076903	0	0.0016	6.1241E+01	47	0.19	0
TUFF	628	302	4561	31	0.0828	1.0262E+01	731	0.01	0
ULEVMIN	46937	6590	164538	0	0.0041	1.0191E+02	70	0.05	0
US04	28016	163	297538	8	0.1104	2.6748E+01	197	0.23	0
VOL1	464	323	1646	0	0.0960	1.1182E+01	3370	0.03	0
VTP-BASE	346	198	1051	0	0.0606	8.2247E+00	1117	0.01	0
WATSON_1 (S)	386992	201155	1055093	0	0.0000	2.5495E+02	2160	14.67	0
WATSON_2 (S)	677224	352013	1846391	0	0.0000	3.3569E+02	1812	22.73	0
WOOD1P	2595	244	70216	0	0.1148	1.7252E+00	88	0.02	0
WOODINFE	89	35	140	0	0.0571	8.0289E+00	15	0.00	0
WOODW	8418	1098	37487	0	0.0191	4.0984E+00	686	0.10	0
WORLD (S)	67147	34506	198883	0	0.0005	1.4068E+02	9811	10.53	0
ZED	142	116	666	0	0.4138	9.0308E+00	102	0.00	0
UF Sparse Matrix Collection examples									
12month1 (S)	872622	12471	22624727	-	0.2742	-	>6310	>600.00	19
130bit	584	567	6120	1	0.0247	3.6512E+00	2701	0.06	0
145bit	1002	966	11315	2	0.0155	6.9710E+00	7522	0.27	0
162bit (S)	3606	3476	37118	16	0.0040	1.1788E+01	29396	3.76	0
176bit (S)	7441	7150	82270	40	0.0022	1.8430E+01	>100000	40.30	0
192bit (S)	13691	13093	154303	82	0.0012	2.4862E+01	>100000	173.37	0
208bit (S)	24430	23191	299756	199	0.0008	-	>100000	>600.00	19
abb313	313	176	1557	0	0.0341	1.1495E+01	58	0.00	0
abtaha1	14596	209	51307	0	0.0191	8.5472E+01	59	0.01	0
abtaha2	37932	331	137228	0	0.0121	1.3963E+02	39	0.02	0
ash219	219	85	438	0	0.0235	1.2360E+01	31	0.00	0
ash331	331	104	662	0	0.0192	1.5722E+01	36	0.00	0
ash608	608	188	1216	0	0.0106	2.0993E+01	33	0.00	0
ash958	958	292	1916	0	0.0068	2.6425E+01	35	0.00	0
beacxc	489	449	50409	0	0.5635	9.2317E-03	9942	0.90	0
beaflw (S)	500	492	53403	4	0.8130	5.0570E+00	43875	4.07	0

Table 2.2: Complete results for LSMR(0) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
beause	505	492	44551	3	0.8130	4.6890E+00	41073	3.29	0
bibd_11_5	462	55	4620	0	0.1818	2.0126E+01	14	0.00	0
bibd_12_4	495	66	2970	0	0.0909	2.0677E+01	14	0.00	0
bibd_12_5	792	66	7920	0	0.1515	2.6743E+01	12	0.00	0
bibd_13_6	1716	78	25740	0	0.1923	4.0221E+01	10	0.00	0
bibd_14_7	3432	91	72072	0	0.2308	5.7912E+01	9	0.00	0
bibd_15_3	455	105	1365	0	0.0286	1.8238E+01	19	0.00	0
bibd_15_7	6435	105	135135	0	0.2000	7.9658E+01	8	0.00	0
bibd_16_8	12870	120	360360	0	0.2333	1.1286E+02	7	0.01	0
bibd_17_3	680	136	2040	0	0.0221	2.3567E+01	18	0.00	0
bibd_17_4b	2380	136	14280	0	0.0441	4.7340E+01	11	0.00	0
bibd_17_4	2380	136	14280	0	0.0441	4.7340E+01	11	0.00	0
bibd_17_8	24310	136	680680	0	0.2059	1.5546E+02	7	0.01	0
bibd_18_9	48620	153	1750320	0	0.2353	2.2010E+02	6	0.03	0
bibd_19_9	92378	171	3325608	0	0.2105	3.0364E+02	6	0.05	0
bibd_20_10	184756	190	8314020	0	0.2368	4.2958E+02	6	0.12	0
bibd_22_8	319770	231	8953560	0	0.1212	5.6528E+02	5	0.12	0
bibd_49_3	18424	1176	55272	0	0.0026	1.3141E+02	12	0.00	0
bibd_81_3	85320	3240	255960	0	0.0009	2.8646E+02	11	0.01	0
bibd_9_3	84	36	252	0	0.0833	6.5585E+00	24	0.00	0
bibd_9_5	126	36	1260	0	0.2778	9.5326E+00	19	0.00	0
c8_mat11_I	5761	4562	2462970	0	0.5298	2.2179E+01	40760	176.27	0
c8_mat11 (S)	5761	4562	2462970	0	0.5298	2.2179E+01	40787	175.75	0
cat_ears_2_4	2689	1009	7982	0	0.0030	4.1328E+01	121	0.01	0
cat_ears_3_1	204	181	542	4	0.0331	5.2776E+00	291	0.00	0
cat_ears_3_4	13271	5226	39592	0	0.0006	8.9890E+01	397	0.08	0
cat_ears_4_1	377	313	938	4	0.0192	9.1810E+00	510	0.01	0
cat_ears_4_4	44448	19020	132888	0	0.0002	1.5904E+02	445	0.25	0
ch3-3-b1	18	9	36	0	0.2222	1.9181E+00	2	0.00	0
ch3-3-b2	18	6	18	0	0.1667	4.2426E+00	1	0.00	0
ch4-4-b1	72	16	144	0	0.1250	4.3706E+00	2	0.00	0
ch4-4-b2	96	72	288	1	0.0417	4.3753E-01	4	0.00	0
ch4-4-b3	96	24	96	0	0.0417	9.7980E+00	0	0.00	0
ch5-5-b1	200	25	400	0	0.0800	7.4754E+00	2	0.00	0
ch5-5-b2	600	200	1800	0	0.0150	2.1597E-01	4	0.00	0
ch5-5-b4	600	120	600	0	0.0083	2.4000E+01	2	0.00	0
ch6-6-b1	450	36	900	0	0.0556	1.1160E+01	3	0.00	0
ch6-6-b2	2400	450	7200	0	0.0067	1.3254E-01	4	0.00	0
ch6-6-b3	5400	2400	21600	0	0.0017	2.3959E+01	9	0.00	0
ch6-6-b4	5400	4320	21600	19	0.0009	6.9478E+01	11	0.00	0
ch6-6-b5	4320	720	4320	0	0.0014	6.5727E+01	0	0.00	0
ch7-6-b1	630	42	1260	0	0.0476	1.3254E+01	3	0.00	0
ch7-6-b2	4200	630	12600	0	0.0048	4.6708E-06	8	0.00	0
ch7-6-b3	12600	4200	50400	0	0.0010	3.8393E+01	11	0.01	0
ch7-6-b4	15120	12600	75600	0	0.0004	3.5743E-05	17	0.01	0
ch7-6-b5	15120	5040	30240	0	0.0004	1.2296E+02	0	0.00	0
ch7-7-b1	882	49	1764	0	0.0408	1.5951E+01	2	0.00	0
ch7-7-b2	7350	882	22050	0	0.0034	9.3828E-02	4	0.00	0
ch7-7-b5	52920	35280	211680	-	0.0001	2.3004E+02	0	0.00	0
ch7-8-b1	1176	56	2352	0	0.0357	1.8284E+01	4	0.00	0
ch7-8-b2	11760	1176	35280	0	0.0026	1.0986E-06	8	0.00	0
ch7-8-b3	58800	11760	235200	0	0.0003	8.7888E+01	10	0.01	0
ch7-8-b4	141120	58800	705600	-	0.0001	2.1233E-06	16	0.04	0
ch7-9-b1	1512	63	3024	0	0.0317	2.0709E+01	3	0.00	0
ch7-9-b2	17640	1512	52920	0	0.0020	4.2046E-05	7	0.00	0
ch7-9-b3	105840	17640	423360	0	0.0002	1.1794E+02	10	0.01	0
ch7-9-b4	317520	105840	1587600	-	0.0000	3.3137E-06	15	0.07	0
ch7-9-b5	423360	317520	2540160	-	0.0000	1.3659E+02	20	0.21	0
ch8-8-b1	1568	64	3136	0	0.0312	2.1231E+01	3	0.00	0
ch8-8-b2	18816	1568	56448	0	0.0019	7.1853E-02	4	0.00	0
ch8-8-b3	117600	18816	470400	0	0.0002	1.2701E+02	9	0.01	0

Table 2.2: Complete results for LSMR(0) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
ch8-8-b4	376320	117600	1881600	-	0.0000	3.2821E-06	13	0.08	0
ch8-8-b5	564480	376320	3386880	-	0.0000	1.7776E+02	16	0.23	0
Chem97Zt	31022	2541	62044	0	0.0008	1.6859E+02	3563	0.71	0
cis-n4c6-b13	25605	6300	88200	0	0.0013	1.6002E+02	0	0.00	0
cis-n4c6-b14	6300	920	13800	1	0.0065	7.9018E+01	9	0.00	0
cis-n4c6-b15	920	60	960	0	0.0500	3.0332E+01	0	0.00	0
cis-n4c6-b1	210	21	420	0	0.0952	7.9582E+00	2	0.00	0
cis-n4c6-b2	1330	210	3990	0	0.0143	2.0203E-14	2	0.00	0
cis-n4c6-b3	5970	1330	23880	0	0.0030	3.0996E+01	3	0.00	0
cis-n4c6-b4	20058	5970	100290	0	0.0008	1.1372E-06	9	0.00	0
Cities	55	46	1342	0	0.9783	6.4485E-01	82	0.00	0
connectus (S)	394707	458	1127525	0	0.1594	6.2791E+02	1748	7.56	0
D_10	814	459	7614	7	0.0283	2.1638E+01	65	0.00	0
D_11	457	169	2952	1	0.0710	1.7019E+01	37	0.00	0
D_5	430	114	1832	1	0.0702	1.8623E+01	27	0.00	0
D6-6	50760	18660	146520	1417	0.0003	2.1290E+02	24	0.02	0
D_6	967	433	6491	1	0.0300	2.5961E+01	49	0.00	0
D_7	1270	970	12714	4	0.0206	2.6062E+01	64	0.01	0
D_8	1266	1126	14966	7	0.0187	2.4223E+01	33	0.00	0
D_9	1129	814	12395	28	0.0197	2.3798E+01	39	0.00	0
deltaX	68600	21961	247424	0	0.0038	2.7677E+01	1306	1.22	0
divorce	50	9	225	0	1.0000	6.6094E+00	10	0.00	0
ESOC (S)	327062	37349	6019939	0	0.0005	4.0438E+02	5604	157.20	0
EternityII_A_b	358	1	358	0	1.0000	1.8921E+01	1	0.00	0
EternityII_A	150638	7362	782087	0	0.0008	3.8465E-06	692	2.17	0
EternityII_E_b	513	1	513	0	1.0000	2.2650E+01	1	0.00	0
EternityII_E	262144	11077	1503732	0	0.0006	4.9113E-06	109	0.85	0
EternityII_Etilde_ b	512	1	512	0	1.0000	2.2627E+01	1	0.00	0
EternityII_Etilde (S)	204304	10054	1170516	0	0.0007	4.4561E-06	1354	6.67	0
f855_mat9_I	2511	2456	171214	0	0.3375	1.7981E+01	18944	6.14	0
f855_mat9 (S)	2511	2456	171214	0	0.3375	1.7981E+01	19017	6.03	0
flower_4_1	129	121	386	0	0.0248	2.7316E+00	353	0.00	0
flower_4_4	5529	1837	16466	0	0.0016	6.0690E+01	110	0.01	0
flower_5_1	211	201	602	4	0.0249	3.6716E+00	471	0.00	0
flower_5_4	14721	5226	43942	0	0.0006	9.7567E+01	147	0.02	0
flower_7_1	463	393	1178	4	0.0127	9.0402E+00	779	0.01	0
flower_7_4	67593	27693	202218	0	0.0001	1.9933E+02	555	0.49	0
flower_8_1	625	513	1538	5	0.0097	1.1543E+01	920	0.01	0
flower_8_4	125361	55081	375266	0	0.0001	2.6505E+02	846	1.54	0
Franz10	19588	4164	97508	0	0.0012	1.4237E-09	15	0.00	0
Franz11	47104	30144	329728	-	0.0002	7.6180E-12	5	0.01	0
Franz1	2240	768	5120	1	0.0052	2.6503E+01	11	0.00	0
Franz2	4480	4032	21504	375	0.0015	4.9227E+01	23	0.00	0
Franz3	2800	1280	11520	0	0.0250	5.0596E+01	5	0.00	0
Franz4	6784	5252	46528	1049	0.0013	1.4242E-11	10	0.00	0
Franz5	7382	2882	44056	0	0.0021	1.6623E+01	13	0.00	0
Franz6	7576	3016	45456	1	0.0020	1.8468E+01	13	0.00	0
Franz7	10160	1740	40424	0	0.0023	1.8573E+01	11	0.00	0
Franz8	16728	7176	100368	0	0.0008	2.7319E+01	14	0.01	0
Franz9	19588	4164	97508	0	0.0012	1.4193E-09	15	0.01	0
gemat1	10595	4929	46591	0	0.0057	8.7317E+01	13414	2.13	0
GL6_D_10	339	162	2053	5	0.0741	1.4334E+01	36	0.00	0
GL6_D_6	465	199	2526	1	0.0553	1.8285E+01	27	0.00	0
GL6_D_7	636	469	5378	4	0.0341	1.8138E+01	45	0.00	0
GL6_D_8	632	542	6153	32	0.0277	1.7407E+01	29	0.00	0
GL6_D_9	542	339	4349	25	0.0413	1.7578E+01	27	0.00	0
GL7d10	8	1	8	0	1.0000	2.8284E+00	1	0.00	0
GL7d11	783	60	1513	1	0.1333	2.6905E+01	24	0.00	0
GL7d12	8769	1019	37519	0	0.0128	8.7516E+01	47	0.00	0
GL7d13	47221	8899	356232	13	0.0016	1.9394E+02	56	0.07	0
GL7d14	171369	47268	1831183	-	0.0005	3.5107E+02	50	0.61	0

Table 2.2: Complete results for LSMR(0) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
GL7d15	460259	171373	6080381	-	0.0002	5.4847E+02	68	3.11	0
GL7d16 (S)	955127	460260	14488881	-	0.0001	7.4875E+02	61	13.99	0
GL7d17 (S)	1548649	955127	25978098	-	0.0001	8.9897E+02	58	23.38	0
GL7d18 (S)	1955309	1548645	35590540	-	0.0000	9.3184E+02	80	57.09	0
GL7d19 (S)	1955296	1911130	37322725	-	0.0000	1.0426E+03	205	100.66	0
GL7d20 (S)	1911124	1437546	29893084	-	0.0000	1.0916E+03	136	56.31	0
GL7d21 (S)	1437546	822922	18174775	-	0.0000	1.0029E+03	143	33.19	0
GL7d22 (S)	822906	349443	8251000	-	0.0001	7.8940E+02	238	20.68	0
GL7d23 (S)	349443	105054	2695430	-	0.0002	5.3569E+02	340	6.90	0
GL7d24	105049	21074	593892	-	0.0006	3.0259E+02	213	0.66	0
GL7d25	21013	2798	81671	6	0.0029	1.3888E+02	87	0.03	0
GL7d26	2748	303	7412	1	0.0132	5.0381E+01	95	0.00	0
graphics (S)	29493	11822	117954	0	0.0003	-	>100000	>600.00	19
HFE18_96_in (S)	2372	2371	933343	0	0.5065	4.9100E-01	30697	48.69	0
IG5-10	652	527	10273	0	0.1347	1.0425E+01	1831	0.05	0
IG5-11	1227	902	22110	0	0.1231	1.5923E+01	1461	0.08	0
IG5-12	2296	1578	46260	0	0.0741	2.3085E+01	2561	0.26	0
IG5-13	3994	2532	91209	0	0.0470	3.1249E+01	3156	0.63	0
IG5-14	6735	3906	173337	0	0.0307	4.1470E+01	2919	1.06	0
IG5-15 (S)	11369	6146	323509	0	0.0195	5.4856E+01	4577	3.08	0
IG5-16 (S)	18846	9519	588326	0	0.0126	7.1510E+01	7406	9.53	0
IG5-17 (S)	30162	14060	1035008	0	0.0085	9.1039E+01	7264	18.04	0
IG5-18 (S)	47894	20818	1790490	0	0.0058	1.1518E+02	7282	40.50	0
IG5-6	43	30	251	0	0.5333	1.1332E+00	49	0.00	0
IG5-7	75	62	549	0	0.3871	1.8887E+00	155	0.00	0
IG5-8	158	156	1711	2	0.3141	2.6588E-01	990	0.01	0
IG5-9	342	310	4570	0	0.1871	5.9084E+00	1443	0.02	0
illc1033	1033	320	4719	0	0.0156	2.2535E+03	2813	0.04	0
illc1850	1850	712	8636	0	0.0070	1.0300E+03	1355	0.04	0
image_interp	232485	120000	711683	0	0.0000	0.0000E+00	0	0.01	0
IMDB (S)	896302	303617	3782463	-	0.0052	-	>12955	>600.00	19
Kemelmacher	28452	9693	100875	0	0.0007	1.1394E+02	3226	0.96	0
klein-b1	30	10	60	0	0.2000	2.8271E+00	9	0.00	0
klein-b2	30	20	60	0	0.1000	4.7876E+00	20	0.00	0
kneser_10_4_1 (S)	349651	330751	992252	-	0.0000	1.6241E+02	17209	186.42	0
kneser_6_2_1	676	601	2027	0	0.0050	8.5632E+00	1890	0.02	0
kneser_8_3_1	15737	15681	47042	449	0.0007	2.9040E+01	9491	2.18	0
landmark (S)	71952	2673	1146848	2	0.0060	1.3198E-05	19937	43.35	0
LargeRegFile (S)	2111154	801374	4944201	0	0.0000	4.4422E+02	795	29.43	0
lutz30-23-b6	3003	1716	12012	0	0.0035	5.2529E+01	91	0.01	0
Maragal_1	32	14	234	1	1.0000	1.0249E+00	11	0.00	0
Maragal_2	536	260	4357	81	0.3000	3.0681E+00	350	0.01	0
Maragal_3	1682	858	18391	127	0.5455	4.2081E+00	1100	0.06	0
Maragal_4	1964	1027	26719	110	0.5706	5.7947E+00	707	0.06	0
Maragal_5	4654	3296	93091	610	0.4524	9.1207E+00	3321	0.74	0
Maragal_6 (S)	21251	10144	537694	516	0.5857	1.0695E+01	5178	5.87	0
Maragal_7 (S)	46845	26525	1200537	2046	0.3604	1.3690E+01	2769	8.76	0
Maragal_8 (S)	60845	33093	1308415	7107	0.0503	-	>100000	>600.00	19
mesh_deform_D	234023	234023	234023	0	0.0000	4.6118E-06	542	1.64	0
mesh_deform	234023	9393	853829	0	0.0004	0.0000E+00	0	0.00	0
mk10-b1	630	45	1260	0	0.0444	1.2596E+01	3	0.00	0
mk10-b2	3150	630	9450	0	0.0048	3.0008E-14	5	0.00	0
mk10-b3	4725	3150	18900	0	0.0013	1.6323E+01	8	0.00	0
mk10-b4	4725	945	4725	0	0.0011	6.7350E+01	2	0.00	0
mk11-b1	990	55	1980	0	0.0364	1.5977E+01	3	0.00	0
mk11-b2	6930	990	20790	0	0.0030	3.1250E-14	5	0.00	0
mk11-b3	17325	6930	69300	0	0.0006	3.7435E+01	7	0.00	0
mk11-b4b	17325	9450	47250	0	0.0003	1.2667E+02	10	0.00	0
mk11-b4	17325	10395	51975	0	0.0003	1.2634E+02	9	0.00	0
mk12-b1	1485	66	2970	1	0.0303	2.0043E+01	2	0.00	0
mk12-b2	13860	1485	41580	0	0.0020	1.0175E-13	5	0.00	0

Table 2.2: Complete results for LSMR(0) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
mk12-b3	51975	13860	207900	0	0.0003	7.0503E+01	8	0.01	0
mk12-b4	62370	51975	311850	-	0.0001	5.2622E-11	12	0.01	0
mk12-b5	62370	10395	62370	0	0.0001	2.4974E+02	0	0.00	0
mk13-b5	270270	135135	810810	-	0.0000	5.1987E+02	0	0.01	0
mk9-b1	378	36	756	0	0.0556	9.9635E+00	2	0.00	0
mk9-b2	1260	378	3780	0	0.0079	4.1526E-01	4	0.00	0
mk9-b3	1260	945	3780	0	0.0032	3.5496E+01	0	0.00	0
mri1 (S)	114637	65536	589824	603	0.0037	2.6742E+01	6108	16.60	0
mri2 (S)	104597	63240	569160	-	0.0660	1.4126E+02	11852	24.04	0
n2c6-b10	306	30	330	0	0.1667	1.7426E+01	2	0.00	0
n2c6-b1	105	15	210	0	0.1333	5.5076E+00	2	0.00	0
n2c6-b2	455	105	1365	0	0.0286	7.5068E-15	2	0.00	0
n2c6-b3	1365	455	5460	0	0.0088	1.4149E+01	2	0.00	0
n2c6-b4	3003	1365	15015	0	0.0037	7.3962E-13	2	0.00	0
n2c6-b5	4945	3003	29670	0	0.0020	2.0512E+01	3	0.00	0
n2c6-b6	5715	4945	40005	27	0.0014	3.0831E-07	19	0.00	0
n2c6-b7	5715	3990	31920	9	0.0020	7.5598E+01	0	0.00	0
n2c6-b8	3990	1470	13230	1	0.0048	6.2175E+01	6	0.00	0
n2c6-b9	1410	306	3060	1	0.0196	3.7550E+01	0	0.00	0
n3c4-b1	15	6	30	1	0.3333	1.8257E+00	2	0.00	0
n3c4-b2	20	15	60	2	0.2000	4.4721E+00	1	0.00	0
n3c4-b3	20	15	60	2	0.2000	4.4721E+00	0	0.00	0
n3c4-b4	15	6	30	1	0.3333	3.8730E+00	1	0.00	0
n3c5-b1	45	10	90	0	0.2000	3.4641E+00	2	0.00	0
n3c5-b2	120	45	360	0	0.0667	3.6095E-15	2	0.00	0
n3c5-b3	210	120	840	0	0.0333	5.0200E+00	2	0.00	0
n3c5-b4	252	210	1260	0	0.0238	3.7010E-14	2	0.00	0
n3c5-b5	252	210	1260	0	0.0238	1.5875E+01	0	0.00	0
n3c5-b6	210	120	840	0	0.0333	1.4491E+01	1	0.00	0
n3c5-b7	120	30	240	0	0.1000	1.0954E+01	0	0.00	0
n3c6-b10	2511	675	7425	0	0.0074	4.9539E+01	16	0.00	0
n3c6-b11	630	60	720	0	0.0667	2.5100E+01	0	0.00	0
n3c6-b2	455	105	1365	0	0.0286	7.5068E-15	2	0.00	0
n3c6-b3	1365	455	5460	0	0.0088	1.4149E+01	2	0.00	0
n3c6-b4	3003	1365	15015	0	0.0037	7.3962E-13	2	0.00	0
n3c6-b5	5005	3003	30030	0	0.0020	2.0712E+01	2	0.00	0
n3c6-b6	6435	5005	45045	0	0.0014	2.6527E-12	2	0.00	0
n3c6-b8	6435	4935	44415	0	0.0014	7.8111E+01	3	0.00	0
n3c6-b9	4935	2511	25110	0	0.0024	7.0250E+01	0	0.00	0
n4c5-b10	630	120	1320	2	0.0333	2.4902E+01	5	0.00	0
n4c5-b11	120	10	120	0	0.1000	1.0954E+01	0	0.00	0
n4c5-b1	105	15	210	0	0.1333	5.5076E+00	2	0.00	0
n4c5-b2	455	105	1365	0	0.0286	7.5068E-15	2	0.00	0
n4c5-b3	1350	455	5400	0	0.0088	1.3972E+01	4	0.00	0
n4c5-b4	2852	1350	14260	0	0.0037	2.9243E-07	11	0.00	0
n4c5-b5	4340	2852	26040	1	0.0021	1.8576E+01	10	0.00	0
n4c5-b6	4735	4340	33145	57	0.0016	4.4160E-07	15	0.00	0
n4c5-b7	4735	3635	29080	26	0.0022	6.8811E+01	0	0.00	0
n4c5-b8	3635	1895	17055	0	0.0037	5.9042E+01	14	0.00	0
n4c5-b9	1895	630	6300	0	0.0095	4.3532E+01	0	0.00	0
n4c6-b10	186558	132402	1456422	-	0.0001	4.2339E+02	14	0.07	0
n4c6-b11	132402	69235	830820	-	0.0001	3.6387E+02	0	0.01	0
n4c6-b12	69235	25605	332865	0	0.0004	2.6025E+02	13	0.01	0
n4c6-b13	25605	6300	88200	0	0.0013	1.6002E+02	0	0.00	0
n4c6-b14	6300	920	13800	1	0.0065	7.9018E+01	9	0.00	0
n4c6-b15	920	60	960	0	0.0500	3.0332E+01	0	0.00	0
n4c6-b1	210	21	420	0	0.0952	7.9582E+00	2	0.00	0
n4c6-b2	1330	210	3990	0	0.0143	2.0203E-14	2	0.00	0
n4c6-b3	5970	1330	23880	0	0.0030	3.0996E+01	3	0.00	0
n4c6-b4	20058	5970	100290	0	0.0008	1.1372E-06	9	0.01	0
n4c6-b5	51813	20058	310878	0	0.0003	7.1632E+01	9	0.01	0

Table 2.2: Complete results for LSMR(0) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
n4c6-b6	104115	51813	728805	-	0.0001	2.5905E-06	12	0.03	0
n4c6-b7	163215	104115	1305720	-	0.0001	1.0147E+02	11	0.05	0
n4c6-b8	198895	163215	1790055	-	0.0001	3.5572E-06	15	0.10	0
n4c6-b9	198895	186558	1865580	-	0.0001	4.4598E+02	0	0.01	0
NotreDame_actors (S)	383640	127823	1470404	-	0.0051	-	>52691	>600.00	19
Pd_rhs	5804	4371	6323	0	0.0069	3.6188E+01	3882	0.22	0
photogrammetry2	4472	936	37056	7	0.0096	3.0388E+02	142	0.03	0
photogrammetry	1388	390	11816	7	0.0231	9.0895E+01	841	0.04	0
psse0 (S)	26722	11028	102432	0	0.0004	6.6360E+01	82324	31.74	0
psse1 (S)	14318	11028	57376	0	0.0016	3.5979E+01	64151	18.95	0
psse2 (S)	28634	11028	115262	0	0.0025	7.8597E+01	81831	34.75	0
QRpivot_b	391	1	391	0	1.0000	1.9774E+01	1	0.00	0
QRpivot	749	660	3808	0	0.0152	1.5593E+01	904	0.01	0
rel3	6	3	18	2	1.0000	1.4957E-15	2	0.00	0
rel4	28	10	104	5	0.4000	8.9443E-01	6	0.00	0
rel5	172	33	656	2	0.1212	5.3439E+00	24	0.00	0
rel6	1300	155	5101	2	0.0258	1.8073E+01	52	0.00	0
rel7	12770	1043	50636	2	0.0038	6.4132E+01	67	0.01	0
rel8	206040	12345	821839	2	0.0003	2.7707E+02	91	0.56	0
rel9 (S)	5921786	274667	23667183	-	0.0000	1.5416E+03	110	34.16	0
relat3	8	3	24	2	1.0000	2.8284E+00	1	0.00	0
relat4	46	10	172	5	0.4000	5.7639E+00	5	0.00	0
relat5	276	33	1058	2	0.1212	1.4900E+01	23	0.00	0
relat6	2063	155	8108	2	0.0258	4.1070E+01	43	0.00	0
relat7b	20500	1043	81355	1	0.0038	1.3429E+02	54	0.02	0
relat7	20500	1043	81355	1	0.0038	1.3429E+02	54	0.02	0
relat8	334362	12345	1334038	1	0.0003	5.5522E+02	74	0.57	0
relat9 (S)	9746232	274667	38955420	-	0.0000	3.0561E+03	88	48.46	0
rkat7_mat5	738	694	38114	0	0.3703	1.3056E+01	5048	0.37	0
robot24c1_mat5_J	404	302	15118	0	0.3013	6.4682E+00	1064	0.05	0
robot24c1_mat5	404	302	15118	0	0.3013	6.4682E+00	1065	0.05	0
Rucci1 (S)	1977885	109900	7791168	0	0.0000	7.2798E+02	17837	596.42	0
Sandi_sandi	360	314	613	66	0.0191	1.1104E+01	442	0.00	0
shar_te2-b1	17160	286	34320	0	0.0070	6.1422E+01	4	0.00	0
shar_te2-b2	200200	17160	600600	0	0.0002	1.5391E-13	11	0.03	0
sls (S)	1748122	62729	6804304	0	0.0001	1.3099E-05	638	33.75	0
TF10	106	99	622	0	0.0909	9.2992E-08	279	0.00	0
TF11	235	216	1607	0	0.0463	1.4847E-07	935	0.01	0
TF12	551	488	4231	0	0.0225	2.2792E-07	3233	0.05	0
TF13	1301	1121	11185	0	0.0107	3.5745E-07	10493	0.42	0
TF14 (S)	3159	2644	29862	0	0.0049	5.5790E-07	34727	3.42	0
TF15 (S)	7741	6334	80057	0	0.0022	8.7869E-07	>100000	26.85	0
TF16 (S)	19320	15437	216173	0	0.0010	1.3895E-06	>100000	209.74	0
TF17 (S)	48629	38132	586218	-	0.0004	-	>100000	>600.00	19
TF18 (S)	123867	95368	1597545	-	0.0002	-	>100000	>600.00	19
TF19 (S)	317955	241029	4370721	-	0.0001	-	>32164	>600.00	19
tomographic1 (S)	59360	45908	647495	3436	0.0003	4.2070E+01	65455	145.39	0
Trec10	475	106	8612	0	0.7453	1.6372E+01	187	0.00	0
Trec11	1136	235	35705	0	0.7617	2.6544E+01	369	0.03	0
Trec12	2724	551	151219	0	0.7586	4.3372E+01	949	0.24	0
Trec13	6560	1301	654517	0	0.7656	6.9694E+01	1361	1.58	0
Trec14 (S)	15904	3159	2872265	0	0.7914	1.1217E+02	2007	14.54	0
Trec3	1	1	1	0	1.0000	1.0000E+00	1	0.00	0
Trec4	2	2	3	0	1.0000	1.5424E-15	3	0.00	0
Trec5	6	3	12	0	1.0000	6.6169E-01	4	0.00	0
Trec6	14	6	40	0	0.8333	1.8236E+00	7	0.00	0
Trec7	35	11	147	0	0.8182	2.9715E+00	13	0.00	0
Trec8	83	23	549	0	0.7826	5.8826E+00	32	0.00	0
Trec9	200	47	2147	0	0.7660	9.7112E+00	67	0.00	0
well1033	1033	320	4732	0	0.0156	2.2534E+03	140	0.00	0
well1850	1850	712	8755	0	0.0070	1.0300E+03	375	0.02	0

Table 2.2: Complete results for LSMR(0) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
wheel_3_1	25	21	74	0	0.1429	2.2738E+00	23	0.00	0
wheel_4_1	41	36	122	0	0.0833	1.5091E+00	41	0.00	0
wheel_5_1	61	57	182	0	0.0526	1.1067E+00	110	0.00	0
wheel_601 (S)	902103	723605	2170814	-	0.0008	-	>19475	>600.00	19
wheel_6_1	85	83	254	2	0.0361	2.5685E+00	131	0.00	0
wheel_7_1	114	113	338	4	0.0708	2.3883E+00	231	0.00	0
wm1	260	207	2909	0	0.2415	8.1946E+00	148	0.00	0
wm2	259	207	2942	0	0.2415	8.4071E+00	199	0.00	0
wm3	259	207	2948	0	0.2705	8.1940E+00	202	0.00	0
WorldCities	313	100	7518	0	0.9900	5.3353E+00	58	0.00	0

Table 2.3: Complete LSMR(10) results for all problems with no preconditioning.

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
CUTEst examples									
25FV47	1876	820	10705	1	0.0256	2.0432E+01	4568	0.49	0
80BAU3B	11934	2262	23264	0	0.0053	8.2705E+01	104	0.03	0
AA01	8904	823	72965	15	0.0182	1.9002E+01	232	0.13	0
AA03	8627	825	70806	25	0.0206	1.9090E+01	248	0.13	0
AA3	8627	825	70806	27	0.0206	1.9090E+01	248	0.13	0
AA4	7195	426	52121	10	0.0329	1.5866E+01	160	0.07	0
AA5	8308	801	65953	22	0.0187	1.8653E+01	228	0.11	0
AA6	7292	646	51728	14	0.0217	1.6804E+01	192	0.08	0
ADLITTL2	138	56	424	0	0.1964	7.3997E+00	42	0.00	0
ADLITTLE	138	56	424	0	0.1964	7.3997E+00	42	0.00	0
AFIRO	51	27	102	0	0.1481	5.2189E+00	21	0.00	0
AFIROE	24	8	34	0	0.2500	4.1055E+00	8	0.00	0
AGG	615	488	2862	0	0.0881	1.1455E+01	172	0.01	0
AGG2	758	516	4740	0	0.0833	1.3214E+01	164	0.01	0
AGG3	758	516	4756	0	0.0833	1.3214E+01	213	0.01	0
AIRO2	6774	50	61555	0	0.3400	1.5416E+01	28	0.01	0
AIRO3	10757	124	91028	0	0.1129	1.7479E+01	162	0.10	0
AIRO4	8904	823	72965	23	0.0182	1.9002E+01	232	0.13	0
AIRO5	7195	426	52121	11	0.0329	1.5866E+01	160	0.06	0
AIRO6	8627	825	70806	30	0.0206	1.9090E+01	248	0.13	0
AIR	7517	3754	20267	0	0.2001	8.6603E+01	9	0.00	0
ALLINLP	687500	250000	687500	0	0.0000	7.1249E+02	2	0.04	0
BANDM	472	305	2494	0	0.0721	9.8785E+00	2013	0.05	0
BAS1LP (S)	9825	5411	587775	0	0.0675	5.5448E+01	13282	54.97	0
BAXTER (S)	30733	27441	111576	2993	0.0017	-	>100000	>151.52	18
BCDOUT (S)	7078	5412	67344	2	0.1554	-	>100000	>63.78	18
BEACONFD	295	173	3408	0	0.1561	5.5647E+00	214	0.01	0
BGDBG1	629	348	1662	0	0.0460	1.9660E+01	37	0.00	0
BGETAM	816	400	2537	0	0.0200	1.6322E+01	894	0.03	0
BGINDY	10880	2671	66266	0	0.0060	3.6010E+01	309	0.18	0
BGPRTR	40	20	70	0	0.2000	3.1175E+00	17	0.00	0
BLEND	114	74	522	0	0.2162	6.0635E+00	163	0.00	0
BNL1	1586	642	5532	1	0.0125	2.0313E+01	1306	0.08	0
BNL2	4486	2324	14996	0	0.0034	3.7869E+01	3429	0.62	0
BOEING1	726	351	3827	0	0.0912	1.3035E+01	792	0.03	0
BOEING2	305	166	1358	0	0.1386	7.3877E+00	275	0.00	0
BORE3D	334	233	1448	2	0.1202	8.0348E+00	630	0.01	0
BOX1	261	231	651	1	0.0216	1.5955E+01	29	0.00	0
BRANDY	303	193	2202	27	0.1503	8.7556E+00	567	0.01	0
CAPRI	482	271	1896	0	0.0923	1.3828E+01	675	0.02	0
CAR4	33052	16384	63724	0	0.0067	1.8158E+02	5	0.00	0
CARI	1200	400	152800	0	0.9500	3.4641E+01	1	0.00	0
CEP1	4769	1521	8233	0	0.1440	6.1852E+01	11	0.00	0
CERIA3D	4400	3576	21178	0	0.2704	3.0961E+01	64	0.02	0
CH	8291	3700	24102	0	0.0038	5.7926E+01	798	0.22	0
CHEMCOM	744	288	1590	0	0.0208	1.8078E+01	29	0.00	0
CO5	12325	5774	57993	0	0.0048	6.5536E+01	11330	6.77	0
CO9 (S)	22924	10789	109651	0	0.0026	8.9188E+01	24677	27.44	0
COMPLEX	1408	1023	46463	0	0.5005	3.1888E+01	5	0.00	0
CONT1	161589	160792	521181	-	0.5025	4.0197E+02	8	0.06	0
CONT11	201587	160792	521181	0	0.0000	3.0775E+02	12	0.11	0
CONT11_L (S)	1961394	1468599	5382999	0	0.0000	8.0916E+02	206	20.31	0
CONT1_L	1921596	1918399	7031999	-	0.6672	1.3862E+03	3	0.30	0
CONT4	161589	160792	519589	-	0.5025	4.0197E+02	8	0.07	0
CPLEX1	5224	3005	10947	0	0.4995	4.6078E+01	90	0.01	0
CPLEX2	378	224	1215	0	0.0357	2.5454E+00	97	0.00	0
CQ5	11748	5048	51571	0	0.0048	6.1448E+01	1557	0.84	0
CQ9	21534	9278	96653	0	0.0026	8.3008E+01	2124	2.07	0
CR42	1513	905	6614	0	0.3337	3.8739E+01	25	0.00	0

Table 2.3: Complete results for LSMR(10) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
CRE_A_PRE	6382	2684	15739	1	0.0060	5.2407E+01	8325	1.68	0
CRE_B_PRE	36222	5176	111434	2	0.0033	8.4734E+01	9265	9.57	0
CRE_C_PRE	5293	2257	13078	1	0.0062	4.9627E+01	7764	1.31	0
CRE_D_PRE	28489	3990	86144	2	0.0043	7.5197E+01	11160	8.97	0
CREW1	6469	135	46950	0	0.1185	4.7500E+00	61	0.02	0
CYCLE	3371	1890	21234	28	0.0148	2.7738E+01	41142	9.36	0
CZPROB	3562	929	10708	0	0.0043	3.3275E+00	75	0.01	0
D2Q06C (S)	5831	2171	33081	0	0.0157	3.4935E+01	54090	17.77	0
D6CUBE	6184	404	37704	11	0.0248	2.8696E+01	125	0.04	0
DANO3MIP	15851	3202	81633	0	0.1952	3.6615E+01	2631	1.84	0
DBIC1	226317	43200	1081843	0	0.0009	2.2488E+02	417	5.13	0
DBIR1 (S)	45775	18804	1077025	103	0.0119	1.6711E+02	1316	11.03	0
DBIR2 (S)	45877	18906	1158159	101	0.0123	1.6746E+02	16969	152.19	0
DE063155	1596	852	4913	0	0.0141	3.8032E+01	13465	0.74	0
DE063157	1656	936	5119	0	0.0128	4.0603E+01	10	0.00	0
DE080285	1656	936	5082	0	0.0128	2.9637E+01	94060	5.49	0
DEGEN2	757	444	4201	0	0.0495	8.7769E+00	231	0.01	0
DEGEN3	2604	1503	25432	0	0.0326	1.9246E+01	922	0.20	0
DEGENLPA	20	15	82	0	0.4000	8.1996E-01	23	0.00	0
DEGENLPB	20	15	82	0	0.4000	8.1996E-01	23	0.00	0
DEGME	659415	185501	8127528	0	0.0001	3.4604E+02	20	1.45	0
DELF000 (S)	5543	3128	13741	0	0.0029	-	>100000	>17.45	18
DELF001	5514	3098	14322	0	0.0032	-	>100000	>17.84	18
DELF002	5549	3135	14432	0	0.0032	-	>100000	>18.00	18
DELF003	5478	3065	14343	0	0.0033	-	>100000	>17.96	18
DELF004	5558	3142	14696	0	0.0032	-	>100000	>18.12	18
DELF005	5519	3103	14605	0	0.0032	-	>100000	>17.98	18
DELF006	5563	3147	14754	0	0.0032	-	>100000	>18.19	18
DELF007	5555	3137	14898	0	0.0032	-	>100000	>18.32	18
DELF008	5566	3148	14971	0	0.0032	-	>100000	>18.39	18
DELF009	5554	3135	14888	0	0.0032	-	>100000	>18.29	18
DELF010	5566	3147	14952	0	0.0032	-	>100000	>18.34	18
DELF011	5553	3134	14915	0	0.0032	-	>100000	>18.34	18
DELF012	5570	3151	14948	0	0.0032	-	>100000	>18.39	18
DELF013	5535	3116	14928	0	0.0032	-	>100000	>18.26	18
DELF014	5586	3170	15036	0	0.0032	-	>100000	>18.43	18
DELF015	5573	3161	14951	0	0.0032	-	>100000	>18.46	18
DELF017	5587	3176	14904	0	0.0031	-	>100000	>18.37	18
DELF018	5604	3196	14963	0	0.0031	-	>100000	>18.45	18
DELF019	5592	3185	14939	0	0.0031	-	>100000	>18.40	18
DELF020	5616	3213	15270	0	0.0031	-	>100000	>18.62	18
DELF021	5610	3208	15263	0	0.0031	-	>100000	>18.68	18
DELF022	5616	3214	15260	0	0.0031	-	>100000	>18.69	18
DELF023	5616	3214	15298	0	0.0031	-	>100000	>18.79	18
DELF024	5610	3207	15656	0	0.0034	-	>100000	>18.99	18
DELF025	5608	3197	15647	0	0.0034	-	>100000	>18.83	18
DELF026	5606	3190	15420	0	0.0031	-	>100000	>18.68	18
DELF027	5601	3187	15400	0	0.0031	-	>100000	>18.70	18
DELF028	5596	3177	15602	0	0.0035	-	>100000	>18.86	18
DELF029	5598	3179	15602	0	0.0035	-	>100000	>18.80	18
DELF030	5613	3199	15462	0	0.0034	-	>100000	>18.76	18
DELF031	5599	3176	15405	0	0.0035	-	>100000	>18.87	18
DELF032	5611	3196	15451	0	0.0034	-	>100000	>19.01	18
DELF033	5595	3173	15400	0	0.0035	-	>100000	>18.79	18
DELF034	5594	3175	15403	0	0.0035	-	>100000	>18.67	18
DELF035	5607	3193	15479	0	0.0034	-	>100000	>18.83	18
DELF036	5598	3170	15397	0	0.0035	-	>100000	>18.66	18
DETER0	5468	1923	11173	0	0.0099	5.7052E+01	190	0.03	0
DETER1	15737	5527	32187	0	0.0096	9.8357E+01	291	0.11	0
DETER2	17313	6095	35731	0	0.0133	1.0199E+02	278	0.12	0
DETER3	21777	7647	44547	0	0.0095	1.2196E+02	309	0.17	0

Table 2.3: Complete results for LSMR(10) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
DETER4	9133	3235	19231	0	0.0219	7.4270E+01	170	0.04	0
DETER5	14529	5103	29715	0	0.0096	9.8117E+01	284	0.11	0
DETER6	12113	4255	24771	0	0.0096	8.9066E+01	260	0.08	0
DETER7	18153	6375	37131	0	0.0096	1.1073E+02	300	0.13	0
DETER8	10905	3831	22299	0	0.0097	8.4952E+01	245	0.07	0
DF2177	10358	630	22336	0	0.0127	5.4305E+01	10	0.00	0
DFL001	12230	6071	35632	0	0.0023	5.5173E+01	775	0.43	0
DISP3	3990	2182	8541	0	0.0027	4.6507E+01	50	0.01	0
DSBMIP	2667	1182	8156	0	0.0068	2.6848E+01	1159	0.11	0
E18	38601	24617	156466	0	0.0040	1.1964E+02	9	0.02	0
E226	472	223	2768	0	0.0942	1.3971E+01	514	0.01	0
ETAMACRO	816	400	2537	0	0.0200	1.6322E+01	898	0.03	0
EX2STA1	17516	17443	68779	0	0.0026	3.5780E+00	4561	4.08	0
EX72A	215	197	467	1	0.0152	1.3687E+01	96	0.00	0
EX73A	211	193	457	1	0.0155	1.3619E+01	93	0.00	0
FARM	17	7	41	0	0.5714	2.6111E+00	7	0.00	0
FFFFF800	1028	524	6401	0	0.0954	1.0705E+01	3993	0.24	0
FINNIS	1064	497	2760	0	0.0282	2.1406E+01	277	0.01	0
FIT1D	1049	24	13427	0	0.7500	3.0717E+01	31	0.00	0
FIT1P	1677	627	9868	0	1.0000	4.0153E+01	52	0.01	0
FIT2D	10524	25	129042	0	0.6800	1.0026E+02	34	0.03	0
FIT2P	13525	3000	50284	0	1.0000	1.1051E+02	52	0.03	0
FOME11	24460	12142	71264	0	0.0012	7.8027E+01	780	0.86	0
FOME12	48920	24284	142528	0	0.0006	1.1035E+02	777	1.73	0
FOME13	97840	48568	285056	1	0.0003	1.5605E+02	783	3.64	0
FOME20	108175	33798	232647	77	0.0001	8.8731E+01	271	0.92	0
FOME21	216350	67596	465294	152	0.0000	1.2549E+02	272	1.93	0
FOREST	131	66	246	0	0.0455	5.8417E+00	19	0.00	0
FORPLAN	492	161	4634	0	0.2174	7.4845E+00	92	0.00	0
FXM2_16	7335	3900	32972	0	0.0092	5.0100E+01	1372	0.45	0
FXM2_6	2845	1520	12812	0	0.0158	3.1221E+01	1285	0.17	0
FXM3_16	85575	41340	392252	0	0.0009	1.7544E+02	1444	5.80	0
FXM3_6	12625	6200	57722	0	0.0039	6.6994E+01	1356	0.78	0
FXM4_6	47185	22400	265442	0	0.0011	1.4534E+02	1311	3.25	0
GALENET	14	8	22	0	0.2500	3.7417E+00	1	0.00	0
GAMS10A	171	114	407	0	0.0614	8.8742E+00	9	0.00	0
GAMS10AM	171	114	407	0	0.0614	8.1798E+00	10	0.00	0
GAMS30A	531	354	1287	0	0.0198	1.3857E+01	19	0.00	0
GAMS30AM	531	354	1287	0	0.0198	1.2209E+01	19	0.00	0
GAMS60AM	1071	714	2607	0	0.0098	1.6497E+01	28	0.00	0
GANGES	1706	1309	6937	0	0.0099	1.4580E+01	118	0.01	0
GAS11	860	459	2166	0	0.0261	1.7536E+01	16222	0.44	0
GE (S)	16369	10099	44825	0	0.0036	7.2589E+01	71285	45.74	0
GEN	2561	769	63086	0	0.0858	2.5015E+00	64	0.03	0
GEN1	2561	769	63086	0	0.0858	2.5015E+00	64	0.03	0
GEN2	3264	1121	81855	0	0.0937	1.6054E+00	60	0.04	0
GEN4	4298	1537	107103	0	0.0625	2.8739E+00	49	0.04	0
GFRD-PNC	1160	616	2445	0	0.0049	2.8248E+01	105	0.00	0
GOFFIN	101	50	2600	0	1.0000	9.8528E+00	2	0.00	0
GOSH	13455	3790	99953	2	0.0045	5.0199E+01	10422	8.45	0
GRAN	2604	2525	20111	471	0.0341	2.1249E+01	73194	9.30	0
GREENBEA	5598	2389	31070	3	0.0100	3.1909E+01	1848	0.59	0
GREENBEB	5598	2389	31070	3	0.0100	3.1909E+01	1848	0.58	0
GREENBEI	5596	2390	31074	3	0.0100	3.1810E+01	1844	0.58	0
GROW15	645	300	5620	0	0.0667	2.1646E+01	34	0.00	0
GROW22	946	440	8252	0	0.0455	2.5881E+01	35	0.00	0
GROW7	301	140	2612	0	0.1429	1.5322E+01	29	0.00	0
IIASA	3639	669	7317	0	0.0105	2.9786E+01	31	0.00	0
IPROB	3001	3001	9000	0	0.9997	4.2779E+01	3	0.00	0
ISRAEL	316	174	2443	0	0.7816	1.0905E+01	485	0.02	0
ITEST2	13	9	26	0	0.5556	3.1922E+00	5	0.00	0

Table 2.3: Complete results for LSMR(10) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
ITEST6	17	11	29	0	0.4545	3.6023E+00	10	0.00	0
JENDREC1	4228	2109	89608	0	0.9886	6.4699E+01	125	0.09	0
KARTED	133115	46502	1770349	0	0.0005	1.1284E+02	32	0.52	0
KB2	68	43	313	0	0.3256	5.7141E+00	93	0.00	0
KEN_07_PRE	2033	887	4354	0	0.0034	2.4960E+01	36	0.00	0
KEN_11_PRE	11984	5511	26538	3	0.0005	7.1971E+01	90	0.03	0
KEN_13_PRE	24818	10962	57238	18	0.0004	9.7208E+01	110	0.08	0
KEN_18_PRE	89439	39867	208594	1	0.0001	1.5484E+02	147	0.42	0
KENT	47920	31300	216010	0	0.0006	7.5567E+01	824	1.94	0
KL02	36699	71	212536	0	0.1127	1.6400E-06	42	0.07	0
KLEEMIN3	6	3	9	0	1.0000	1.4920E+00	3	0.00	0
KLEEMIN4	8	4	14	0	1.0000	1.4351E+00	4	0.00	0
KLEEMIN5	10	5	20	0	1.0000	1.4439E+00	4	0.00	0
KLEEMIN6	12	6	27	0	1.0000	1.4488E+00	5	0.00	0
KLEEMIN7	14	7	35	0	1.0000	1.5542E+00	3	0.00	0
KLEEMIN8	16	8	44	0	1.0000	3.8442E+00	2	0.00	0
KLEIN1	108	54	750	0	0.3889	8.3196E+00	156	0.00	0
KLEIN2	531	477	5062	0	0.3438	1.5237E+01	249	0.02	0
KLEIN3	1082	994	13101	0	0.2767	2.1013E+01	840	0.11	0
L30	16281	2701	52070	0	0.0030	1.2489E+02	223	0.10	0
L9	1483	244	4659	0	0.0328	3.7508E+01	82	0.01	0
LARGE000	7253	4239	18313	0	0.0024	6.1470E+01	40270	9.38	0
LARGE001 (S)	7176	4162	18887	0	0.0026	6.0689E+01	54427	12.85	0
LARGE002	7260	4249	20075	0	0.0028	5.9736E+01	71606	17.70	0
LARGE003	7216	4200	19717	0	0.0029	6.1237E+01	70094	17.18	0
LARGE004	7266	4250	19489	0	0.0028	6.0729E+01	66515	16.38	0
LARGE005	7256	4237	19314	0	0.0026	6.0714E+01	67006	16.12	0
LARGE006	7267	4249	19637	0	0.0026	6.0400E+01	67951	16.60	0
LARGE007	7255	4236	19595	0	0.0026	6.0316E+01	72180	17.64	0
LARGE008	7267	4248	19648	0	0.0026	6.0334E+01	73592	18.00	0
LARGE009	7256	4237	19617	0	0.0026	6.0292E+01	74439	18.12	0
LARGE010	7267	4247	19637	0	0.0026	6.0325E+01	74423	18.19	0
LARGE011	7256	4236	19617	0	0.0026	6.0318E+01	73436	17.89	0
LARGE012	7273	4253	19674	0	0.0026	6.0332E+01	73191	17.93	0
LARGE013	7265	4248	19688	0	0.0026	5.9904E+01	76094	18.65	0
LARGE014	7288	4271	19749	0	0.0026	6.0703E+01	69408	17.00	0
LARGE015	7278	4265	19717	0	0.0026	6.0682E+01	68954	16.89	0
LARGE016	7298	4287	19809	0	0.0026	6.0739E+01	69233	16.96	0
LARGE017	7288	4277	19754	0	0.0026	6.0762E+01	67925	16.58	0
LARGE018	7305	4297	19579	0	0.0026	6.0632E+01	68615	16.79	0
LARGE019	7304	4300	19574	0	0.0026	5.9969E+01	72501	17.69	0
LARGE020	7317	4315	19936	0	0.0025	5.9599E+01	74650	18.38	0
LARGE021	7313	4311	19952	0	0.0026	5.9658E+01	72664	17.90	0
LARGE022	7314	4312	19904	0	0.0026	5.9679E+01	69299	17.09	0
LARGE023	7304	4302	19912	0	0.0026	5.9857E+01	63058	15.54	0
LARGE024	7311	4292	20399	0	0.0028	6.0055E+01	46886	11.73	0
LARGE025	7312	4297	20543	0	0.0028	6.0323E+01	51212	12.88	0
LARGE026	7304	4284	20431	0	0.0028	6.0300E+01	50114	12.61	0
LARGE027	7301	4275	20362	0	0.0028	6.0470E+01	45253	11.34	0
LARGE028	7313	4302	20686	0	0.0028	6.0616E+01	48718	12.38	0
LARGE029	7312	4301	20752	0	0.0028	6.0631E+01	50440	12.86	0
LARGE030	7303	4285	20643	0	0.0028	6.1137E+01	50805	12.77	0
LARGE031	7306	4294	20667	0	0.0028	6.1091E+01	50672	12.85	0
LARGE032	7307	4292	20650	0	0.0028	6.1080E+01	50625	12.85	0
LARGE033	7292	4273	20586	0	0.0028	6.0623E+01	50867	12.74	0
LARGE034	7306	4294	20650	0	0.0028	6.0513E+01	50364	12.78	0
LARGE035	7304	4293	20676	0	0.0028	6.0485E+01	51055	12.88	0
LARGE036	7297	4282	20635	0	0.0028	6.0441E+01	51990	13.10	0
LINSPANH	97	33	194	0	0.0606	4.6238E+00	21	0.00	0
LOTFI	366	153	1136	0	0.0654	9.7311E+00	264	0.01	0
LP22	16392	2958	68518	0	0.0132	6.2250E+01	105	0.07	0

Table 2.3: Complete results for LSMR(10) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
LPL1 (S)	129959	39951	386218	44	0.0004	7.0878E+01	29751	133.21	0
LPL2	10881	3294	32232	5	0.0009	5.7537E+01	86	0.03	0
LPL3	33686	10828	100525	1	0.0003	9.4797E+01	108	0.11	0
LSQPROB	138	56	424	0	0.1964	7.3997E+00	43	0.00	0
LSQROB	138	56	424	0	0.1964	7.3997E+00	43	0.00	0
MAKELA4	61	40	120	0	1.0000	7.4289E+00	2	0.00	0
MAROS-R7	9408	3136	144848	0	0.0147	8.2622E+01	12	0.02	0
MAROS	1966	846	10137	0	0.0236	2.4629E+01	12381	1.26	0
MOD2 (S)	66409	34774	199810	0	0.0005	1.3872E+02	10665	25.76	0
MODEL	80	38	136	0	0.1579	6.7703E+00	292	0.00	0
MODEL1	798	362	3028	0	0.0442	9.6897E+00	72	0.00	0
MODEL10 (S)	16819	4400	150372	0	0.0039	5.3558E+01	35115	42.68	0
MODEL11	20464	7056	58035	0	0.0028	1.2316E+02	83	0.05	0
MODEL2	1321	379	7607	2	0.0369	1.5367E+01	1765	0.12	0
MODEL3	4565	1609	23974	0	0.0149	3.5843E+01	5000	1.15	0
MODEL4	4962	1337	45753	0	0.0127	2.7593E+01	20051	7.33	0
MODEL5	11802	1744	89925	144	0.0097	3.3983E+01	3564	2.49	0
MODEL6	5289	2094	27628	2	0.0124	2.5143E+01	5138	1.42	0
MODEL7	9560	3358	51027	0	0.0071	5.1244E+01	10215	5.04	0
MODEL8	6464	2896	25277	0	0.0055	1.7963E+01	270	0.07	0
MODEL9	10939	2787	55956	92	0.0068	6.9788E+01	2683	1.37	0
MODSZK1	1620	686	3168	1	0.0335	3.3236E+01	69	0.00	0
MONDOU2	604	312	1208	0	0.0064	2.2419E+01	136	0.00	0
MPSBCD03 (S)	7078	5412	66210	2	0.1554	-	>100000	>63.41	18
MULTI	160	61	1019	0	0.2131	5.6174E+00	31	0.00	0
NEMSAFM	2348	334	2826	0	0.0120	4.5918E+01	29	0.00	0
NEMSCEM	1712	651	3840	0	0.0061	2.3126E+01	105	0.01	0
NEMSEMM1	75310	3945	1053986	0	0.0352	8.7388E+01	1193	9.27	0
NEMSEMM2	48878	6943	182012	0	0.0058	1.0617E+02	1143	1.85	0
NEMSPMM1	8903	2362	55867	10	0.0258	4.7785E+01	10750	5.21	0
NEMSPMM2	8734	2301	68225	0	0.0278	3.8815E+01	13465	7.58	0
NEMSWRLD	28550	6647	192283	491	0.0078	6.0760E+01	1222	1.95	0
NEOS	515905	479119	1526794	0	0.0339	4.9938E+02	330	8.92	0
NEOS1	133473	131581	599590	0	0.0275	3.5694E+02	134	1.05	0
NEOS2	134128	132568	685087	0	0.0330	3.5375E+02	216	1.85	0
NEOS3	518832	512209	2055024	0	0.0005	2.0785E+01	7	0.22	0
NESM	3105	662	13470	0	0.0151	4.1883E+01	190	0.02	0
EMSDZ	15325	7039	47035	0	0.0021	7.5844E+01	4946	2.68	0
NSCT1	37461	22901	678739	287	0.0269	1.8366E+02	1043	5.72	0
NSCT2 (S)	37563	23003	697738	287	0.0273	1.8394E+02	9120	51.19	0
NSIC1	883	451	3273	0	0.0599	2.5158E+01	126	0.01	0
NSIC2	897	465	3449	0	0.0581	2.5435E+01	1036	0.04	0
NSIR1	10011	4407	143249	0	0.0517	8.0262E+01	885	1.00	0
NSIR2 (S)	10057	4453	154939	0	0.0528	8.0556E+01	8695	10.44	0
NUG05	225	210	1050	3	0.0476	1.0643E+01	2	0.00	0
NUG06	486	372	2232	1	0.0323	4.0476E-13	3	0.00	0
NUG07	931	602	4214	0	0.0233	7.6004E-13	3	0.00	0
NUG08	1632	912	7296	0	0.0175	3.8653E-13	3	0.00	0
NUG12	8856	3192	38304	0	0.0075	3.8506E-11	3	0.00	0
NUG15	22275	6330	94950	0	0.0047	5.0151E-11	3	0.00	0
NUG20	72600	15240	304800	1	0.0026	7.8274E-11	3	0.01	0
NUG30	379350	52260	1567800	0	0.0011	4.0749E-09	3	0.08	0
NW14	123409	73	904910	0	0.1507	3.8730E+01	99	0.70	0
OET1	1005	1002	4006	0	1.0000	3.1677E+01	2	0.00	0
OET3	1006	1002	5006	0	1.0000	3.1670E+01	4	0.00	0
ORNA1	1764	882	3990	0	0.0170	1.1814E+01	17837	0.99	0
ORNA2	1764	882	3990	0	0.0170	1.2116E+01	18029	0.99	0
ORNA3	1764	882	3990	0	0.0170	1.2142E+01	18048	0.99	0
ORNA4	1764	882	3990	0	0.0170	1.2217E+01	18051	1.01	0
ORNA7	1764	882	3990	0	0.0170	1.2142E+01	18048	1.01	0
ORSWQ2	160	80	344	0	0.1250	8.7296E+00	27	0.00	0

Table 2.3: Complete results for LSMR(10) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
OSA_07_PRE	24062	1047	63037	0	0.0038	4.3640E+01	29	0.02	0
OSA_14_PRE	52723	2266	139136	0	0.0018	6.3861E+01	32	0.04	0
OSA_30_PRE	100396	4279	267149	0	0.0009	8.7145E+01	39	0.09	0
OSA_60_PRE	234334	10209	594462	0	0.0004	1.3992E+02	36	0.21	0
P0033	48	15	113	0	0.3333	3.9213E+00	26	0.00	0
P0040	63	23	133	0	0.1304	3.3924E+00	4	0.00	0
P10	19090	10090	118000	0	0.0020	9.8334E+01	167	0.19	0
P0201	334	133	2056	0	0.1053	6.5816E+00	34	0.00	0
P0282	523	241	2207	0	0.4647	2.1966E+01	61	0.00	0
P0291	543	252	2283	0	0.4167	2.1565E+01	45	0.00	0
P05	9590	5090	59045	0	0.0039	7.0494E+01	148	0.08	0
P0548	724	176	1887	0	0.0284	2.0066E+01	103	0.00	0
P19	851	284	5570	0	0.0458	1.0707E+01	49	0.00	0
P2756	3511	755	9692	0	0.0212	4.7567E+01	243	0.03	0
P6000	7947	2095	19826	0	0.0029	6.5556E+01	4	0.00	0
P80BAU3B	10613	1984	21000	0	0.0055	7.6989E+01	117	0.03	0
PANG	741	361	2933	0	0.0831	1.5295E+01	346	0.01	0
PCB1000	2820	1565	20463	0	0.0166	1.7326E+01	361	0.08	0
PCB3000	7732	3960	57479	0	0.0071	2.7109E+01	588	0.34	0
PDE1 (S)	271792	270595	990587	-	0.6696	3.0302E+02	1624	24.21	0
PDE2	361491	270595	990587	0	0.0000	3.4879E+02	655	9.97	0
PDS_02_PRE	3056	877	7484	1	0.0057	2.2013E+01	57	0.00	0
PDS_06_PRE	18530	2972	42304	0	0.0020	4.2161E+01	145	0.07	0
PDS_10_PRE	33270	4725	76307	1	0.0013	5.3829E+01	176	0.15	0
PDS_20_PRE	81224	10214	184176	0	0.0006	8.0747E+01	208	0.46	0
PDS-100 (S)	514577	156016	1096002	227	0.0000	2.8489E+02	680	11.77	0
PDS-20	108175	33798	232647	76	0.0001	8.8731E+01	271	0.94	0
PDS-30	158489	49788	340635	156	0.0001	1.2041E+02	351	1.82	0
PDS-40	217531	66641	466800	203	0.0000	1.5176E+02	447	3.21	0
PDS-50	275814	82837	590833	223	0.0000	1.8065E+02	494	4.50	0
PDS-60	336421	99204	719557	227	0.0000	2.0695E+02	532	5.91	0
PDS-70	390005	114717	833465	227	0.0000	2.3001E+02	565	7.42	0
PDS-80	434580	128954	927826	227	0.0000	2.5040E+02	595	8.75	0
PDS-90 (S)	475448	142596	1014136	227	0.0000	2.6847E+02	638	10.18	0
PEROLD	1506	625	6148	0	0.0256	2.8421E+01	22813	1.35	0
PF2177	9908	9728	30984	42	0.0038	9.4105E-01	121	0.06	0
PGP2	13254	4034	22474	0	0.1433	9.9046E+01	6	0.00	0
PILOT-JA (S)	2267	940	14977	0	0.0585	-	>100000	>13.02	18
PILOT-WE	2928	722	9265	0	0.0166	2.7742E+01	29410	2.54	0
PILOT	4860	1441	44375	0	0.0840	4.4917E+01	2026	0.74	0
PILOT4	1123	410	5264	0	0.0659	2.5522E+01	5153	0.25	0
PILOT4I	1123	410	5264	0	0.0659	2.5515E+01	5054	0.25	0
PILOT87	6680	2030	74949	0	0.0473	5.2250E+01	4586	2.70	0
PILOTNOV (S)	2446	975	13331	0	0.0410	3.5044E+01	95219	11.45	0
PLDD000B	5049	3069	10762	0	0.0029	4.8552E+01	1657	0.26	0
PLDD001B	5049	3069	10763	0	0.0029	4.8535E+01	1654	0.25	0
PLDD002B	5049	3069	10764	0	0.0029	4.8527E+01	1645	0.25	0
PLDD003B	5049	3069	10765	0	0.0029	4.8524E+01	1642	0.26	0
PLDD004B	5049	3069	10766	0	0.0029	4.8521E+01	1642	0.26	0
PLDD005B	5049	3069	10767	0	0.0029	4.8519E+01	1642	0.25	0
PLDD006B	5049	3069	10768	0	0.0029	4.8517E+01	1642	0.25	0
PLDD007B	5049	3069	10769	0	0.0029	4.8514E+01	1642	0.25	0
PLDD008B	5049	3069	10829	0	0.0029	4.8248E+01	1642	0.26	0
PLDD009B	5049	3069	10832	0	0.0029	4.8240E+01	1642	0.26	0
PLDD010B	5049	3069	10835	0	0.0029	4.8233E+01	1640	0.26	0
PLDD011B	5049	3069	10837	0	0.0029	4.8229E+01	1639	0.25	0
PLDD012B	5049	3069	10839	0	0.0029	4.8224E+01	1639	0.25	0
PLTEXPA2-1	4540	1726	9233	0	0.0104	3.8985E+01	40	0.00	0
PLTEXPA2-6	1820	686	3703	0	0.0117	2.4377E+01	39	0.00	0
PLTEXPA3_1	74172	28350	150801	0	0.0006	1.5888E+02	46	0.09	0
PLTEXPA3_6	11612	4430	23611	0	0.0018	6.2691E+01	44	0.01	0

Table 2.3: Complete results for LSMR(10) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
PLTEXPA4_6	70364	26894	143059	0	0.0003	1.5475E+02	49	0.09	0
PRESOLVE	932	428	5224	0	0.0911	1.3968E+01	2728	0.13	0
PRIMAGAZ	10836	1554	21665	0	0.0013	5.2779E+00	2	0.00	0
PROBLEM	46	12	86	0	0.1667	6.7823E+00	0	0.00	0
PROGAS	1900	1650	8897	0	0.0085	2.4639E+01	3691	0.37	0
PT	503	501	1503	0	1.0000	2.2414E+01	2	0.00	0
QAP12	8856	3192	38304	0	0.0075	2.4786E-11	3	0.00	0
QAP15	22275	6330	94950	0	0.0047	2.8432E-11	3	0.00	0
QAP8	1632	912	7296	0	0.0175	3.1159E-13	3	0.00	0
QIU	1900	1192	4492	0	0.0092	1.3884E+01	41	0.00	0
QPBD_OUT	442	211	2589	0	0.0995	1.3154E+01	615	0.02	0
QUAL	464	323	1646	0	0.0960	1.1182E+01	2996	0.06	0
R05	9690	5190	104145	0	0.0058	7.0877E+01	168	0.15	0
RAIL2586 (S)	923269	2586	8011362	0	0.0046	1.4113E+02	880	75.90	0
RAIL4284 (S)	1096894	4284	11284032	0	0.0028	1.6948E+02	864	122.27	0
RAIL507	63516	507	409856	0	0.0237	4.7606E+01	288	0.90	0
RAIL516	47827	516	315412	0	0.0233	3.7721E+01	278	0.68	0
RAIL582	56097	582	402290	0	0.0206	4.5502E+01	305	0.94	0
RAT1	9408	3136	88267	0	0.0086	9.1651E+01	7	0.01	0
RAT5	9408	3136	137413	0	0.0137	9.1537E+01	7	0.01	0
RAT7A	9408	3136	268908	0	0.0281	9.0828E+01	7	0.01	0
REACTOR	808	318	2591	0	0.0314	1.5910E+01	75	0.00	0
READING2	6003	4000	16000	0	0.0010	7.5465E+01	2000	0.43	0
RECIPELP	204	91	687	0	0.1099	1.1855E+01	124	0.00	0
REFINE	62	29	153	0	0.1724	5.2566E+00	29	0.00	0
REFINERY	464	323	1626	0	0.0960	1.1271E+01	2962	0.06	0
RLFDDD	61521	4050	264627	0	0.0119	1.5612E+02	100	0.21	0
RLFDUAL	74970	8052	282031	0	0.0055	1.9310E+02	99	0.24	0
RLFPRIM	62712	58866	320591	78	0.0034	1.1503E+02	2562	9.92	0
ROSEN1	1544	520	23794	0	0.0462	2.4644E+01	138	0.03	0
ROSEN10	6152	2056	64192	0	0.0078	5.2010E+01	201	0.10	0
ROSEN2	3080	1032	47536	0	0.0233	3.4740E+01	168	0.06	0
ROSEN7	776	264	8034	0	0.0606	1.8542E+01	143	0.01	0
ROSEN8	1544	520	16058	0	0.0308	2.6097E+01	174	0.03	0
ROUTE	43019	20894	206782	31	0.0021	1.4276E+02	76	0.16	0
S277-280	8	4	20	0	1.0000	2.6966E+00	4	0.00	0
SC105	163	105	340	0	0.0476	8.8268E+00	61	0.00	0
SC2052R100	3923	2213	7739	0	0.0461	5.5573E+01	33	0.00	0
SC2052R16	647	365	1271	0	0.0493	2.2439E+01	30	0.00	0
SC2052R160	62423	35213	123239	0	0.0455	2.2195E+02	36	0.06	0
SC2052R200	7823	4413	15439	0	0.0458	7.8527E+01	33	0.01	0
SC2052R27	1076	607	2118	0	0.0478	2.9013E+01	31	0.00	0
SC2052R32	1271	717	2503	0	0.0474	3.1553E+01	32	0.00	0
SC2052R4	179	101	347	0	0.0594	1.1656E+01	25	0.00	0
SC2052R400	15623	8813	30839	0	0.0456	1.1101E+02	33	0.02	0
SC2052R50	1973	1113	3889	0	0.0467	3.9364E+01	32	0.00	0
SC2052R64	2519	1421	4967	0	0.0464	4.4501E+01	32	0.00	0
SC2052R8	335	189	655	0	0.0529	1.6062E+01	27	0.00	0
SC2052R800	31223	17613	61639	0	0.0455	1.5696E+02	33	0.03	0
SC205	317	205	665	0	0.0244	1.0407E+01	108	0.00	0
SC50A	78	50	160	0	0.1000	7.2153E+00	35	0.00	0
SC50B	78	50	148	0	0.0800	6.5537E+00	37	0.00	0
SCAGR25	671	471	1725	0	0.0191	1.3015E+01	129	0.00	0
SCAGR7CX	887	623	2285	0	0.1814	1.7437E+01	61	0.00	0
SCAGR7AX	239	167	605	0	0.1737	8.2088E+00	50	0.00	0
SCAGR7GX	13847	9743	35885	0	0.1840	7.2243E+01	92	0.05	0
SCAGR7CQ	887	623	2285	0	0.1814	1.7437E+01	61	0.00	0
SCAGR7AQ	239	167	605	0	0.1737	8.2088E+00	50	0.00	0
SCAGR7GQ	3479	2447	9005	0	0.1835	3.5822E+01	77	0.01	0
SCAGR7HH	5855	4119	15057	0	0.1838	4.6739E+01	79	0.02	0
SCAGR7CH	887	623	2285	0	0.1814	1.7437E+01	61	0.00	0

Table 2.3: Complete results for LSMR(10) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
SCAGR7IH	11687	8223	30069	0	0.1840	6.6324E+01	88	0.04	0
SCAGR7DH	1481	1041	3825	0	0.1825	2.2963E+01	66	0.00	0
SCAGR7EH	1751	1231	4525	0	0.1828	2.5083E+01	67	0.00	0
SCAGR7AH	239	167	605	0	0.1737	8.2088E+00	50	0.00	0
SCAGR7JH	23351	16431	60093	0	0.1841	9.3970E+01	96	0.08	0
SCAGR7FH	2939	2067	7605	0	0.1834	3.2843E+01	73	0.01	0
SCAGR7GH	3479	2447	9005	0	0.1835	3.5822E+01	77	0.01	0
SCAGR7BH	455	319	1165	0	0.1787	1.2004E+01	57	0.00	0
SCAGR7KH	46679	32847	120141	0	0.1842	1.3303E+02	102	0.18	0
SCAGR7	185	129	465	0	0.0698	6.4363E+00	74	0.00	0
SCALED	27	15	53	0	0.2667	3.9671E+00	11	0.00	0
SCFXM1B16	4263	2460	14508	0	0.0146	3.3662E+01	557	0.09	0
SCFXM1B4	1179	684	4164	0	0.0322	1.8003E+01	502	0.02	0
SCFXM1B64	33047	19036	111052	0	0.0137	9.3268E+01	620	0.78	0
SCFXM1C4	1179	684	4164	0	0.0322	1.8003E+01	502	0.03	0
SCFXM1R128	33047	19036	111052	0	0.0137	9.3268E+01	620	0.77	0
SCFXM1R16	4263	2460	14508	0	0.0146	3.3662E+01	557	0.09	0
SCFXM1R256	65943	37980	221388	0	0.0136	1.3171E+02	625	1.69	0
SCFXM1R27	7090	4088	23990	0	0.0142	4.3313E+01	569	0.16	0
SCFXM1R32	8375	4828	28300	0	0.0141	4.7050E+01	581	0.19	0
SCFXM1R4	1179	684	4164	0	0.0322	1.8003E+01	502	0.02	0
SCFXM1R64	16599	9564	55884	0	0.0138	6.6147E+01	604	0.39	0
SCFXM1R8	2207	1276	7612	0	0.0204	2.4358E+01	519	0.05	0
SCFXM1R96	24823	14300	83468	0	0.0137	8.0853E+01	613	0.59	0
SCFXM1	600	330	2732	0	0.0606	1.4494E+01	1250	0.04	0
SCFXM2	1200	660	5469	0	0.0303	2.0433E+01	1842	0.11	0
SCFXM3	1800	990	8206	0	0.0202	2.4998E+01	1889	0.16	0
SCORPION	466	388	1534	29	0.0180	1.6015E+01	120	0.00	0
SCRS8CX	907	476	1895	0	0.1429	2.2078E+01	79	0.00	0
SCRS8AX	259	140	527	0	0.1429	1.1308E+01	70	0.00	0
SCRS8	3499	1820	7367	0	0.1429	4.4681E+01	103	0.01	0
SCRS8CQ	907	476	1895	0	0.1429	2.2078E+01	79	0.00	0
SCRS8EQ	1771	924	3719	0	0.1429	3.1356E+01	88	0.00	0
SCRS8AQ	259	140	527	0	0.1429	1.1308E+01	70	0.00	0
SCRS8FQ	3499	1820	7367	0	0.1429	4.4681E+01	103	0.01	0
SCRS8BQ	475	252	983	0	0.1429	1.5667E+01	77	0.00	0
SCRS8GH	6955	3612	14663	0	0.1429	6.3717E+01	122	0.03	0
SCRS8CH	907	476	1895	0	0.1429	2.2078E+01	79	0.00	0
SCRS8HH	13867	7196	29255	0	0.1429	9.0764E+01	131	0.05	0
SCRS8DH	1501	784	3149	0	0.1429	2.8760E+01	86	0.00	0
SCRS8EH	1771	924	3719	0	0.1429	3.1356E+01	88	0.00	0
SCRS8AH	259	140	527	0	0.1429	1.1308E+01	70	0.00	0
SCRS8IH	27691	14364	58439	0	0.1429	1.2903E+02	154	0.12	0
SCRS8FH	3499	1820	7367	0	0.1429	4.4681E+01	103	0.01	0
SCRS8FHH	3499	1820	7367	0	0.1429	4.4681E+01	103	0.01	0
SCRS8BH	475	252	983	0	0.1429	1.5667E+01	77	0.00	0
SCRS8	1275	490	3288	0	0.0163	1.7598E+01	2744	0.10	0
SCSD1	760	77	2388	0	0.0519	2.7568E+01	0	0.00	0
SCSD6	1350	147	4316	0	0.0272	3.6742E+01	0	0.00	0
SCSD8CX	2310	330	7170	0	0.1030	4.8051E+01	37	0.00	0
SCSD8AX	630	90	1890	0	0.1111	2.5085E+01	30	0.00	0
SCSD8GX	35910	5130	112770	0	0.1002	1.8950E+02	50	0.05	0
SCSD8CQ	2310	330	7170	0	0.1030	4.8051E+01	37	0.00	0
SCSD8AQ	630	90	1890	0	0.1111	2.5085E+01	30	0.00	0
SCSD8GQ	35910	5130	112770	0	0.1002	1.8950E+02	50	0.05	0
SCSD8HH	15190	2170	47650	0	0.1005	1.2324E+02	47	0.02	0
SCSD8CH	2310	330	7170	0	0.1030	4.8051E+01	37	0.00	0
SCSD8IH	30310	4330	95170	0	0.1002	1.7409E+02	49	0.04	0
SCSD8DH	3850	550	12010	0	0.1018	6.2039E+01	39	0.01	0
SCSD8EH	4550	650	14210	0	0.1015	6.7444E+01	41	0.01	0
SCSD8AH	630	90	1890	0	0.1111	2.5085E+01	30	0.00	0

Table 2.3: Complete results for LSMR(10) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
SCSD8JH	60550	8650	190210	0	0.1001	2.4607E+02	53	0.09	0
SCSD8FH	7630	1090	23890	0	0.1009	8.7342E+01	43	0.01	0
SCSD8GH	9030	1290	28290	0	0.1008	9.5019E+01	45	0.01	0
SCSD8BH	1190	170	3650	0	0.1059	3.4483E+01	35	0.00	0
SCSD8BHH	1190	170	3650	0	0.1059	3.4483E+01	35	0.00	0
SCSD8	2750	397	8584	0	0.0101	5.2440E+01	0	0.00	0
SCTAP1B16	2178	990	6334	0	0.0515	3.1038E+01	120	0.01	0
SCTAP1B4	594	270	1678	0	0.0556	1.6082E+01	115	0.01	0
SCTAP1B64	33858	15390	99454	0	0.0501	1.2367E+02	188	0.21	0
SCTAP1C16	2178	990	6334	0	0.0515	3.1038E+01	120	0.01	0
SCTAP1C4	594	270	1678	0	0.0556	1.6082E+01	115	0.00	0
SCTAP1C64	7458	3390	21854	0	0.0504	5.7784E+01	122	0.03	0
SCTAP1R108	14322	6510	42030	0	0.0502	8.0267E+01	166	0.08	0
SCTAP1R16	2178	990	6334	0	0.0515	3.1038E+01	120	0.01	0
SCTAP1R216	28578	12990	83934	0	0.0501	1.1358E+02	188	0.18	0
SCTAP1R27	3630	1650	10602	0	0.0509	4.0178E+01	115	0.01	0
SCTAP1R32	4290	1950	12542	0	0.0508	4.3714E+01	122	0.02	0
SCTAP1R4	594	270	1678	0	0.0556	1.6082E+01	115	0.00	0
SCTAP1R480	63426	28830	186366	0	0.0501	1.6941E+02	230	0.49	0
SCTAP1R54	7194	3270	21078	0	0.0505	5.6743E+01	122	0.03	0
SCTAP1R64	8514	3870	24958	0	0.0504	6.1773E+01	130	0.04	0
SCTAP1R8	1122	510	3230	0	0.0529	2.2195E+01	124	0.01	0
SCTAP1R8B	1122	510	3230	0	0.0529	2.2195E+01	124	0.01	0
SCTAP1	660	300	1872	0	0.0200	1.6745E+01	318	0.01	0
SCTAP2	2500	1090	7334	0	0.0055	3.1937E+01	562	0.05	0
SCTAP3	3340	1480	9734	0	0.0041	3.7029E+01	599	0.08	0
SEBA	1036	515	4360	0	0.4466	1.7950E+01	114	0.01	0
SELF	7364	960	1148845	0	1.0000	1.2263E+01	267	2.12	0
SEYMOUR	6316	4944	38493	0	0.0552	7.3269E+01	111	0.06	0
SGPF5Y6	312540	246077	831976	0	0.0000	2.5234E+02	63	0.87	0
SHARE1B	253	117	1179	0	0.0855	6.9161E+00	3189	0.04	0
SHARE2B	162	96	777	0	0.1250	6.7659E+00	423	0.00	0
SHELL	1777	536	3558	0	0.0056	2.1346E+01	73	0.00	0
SHIP04L	2166	360	6380	42	0.0167	1.4125E+01	67	0.00	0
SHIP04S	1506	360	4400	42	0.0167	1.4038E+01	85	0.00	0
SHIP08L	4363	712	12882	66	0.0084	1.9832E+01	100	0.02	0
SHIP08S	2467	712	7194	66	0.0084	1.9707E+01	141	0.01	0
SHIP12L	5533	1042	16276	109	0.0058	2.4097E+01	79	0.01	0
SHIP12S	2869	1042	8284	109	0.0058	2.4018E+01	106	0.01	0
SIERRA	2735	1227	8001	2	0.0033	3.9098E+01	59	0.01	0
SIPOW1	2002	2000	6000	0	1.0000	4.4699E-02	3	0.00	0
SIPOW1M	2002	2000	6000	0	1.0000	4.4699E-02	3	0.00	0
SIPOW2	2002	2000	5000	0	1.0000	4.4651E+01	3	0.00	0
SIPOW2M	2002	2000	5000	0	1.0000	4.4651E+01	3	0.00	0
SIPOW3	2004	2000	7992	0	1.0000	4.4734E+01	3	0.00	0
SIPOW4	2004	2000	9000	0	1.0000	4.4733E+01	4	0.00	0
SLP-TSK	3347	2861	72465	0	0.3100	5.6689E+01	158	0.09	0
SMALL000	1215	709	3044	0	0.0141	2.5413E+01	4006	0.16	0
SMALL001	1193	687	3144	0	0.0160	2.4820E+01	6635	0.27	0
SMALL002	1220	713	3246	0	0.0154	2.5271E+01	8225	0.33	0
SMALL003	1215	711	3240	0	0.0155	2.4850E+01	9085	0.39	0
SMALL004	1220	717	3283	0	0.0153	2.5028E+01	8290	0.45	0
SMALL005	1220	717	3317	0	0.0153	2.5458E+01	4689	0.19	0
SMALL006	1213	710	3319	0	0.0169	2.5059E+01	8659	0.36	0
SMALL007	1212	711	3374	0	0.0169	2.4794E+01	9665	0.40	0
SMALL008	1214	712	3342	0	0.0169	2.4952E+01	8778	0.38	0
SMALL009	1213	710	3328	0	0.0169	2.4952E+01	8205	0.34	0
SMALL010	1213	711	3322	0	0.0169	2.5206E+01	7807	0.33	0
SMALL011	1208	705	3300	0	0.0170	2.5491E+01	4673	0.19	0
SMALL012	1209	706	3309	0	0.0170	2.5481E+01	4585	0.19	0
SMALL013	1204	701	3282	0	0.0171	2.5476E+01	4633	0.21	0

Table 2.3: Complete results for LSMR(10) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
SMALL014	1190	687	3207	0	0.0160	2.5330E+01	4773	0.19	0
SMALL015	1186	683	3243	0	0.0161	2.5276E+01	4924	0.20	0
SMALL016	1180	677	3207	0	0.0162	2.5187E+01	5092	0.21	0
SOUTHERN1	36321	18425	112398	0	0.9509	1.8807E+02	162	0.21	0
SPAL_004 (S)	321696	10203	46168124	0	0.0165	-	>1449	>600.00	19
SSEBLIN	218	72	336	0	0.0278	1.2971E+01	18	0.00	0
STAIR	614	356	4003	0	0.0955	1.3875E+01	120	0.01	0
STANDATA	1274	359	3230	0	0.0279	1.3676E+01	135	0.01	0
STANDGUB	1382	360	3338	1	0.0278	1.4397E+01	139	0.01	0
STANDMPS	1274	467	3878	0	0.0214	1.2022E+01	245	0.01	0
STAT96V1	197472	5995	588798	0	0.0030	4.4182E+02	643	3.11	0
STAT96V2 (S)	957432	29089	2852184	0	0.0004	9.7273E+02	905	22.09	0
STAT96V3 (S)	1113780	33841	3317736	0	0.0004	1.0492E+03	957	26.89	0
STAT96V4 (S)	63076	3173	491336	0	0.0028	1.2052E+02	3883	13.83	0
STAT96V5	75779	2305	233921	2	0.3336	2.7479E+02	22	0.04	0
STOCFOR1	165	117	501	0	0.0513	5.2802E+00	70	0.00	0
STOCFOR2	3045	2157	9357	0	0.0046	2.6098E+01	226	0.03	0
STOCFOR3	23541	16675	72721	0	0.0011	7.3948E+01	497	0.45	0
STORMG2125	172431	65935	433256	250	0.0021	3.1685E+02	1016	5.56	0
STORMG227	37485	14387	94274	54	0.0028	1.4714E+02	875	0.96	0
STORMG28	11322	4393	28553	16	0.0048	7.9906E+01	705	0.24	0
STORMG21K (S)	1377306	526185	3459881	0	0.0019	8.9636E+02	1473	72.18	0
STP3D	336283	159488	793531	0	0.0000	4.8623E+02	212	2.77	0
SWS	26775	14310	107325	0	0.0008	5.4263E+01	78	0.09	0
T0331-4L	46915	664	430982	0	0.0346	7.3313E+01	456	1.53	0
SC205	31223	17613	61639	0	0.0455	1.4370E+02	33	0.03	0
TESTDECK	27	15	53	0	0.2667	3.6108E+00	9	0.00	0
TFI2	104	101	402	0	1.0000	9.9041E+00	3	0.00	0
MPD	1014301	142752	11537419	0	0.0001	3.5588E+02	12	1.31	0
TRUSS	8806	1000	27836	0	0.0040	9.3840E+01	0	0.00	0
TS-PALKO	47235	22002	1076903	0	0.0016	6.1241E+01	38	0.36	0
TUFF	628	302	4561	31	0.0828	1.0262E+01	734	0.03	0
ULEVMIN	46937	6590	164538	0	0.0041	1.0191E+02	76	0.11	0
US04	28016	163	297538	8	0.1104	2.6748E+01	186	0.41	0
VOL1	464	323	1646	0	0.0960	1.1182E+01	2996	0.06	0
VTP-BASE	346	198	1051	0	0.0606	8.2246E+00	1112	0.02	0
WATSON_1 (S)	386992	201155	1055093	0	0.0000	2.5495E+02	2155	31.07	0
WATSON_2 (S)	677224	352013	1846391	0	0.0000	3.3569E+02	1805	48.30	0
WOOD1P	2595	244	70216	0	0.1148	1.7252E+00	81	0.04	0
WOODINFE	89	35	140	0	0.0571	8.0289E+00	15	0.00	0
WOODW	8418	1098	37487	0	0.0191	4.0984E+00	724	0.23	0
WORLD (S)	67147	34506	198883	0	0.0005	1.4068E+02	9811	24.03	0
ZED	142	116	666	0	0.4138	9.0308E+00	76	0.00	0
UF Sparse Matrix Collection examples									
12month1 (S)	872622	12471	22624727	-	0.2742	-	>2597	>600.00	19
130bit	584	567	6120	1	0.0247	3.6512E+00	2549	0.17	0
145bit	1002	966	11315	2	0.0155	6.9710E+00	7264	0.81	0
162bit (S)	3606	3476	37118	16	0.0040	1.1788E+01	26921	11.37	0
176bit (S)	7441	7150	82270	40	0.0022	-	>100000	>90.45	18
192bit (S)	13691	13093	154303	82	0.0012	-	>100000	>171.41	18
208bit (S)	24430	23191	299756	199	0.0008	-	>100000	>331.49	18
abb313	313	176	1557	0	0.0341	1.1495E+01	58	0.00	0
abtaha1	14596	209	51307	0	0.0191	8.5472E+01	59	0.02	0
abtaha2	37932	331	137228	0	0.0121	1.3963E+02	39	0.04	0
ash219	219	85	438	0	0.0235	1.2360E+01	31	0.00	0
ash331	331	104	662	0	0.0192	1.5722E+01	36	0.00	0
ash608	608	188	1216	0	0.0106	2.0993E+01	33	0.00	0
ash958	958	292	1916	0	0.0068	2.6425E+01	35	0.00	0
beacxc	489	449	50409	0	0.5635	9.2316E-03	8867	3.14	0
beaflw (S)	500	492	53403	4	0.8130	5.0570E+00	35466	13.25	0

Table 2.3: Complete results for LSMR(10) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
beause	505	492	44551	3	0.8130	4.6890E+00	33362	10.82	0
bibd_11_5	462	55	4620	0	0.1818	2.0126E+01	14	0.00	0
bibd_12_4	495	66	2970	0	0.0909	2.0677E+01	14	0.00	0
bibd_12_5	792	66	7920	0	0.1515	2.6743E+01	12	0.00	0
bibd_13_6	1716	78	25740	0	0.1923	4.0221E+01	10	0.00	0
bibd_14_7	3432	91	72072	0	0.2308	5.7912E+01	9	0.01	0
bibd_15_3	455	105	1365	0	0.0286	1.8238E+01	19	0.00	0
bibd_15_7	6435	105	135135	0	0.2000	7.9658E+01	8	0.01	0
bibd_16_8	12870	120	360360	0	0.2333	1.1286E+02	7	0.02	0
bibd_17_3	680	136	2040	0	0.0221	2.3567E+01	18	0.00	0
bibd_17_4b	2380	136	14280	0	0.0441	4.7340E+01	11	0.00	0
bibd_17_4	2380	136	14280	0	0.0441	4.7340E+01	11	0.00	0
bibd_17_8	24310	136	680680	0	0.2059	1.5546E+02	7	0.04	0
bibd_18_9	48620	153	1750320	0	0.2353	2.2010E+02	6	0.08	0
bibd_19_9	92378	171	3325608	0	0.2105	3.0364E+02	6	0.15	0
bibd_20_10	184756	190	8314020	0	0.2368	4.2958E+02	6	0.37	0
bibd_22_8	319770	231	8953560	0	0.1212	5.6528E+02	5	0.35	0
bibd_49_3	18424	1176	55272	0	0.0026	1.3141E+02	12	0.01	0
bibd_81_3	85320	3240	255960	0	0.0009	2.8646E+02	11	0.02	0
bibd_9_3	84	36	252	0	0.0833	6.5585E+00	24	0.00	0
bibd_9_5	126	36	1260	0	0.2778	9.5326E+00	19	0.00	0
c8_mat11_I	5761	4562	2462970	0	0.5298	2.2179E+01	35447	593.96	0
c8_mat11 (S)	5761	4562	2462970	0	0.5298	2.2179E+01	35084	598.16	0
cat_ears_2_4	2689	1009	7982	0	0.0030	4.1328E+01	120	0.02	0
cat_ears_3_1	204	181	542	4	0.0331	5.2776E+00	290	0.00	0
cat_ears_3_4	13271	5226	39592	0	0.0006	8.9890E+01	396	0.21	0
cat_ears_4_1	377	313	938	4	0.0192	9.1810E+00	505	0.01	0
cat_ears_4_4	44448	19020	132888	0	0.0002	1.5904E+02	445	0.79	0
ch3-3-b1	18	9	36	0	0.2222	1.9181E+00	2	0.00	0
ch3-3-b2	18	6	18	0	0.1667	4.2426E+00	1	0.00	0
ch4-4-b1	72	16	144	0	0.1250	4.3706E+00	2	0.00	0
ch4-4-b2	96	72	288	1	0.0417	5.9093E-15	5	0.00	0
ch4-4-b3	96	24	96	0	0.0417	9.7980E+00	0	0.00	0
ch5-5-b1	200	25	400	0	0.0800	7.4754E+00	2	0.00	0
ch5-5-b2	600	200	1800	0	0.0150	7.2959E-15	5	0.00	0
ch5-5-b4	600	120	600	0	0.0083	2.4495E+01	1	0.00	0
ch6-6-b1	450	36	900	0	0.0556	1.1320E+01	2	0.00	0
ch6-6-b2	2400	450	7200	0	0.0067	1.3730E-13	5	0.00	0
ch6-6-b3	5400	2400	21600	0	0.0017	2.3959E+01	9	0.00	0
ch6-6-b4	5400	4320	21600	19	0.0009	6.9478E+01	10	0.00	0
ch6-6-b5	4320	720	4320	0	0.0014	6.5727E+01	0	0.00	0
ch7-6-b1	630	42	1260	0	0.0476	1.3254E+01	3	0.00	0
ch7-6-b2	4200	630	12600	0	0.0048	2.6043E-13	9	0.00	0
ch7-6-b3	12600	4200	50400	0	0.0010	3.8393E+01	11	0.00	0
ch7-6-b4	15120	12600	75600	0	0.0004	1.3613E-13	18	0.01	0
ch7-6-b5	15120	5040	30240	0	0.0004	1.2296E+02	0	0.00	0
ch7-7-b1	882	49	1764	0	0.0408	1.5951E+01	2	0.00	0
ch7-7-b2	7350	882	22050	0	0.0034	6.0134E-13	5	0.00	0
ch7-7-b5	52920	35280	211680	-	0.0001	2.3004E+02	0	0.00	0
ch7-8-b1	1176	56	2352	0	0.0357	1.8284E+01	4	0.00	0
ch7-8-b2	11760	1176	35280	0	0.0026	1.8966E-12	9	0.00	0
ch7-8-b3	58800	11760	235200	0	0.0003	8.7888E+01	10	0.02	0
ch7-8-b4	141120	58800	705600	-	0.0001	2.1233E-06	16	0.11	0
ch7-9-b1	1512	63	3024	0	0.0317	2.0709E+01	3	0.00	0
ch7-9-b2	17640	1512	52920	0	0.0020	1.8002E-12	8	0.00	0
ch7-9-b3	105840	17640	423360	0	0.0002	1.1794E+02	10	0.04	0
ch7-9-b4	317520	105840	1587600	-	0.0000	3.3137E-06	15	0.23	0
ch7-9-b5	423360	317520	2540160	-	0.0000	1.3659E+02	20	0.55	0
ch8-8-b1	1568	64	3136	0	0.0312	2.1385E+01	2	0.00	0
ch8-8-b2	18816	1568	56448	0	0.0019	2.1606E-12	5	0.00	0
ch8-8-b3	117600	18816	470400	0	0.0002	1.2701E+02	9	0.04	0

Table 2.3: Complete results for LSMR(10) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
ch8-8-b4	376320	117600	1881600	-	0.0000	3.2821E-06	13	0.23	0
ch8-8-b5	564480	376320	3386880	-	0.0000	1.7776E+02	16	0.57	0
Chem97Zt	31022	2541	62044	0	0.0008	1.6859E+02	3501	2.09	0
cis-n4c6-b13	25605	6300	88200	0	0.0013	1.6002E+02	0	0.00	0
cis-n4c6-b14	6300	920	13800	1	0.0065	7.9018E+01	9	0.00	0
cis-n4c6-b15	920	60	960	0	0.0500	3.0332E+01	0	0.00	0
cis-n4c6-b1	210	21	420	0	0.0952	1.4491E+01	1	0.00	0
cis-n4c6-b2	1330	210	3990	0	0.0143	2.0203E-14	2	0.00	0
cis-n4c6-b3	5970	1330	23880	0	0.0030	3.0999E+01	2	0.00	0
cis-n4c6-b4	20058	5970	100290	0	0.0008	1.1372E-06	9	0.01	0
Cities	55	46	1342	0	0.9783	6.4485E-01	73	0.00	0
connectus (S)	394707	458	1127525	0	0.1594	6.2791E+02	1651	17.96	0
D_10	814	459	7614	7	0.0283	2.1638E+01	58	0.01	0
D_11	457	169	2952	1	0.0710	1.7019E+01	37	0.00	0
D_5	430	114	1832	1	0.0702	1.8623E+01	25	0.00	0
D6-6	50760	18660	146520	1417	0.0003	2.1290E+02	24	0.04	0
D_6	967	433	6491	1	0.0300	2.5961E+01	44	0.00	0
D_7	1270	970	12714	4	0.0206	2.6062E+01	58	0.01	0
D_8	1266	1126	14966	7	0.0187	2.4223E+01	32	0.00	0
D_9	1129	814	12395	28	0.0197	2.3798E+01	36	0.01	0
deltaX	68600	21961	247424	0	0.0038	2.7677E+01	1300	3.69	0
divorce	50	9	225	0	1.0000	6.6094E+00	9	0.00	0
ESOC (S)	327062	37349	6019939	0	0.0005	4.0438E+02	5476	323.33	0
EternityII_A_b	358	1	358	0	1.0000	1.8921E+01	1	0.00	0
EternityII_A	150638	7362	782087	0	0.0008	3.6381E-06	688	5.81	0
EternityII_E_b	513	1	513	0	1.0000	2.2650E+01	1	0.00	0
EternityII_E	262144	11077	1503732	0	0.0006	4.5886E-06	97	1.77	0
EternityII_Etilde_ b	512	1	512	0	1.0000	2.2627E+01	1	0.00	0
EternityII_Etilde (S)	204304	10054	1170516	0	0.0007	4.2976E-06	1346	17.39	0
f855_mat9_I	2511	2456	171214	0	0.3375	1.7981E+01	17467	21.65	0
f855_mat9 (S)	2511	2456	171214	0	0.3375	1.7981E+01	17681	21.91	0
flower_4_1	129	121	386	0	0.0248	2.7316E+00	351	0.00	0
flower_4_4	5529	1837	16466	0	0.0016	6.0690E+01	110	0.02	0
flower_5_1	211	201	602	4	0.0249	3.6716E+00	471	0.00	0
flower_5_4	14721	5226	43942	0	0.0006	9.7567E+01	147	0.08	0
flower_7_1	463	393	1178	4	0.0127	9.0402E+00	781	0.01	0
flower_7_4	67593	27693	202218	0	0.0001	1.9933E+02	554	1.50	0
flower_8_1	625	513	1538	5	0.0097	1.1543E+01	910	0.02	0
flower_8_4	125361	55081	375266	0	0.0001	2.6505E+02	844	4.60	0
Franz10	19588	4164	97508	0	0.0012	6.1479E-10	14	0.01	0
Franz11	47104	30144	329728	-	0.0002	1.8222E-11	5	0.01	0
Franz1	2240	768	5120	1	0.0052	2.6503E+01	11	0.00	0
Franz2	4480	4032	21504	375	0.0015	4.9227E+01	23	0.01	0
Franz3	2800	1280	11520	0	0.0250	5.0671E+01	4	0.00	0
Franz4	6784	5252	46528	1049	0.0013	5.2207E-12	10	0.00	0
Franz5	7382	2882	44056	0	0.0021	1.6623E+01	13	0.01	0
Franz6	7576	3016	45456	1	0.0020	1.8468E+01	13	0.01	0
Franz7	10160	1740	40424	0	0.0023	1.8573E+01	11	0.00	0
Franz8	16728	7176	100368	0	0.0008	2.7319E+01	14	0.01	0
Franz9	19588	4164	97508	0	0.0012	6.3328E-10	14	0.01	0
gemat1	10595	4929	46591	0	0.0057	8.7317E+01	9042	4.59	0
GL6_D_10	339	162	2053	5	0.0741	1.4334E+01	34	0.00	0
GL6_D_6	465	199	2526	1	0.0553	1.8285E+01	25	0.00	0
GL6_D_7	636	469	5378	4	0.0341	1.8138E+01	42	0.00	0
GL6_D_8	632	542	6153	32	0.0277	1.7407E+01	28	0.00	0
GL6_D_9	542	339	4349	25	0.0413	1.7578E+01	27	0.00	0
GL7d10	8	1	8	0	1.0000	2.8284E+00	1	0.00	0
GL7d11	783	60	1513	1	0.1333	2.6905E+01	24	0.00	0
GL7d12	8769	1019	37519	0	0.0128	8.7516E+01	46	0.02	0
GL7d13	47221	8899	356232	13	0.0016	1.9394E+02	55	0.19	0
GL7d14	171369	47268	1831183	-	0.0005	3.5107E+02	50	1.36	0

Table 2.3: Complete results for LSMR(10) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
GL7d15	460259	171373	6080381	-	0.0002	5.4847E+02	68	6.65	0
GL7d16 (S)	955127	460260	14488881	-	0.0001	7.4875E+02	60	16.19	0
GL7d17 (S)	1548649	955127	25978098	-	0.0001	8.9897E+02	53	31.90	0
GL7d18 (S)	1955309	1548645	35590540	-	0.0000	9.3184E+02	77	73.18	0
GL7d19 (S)	1955296	1911130	37322725	-	0.0000	1.0426E+03	186	192.60	0
GL7d20 (S)	1911124	1437546	29893084	-	0.0000	1.0916E+03	127	102.71	0
GL7d21 (S)	1437546	822922	18174775	-	0.0000	1.0029E+03	133	56.79	0
GL7d22 (S)	822906	349443	8251000	-	0.0001	7.8940E+02	215	34.74	0
GL7d23 (S)	349443	105054	2695430	-	0.0002	5.3569E+02	309	14.10	0
GL7d24	105049	21074	593892	-	0.0006	3.0259E+02	200	1.56	0
GL7d25	21013	2798	81671	6	0.0029	1.3888E+02	77	0.06	0
GL7d26	2748	303	7412	1	0.0132	5.0381E+01	80	0.01	0
graphics (S)	29493	11822	117954	0	0.0003	-	>100000	>126.24	18
HFE18_96_in (S)	2372	2371	933343	0	0.5065	4.9100E-01	30649	195.62	0
IG5-10	652	527	10273	0	0.1347	1.0425E+01	1624	0.14	0
IG5-11	1227	902	22110	0	0.1231	1.5923E+01	1348	0.25	0
IG5-12	2296	1578	46260	0	0.0741	2.3085E+01	2397	0.91	0
IG5-13	3994	2532	91209	0	0.0470	3.1249E+01	2979	2.14	0
IG5-14	6735	3906	173337	0	0.0307	4.1470E+01	2750	3.68	0
IG5-15 (S)	11369	6146	323509	0	0.0195	5.4856E+01	4245	10.53	0
IG5-16 (S)	18846	9519	588326	0	0.0126	7.1510E+01	6853	31.16	0
IG5-17 (S)	30162	14060	1035008	0	0.0085	9.1039E+01	6732	56.32	0
IG5-18 (S)	47894	20818	1790490	0	0.0058	1.1518E+02	6765	106.63	0
IG5-6	43	30	251	0	0.5333	1.1332E+00	45	0.00	0
IG5-7	75	62	549	0	0.3871	1.8887E+00	139	0.00	0
IG5-8	158	156	1711	2	0.3141	2.6588E-01	908	0.01	0
IG5-9	342	310	4570	0	0.1871	5.9084E+00	1316	0.06	0
illc1033	1033	320	4719	0	0.0156	2.2535E+03	2875	0.12	0
illc1850	1850	712	8636	0	0.0070	1.0300E+03	1350	0.12	0
image_interp	232485	120000	711683	0	0.0000	0.0000E+00	0	0.01	0
IMDB (S)	896302	303617	3782463	-	0.0052	-	>6037	>600.00	19
Kemelmacher	28452	9693	100875	0	0.0007	1.1394E+02	3221	3.08	0
klein-b1	30	10	60	0	0.2000	2.8271E+00	9	0.00	0
klein-b2	30	20	60	0	0.1000	4.7876E+00	20	0.00	0
kneser_10_4_1 (S)	349651	330751	992252	-	0.0000	1.6241E+02	17201	450.84	0
kneser_6_2_1	676	601	2027	0	0.0050	8.5632E+00	1882	0.06	0
kneser_8_3_1	15737	15681	47042	449	0.0007	2.9040E+01	9476	6.61	0
landmark (S)	71952	2673	1146848	2	0.0060	1.3198E-05	19532	159.79	0
LargeRegFile (S)	2111154	801374	4944201	0	0.0000	4.4422E+02	536	48.95	0
lutz30-23-b6	3003	1716	12012	0	0.0035	5.2529E+01	91	0.01	0
Maragal_1	32	14	234	1	1.0000	1.0249E+00	10	0.00	0
Maragal_2	536	260	4357	81	0.3000	3.0681E+00	335	0.01	0
Maragal_3	1682	858	18391	127	0.5455	4.2081E+00	1055	0.18	0
Maragal_4	1964	1027	26719	110	0.5706	5.7947E+00	692	0.16	0
Maragal_5	4654	3296	93091	610	0.4524	9.1207E+00	3169	2.45	0
Maragal_6 (S)	21251	10144	537694	516	0.5857	1.0695E+01	5105	21.22	0
Maragal_7 (S)	46845	26525	1200537	2046	0.3604	1.3690E+01	2750	28.44	0
Maragal_8 (S)	60845	33093	1308415	7107	0.0503	-	>50797	>600.00	19
mesh_deform_D	234023	234023	234023	0	0.0000	4.8276E-06	475	3.95	0
mesh_deform	234023	9393	853829	0	0.0004	0.0000E+00	0	0.00	0
mk10-b1	630	45	1260	0	0.0444	1.2909E+01	2	0.00	0
mk10-b2	3150	630	9450	0	0.0048	3.2679E-13	5	0.00	0
mk10-b3	4725	3150	18900	0	0.0013	1.6323E+01	7	0.00	0
mk10-b4	4725	945	4725	0	0.0011	6.8739E+01	1	0.00	0
mk11-b1	990	55	1980	0	0.0364	1.6275E+01	2	0.00	0
mk11-b2	6930	990	20790	0	0.0030	5.0195E-13	5	0.00	0
mk11-b3	17325	6930	69300	0	0.0006	3.7435E+01	6	0.01	0
mk11-b4b	17325	9450	47250	0	0.0003	1.2667E+02	9	0.01	0
mk11-b4	17325	10395	51975	0	0.0003	1.2634E+02	8	0.01	0
mk12-b1	1485	66	2970	1	0.0303	2.0043E+01	2	0.00	0
mk12-b2	13860	1485	41580	0	0.0020	2.5425E-12	5	0.00	0

Table 2.3: Complete results for LSMR(10) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
mk12-b3	51975	13860	207900	0	0.0003	7.0503E+01	7	0.02	0
mk12-b4	62370	51975	311850	-	0.0001	1.8269E-10	12	0.04	0
mk12-b5	62370	10395	62370	0	0.0001	2.4974E+02	0	0.00	0
mk13-b5	270270	135135	810810	-	0.0000	5.1987E+02	0	0.01	0
mk9-b1	378	36	756	0	0.0556	9.9635E+00	2	0.00	0
mk9-b2	1260	378	3780	0	0.0079	8.8454E-14	5	0.00	0
mk9-b3	1260	945	3780	0	0.0032	3.5496E+01	0	0.00	0
mri1 (S)	114637	65536	589824	603	0.0037	2.6742E+01	5723	43.56	0
mri2 (S)	104597	63240	569160	-	0.0660	1.4126E+02	10639	65.80	0
n2c6-b10	306	30	330	0	0.1667	1.7426E+01	2	0.00	0
n2c6-b1	105	15	210	0	0.1333	5.5076E+00	2	0.00	0
n2c6-b2	455	105	1365	0	0.0286	7.5068E-15	2	0.00	0
n2c6-b3	1365	455	5460	0	0.0088	1.4149E+01	2	0.00	0
n2c6-b4	3003	1365	15015	0	0.0037	7.3962E-13	2	0.00	0
n2c6-b5	4945	3003	29670	0	0.0020	2.0512E+01	3	0.00	0
n2c6-b6	5715	4945	40005	27	0.0014	3.0831E-07	19	0.01	0
n2c6-b7	5715	3990	31920	9	0.0020	7.5598E+01	0	0.00	0
n2c6-b8	3990	1470	13230	1	0.0048	6.2175E+01	6	0.00	0
n2c6-b9	1410	306	3060	1	0.0196	3.7550E+01	0	0.00	0
n3c4-b1	15	6	30	1	0.3333	3.8730E+00	1	0.00	0
n3c4-b2	20	15	60	2	0.2000	4.4721E+00	1	0.00	0
n3c4-b3	20	15	60	2	0.2000	4.4721E+00	0	0.00	0
n3c4-b4	15	6	30	1	0.3333	3.8730E+00	1	0.00	0
n3c5-b1	45	10	90	0	0.2000	3.4641E+00	2	0.00	0
n3c5-b2	120	45	360	0	0.0667	3.6095E-15	2	0.00	0
n3c5-b3	210	120	840	0	0.0333	5.0200E+00	2	0.00	0
n3c5-b4	252	210	1260	0	0.0238	3.7010E-14	2	0.00	0
n3c5-b5	252	210	1260	0	0.0238	1.5875E+01	0	0.00	0
n3c5-b6	210	120	840	0	0.0333	1.4491E+01	1	0.00	0
n3c5-b7	120	30	240	0	0.1000	1.0954E+01	0	0.00	0
n3c6-b10	2511	675	7425	0	0.0074	4.9539E+01	16	0.00	0
n3c6-b11	630	60	720	0	0.0667	2.5100E+01	0	0.00	0
n3c6-b2	455	105	1365	0	0.0286	7.5068E-15	2	0.00	0
n3c6-b3	1365	455	5460	0	0.0088	1.4149E+01	2	0.00	0
n3c6-b4	3003	1365	15015	0	0.0037	7.3962E-13	2	0.00	0
n3c6-b5	5005	3003	30030	0	0.0020	2.0712E+01	2	0.00	0
n3c6-b6	6435	5005	45045	0	0.0014	2.6527E-12	2	0.00	0
n3c6-b8	6435	4935	44415	0	0.0014	7.8129E+01	2	0.00	0
n3c6-b9	4935	2511	25110	0	0.0024	7.0250E+01	0	0.00	0
n4c5-b10	630	120	1320	2	0.0333	2.4902E+01	5	0.00	0
n4c5-b11	120	10	120	0	0.1000	1.0954E+01	0	0.00	0
n4c5-b1	105	15	210	0	0.1333	5.5076E+00	2	0.00	0
n4c5-b2	455	105	1365	0	0.0286	7.5068E-15	2	0.00	0
n4c5-b3	1350	455	5400	0	0.0088	1.3972E+01	4	0.00	0
n4c5-b4	2852	1350	14260	0	0.0037	2.9243E-07	11	0.00	0
n4c5-b5	4340	2852	26040	1	0.0021	1.8576E+01	10	0.00	0
n4c5-b6	4735	4340	33145	57	0.0016	4.4160E-07	15	0.01	0
n4c5-b7	4735	3635	29080	26	0.0022	6.8811E+01	0	0.00	0
n4c5-b8	3635	1895	17055	0	0.0037	5.9042E+01	14	0.00	0
n4c5-b9	1895	630	6300	0	0.0095	4.3532E+01	0	0.00	0
n4c6-b10	186558	132402	1456422	-	0.0001	4.2339E+02	14	0.19	0
n4c6-b11	132402	69235	830820	-	0.0001	3.6387E+02	0	0.00	0
n4c6-b12	69235	25605	332865	0	0.0004	2.6025E+02	13	0.04	0
n4c6-b13	25605	6300	88200	0	0.0013	1.6002E+02	0	0.00	0
n4c6-b14	6300	920	13800	1	0.0065	7.9018E+01	9	0.00	0
n4c6-b15	920	60	960	0	0.0500	3.0332E+01	0	0.00	0
n4c6-b1	210	21	420	0	0.0952	1.4491E+01	1	0.00	0
n4c6-b2	1330	210	3990	0	0.0143	2.0203E-14	2	0.00	0
n4c6-b3	5970	1330	23880	0	0.0030	3.0999E+01	2	0.00	0
n4c6-b4	20058	5970	100290	0	0.0008	1.1372E-06	9	0.01	0
n4c6-b5	51813	20058	310878	0	0.0003	7.1632E+01	9	0.03	0

Table 2.3: Complete results for LSMR(10) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
n4c6-b6	104115	51813	728805	-	0.0001	2.5905E-06	12	0.08	0
n4c6-b7	163215	104115	1305720	-	0.0001	1.0147E+02	11	0.15	0
n4c6-b8	198895	163215	1790055	-	0.0001	3.5572E-06	15	0.28	0
n4c6-b9	198895	186558	1865580	-	0.0001	4.4598E+02	0	0.01	0
NotreDame_actors (S)	383640	127823	1470404	-	0.0051	-	>22439	>600.00	19
Pd_rhs	5804	4371	6323	0	0.0069	3.6189E+01	2438	0.42	0
photogrammetry2	4472	936	37056	7	0.0096	3.0388E+02	141	0.05	0
photogrammetry	1388	390	11816	7	0.0231	9.0895E+01	831	0.10	0
psse0 (S)	26722	11028	102432	0	0.0004	6.6360E+01	79853	95.63	0
psse1 (S)	14318	11028	57376	0	0.0016	3.5979E+01	63802	57.91	0
psse2 (S)	28634	11028	115262	0	0.0025	7.8597E+01	80282	109.24	0
QRpivot_b	391	1	391	0	1.0000	1.9774E+01	1	0.00	0
QRpivot	749	660	3808	0	0.0152	1.5593E+01	901	0.04	0
rel3	6	3	18	2	1.0000	2.4495E+00	1	0.00	0
rel4	28	10	104	5	0.4000	8.9676E-01	5	0.00	0
rel5	172	33	656	2	0.1212	5.3439E+00	23	0.00	0
rel6	1300	155	5101	2	0.0258	1.8073E+01	52	0.00	0
rel7	12770	1043	50636	2	0.0038	6.4132E+01	67	0.04	0
rel8	206040	12345	821839	2	0.0003	2.7707E+02	90	0.96	0
rel9 (S)	5921786	274667	23667183	-	0.0000	1.5416E+03	109	73.15	0
relat3	8	3	24	2	1.0000	2.8284E+00	1	0.00	0
relat4	46	10	172	5	0.4000	5.7639E+00	5	0.00	0
relat5	276	33	1058	2	0.1212	1.4900E+01	23	0.00	0
relat6	2063	155	8108	2	0.0258	4.1070E+01	42	0.01	0
relat7b	20500	1043	81355	1	0.0038	1.3429E+02	54	0.04	0
relat7	20500	1043	81355	1	0.0038	1.3429E+02	54	0.04	0
relat8	334362	12345	1334038	1	0.0003	5.5522E+02	73	1.39	0
relat9 (S)	9746232	274667	38955420	-	0.0000	3.0561E+03	88	108.24	0
rkat7_mat5	738	694	38114	0	0.3703	1.3056E+01	4563	1.33	0
robot24c1_mat5_J	404	302	15118	0	0.3013	6.4682E+00	979	0.12	0
robot24c1_mat5	404	302	15118	0	0.3013	6.4682E+00	981	0.11	0
Rucci1 (S)	1977885	109900	7791168	0	0.0000	-	>7116	>600.00	19
Sandi_sandi	360	314	613	66	0.0191	1.1104E+01	427	0.01	0
shar_te2-b1	17160	286	34320	0	0.0070	6.1422E+01	4	0.00	0
shar_te2-b2	200200	17160	600600	0	0.0002	2.3032E-11	11	0.07	0
sls (S)	1748122	62729	6804304	0	0.0001	1.3097E-05	546	56.34	0
TF10	106	99	622	0	0.0909	1.0020E-07	292	0.01	0
TF11	235	216	1607	0	0.0463	1.4759E-07	932	0.03	0
TF12	551	488	4231	0	0.0225	2.3220E-07	3219	0.17	0
TF13	1301	1121	11185	0	0.0107	3.6007E-07	10481	1.33	0
TF14 (S)	3159	2644	29862	0	0.0049	5.6203E-07	34660	11.09	0
TF15 (S)	7741	6334	80057	0	0.0022	-	>100000	>81.99	18
TF16 (S)	19320	15437	216173	0	0.0010	-	>100000	>215.04	18
TF17 (S)	48629	38132	586218	-	0.0004	-	>99274	>600.00	19
TF18 (S)	123867	95368	1597545	-	0.0002	-	>35408	>600.00	19
TF19 (S)	317955	241029	4370721	-	0.0001	-	>12216	>600.00	19
tomographic1 (S)	59360	45908	647495	3436	0.0003	4.2070E+01	65150	457.79	0
Trec10	475	106	8612	0	0.7453	1.6372E+01	169	0.01	0
Trec11	1136	235	35705	0	0.7617	2.6544E+01	341	0.09	0
Trec12	2724	551	151219	0	0.7586	4.3372E+01	873	0.90	0
Trec13	6560	1301	654517	0	0.7656	6.9694E+01	1240	5.60	0
Trec14 (S)	15904	3159	2872265	0	0.7914	1.1217E+02	1797	37.15	0
Trec3	1	1	1	0	1.0000	1.0000E+00	1	0.00	0
Trec4	2	2	3	0	1.0000	2.1505E-01	2	0.00	0
Trec5	6	3	12	0	1.0000	7.2162E-01	3	0.00	0
Trec6	14	6	40	0	0.8333	1.8260E+00	6	0.00	0
Trec7	35	11	147	0	0.8182	2.9716E+00	11	0.00	0
Trec8	83	23	549	0	0.7826	5.8826E+00	28	0.00	0
Trec9	200	47	2147	0	0.7660	9.7112E+00	62	0.00	0
well1033	1033	320	4732	0	0.0156	2.2534E+03	138	0.01	0
well1850	1850	712	8755	0	0.0070	1.0300E+03	374	0.04	0

Table 2.3: Complete results for LSMR(10) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
wheel_3_1	25	21	74	0	0.1429	2.2738E+00	22	0.00	0
wheel_4_1	41	36	122	0	0.0833	1.5091E+00	41	0.00	0
wheel_5_1	61	57	182	0	0.0526	1.1067E+00	108	0.00	0
wheel_601 (S)	902103	723605	2170814	-	0.0008	-	>9255	>600.00	19
wheel_6_1	85	83	254	2	0.0361	2.5685E+00	127	0.00	0
wheel_7_1	114	113	338	4	0.0708	2.3883E+00	227	0.00	0
wm1	260	207	2909	0	0.2415	8.1946E+00	121	0.00	0
wm2	259	207	2942	0	0.2415	8.4071E+00	182	0.00	0
wm3	259	207	2948	0	0.2705	8.1940E+00	189	0.01	0
WorldCities	313	100	7518	0	0.9900	5.3353E+00	53	0.00	0

Table 2.4: Complete LSMR(100) results for all problems with no preconditioning.

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
CUTEst examples									
25FV47	1876	820	10705	1	0.0256	2.0432E+01	2511	0.43	0
80BAU3B	11934	2262	23264	0	0.0053	8.2705E+01	65	0.02	0
AA01	8904	823	72965	15	0.0182	1.9002E+01	201	0.06	0
AA03	8627	825	70806	25	0.0206	1.9090E+01	214	0.07	0
AA3	8627	825	70806	27	0.0206	1.9090E+01	214	0.07	0
AA4	7195	426	52121	10	0.0329	1.5866E+01	139	0.03	0
AA5	8308	801	65953	22	0.0187	1.8653E+01	200	0.06	0
AA6	7292	646	51728	14	0.0217	1.6804E+01	164	0.04	0
ADLITTL2	138	56	424	0	0.1964	7.3997E+00	34	0.00	0
ADLITTLE	138	56	424	0	0.1964	7.3997E+00	34	0.00	0
AFIRO	51	27	102	0	0.1481	5.2189E+00	21	0.00	0
AFIROE	24	8	34	0	0.2500	4.1055E+00	8	0.00	0
AGG	615	488	2862	0	0.0881	1.1455E+01	54	0.00	0
AGG2	758	516	4740	0	0.0833	1.3214E+01	71	0.01	0
AGG3	758	516	4756	0	0.0833	1.3214E+01	73	0.01	0
AIR02	6774	50	61555	0	0.3400	1.5416E+01	27	0.01	0
AIR03	10757	124	91028	0	0.1129	1.7479E+01	90	0.03	0
AIR04	8904	823	72965	23	0.0182	1.9002E+01	201	0.07	0
AIR05	7195	426	52121	11	0.0329	1.5866E+01	139	0.03	0
AIR06	8627	825	70806	30	0.0206	1.9090E+01	214	0.07	0
AIR	7517	3754	20267	0	0.2001	8.6603E+01	9	0.00	0
ALLINLP	687500	250000	687500	0	0.0000	7.1249E+02	2	0.03	0
BANDM	472	305	2494	0	0.0721	9.8785E+00	409	0.02	0
BAS1LP (S)	9825	5411	587775	0	0.0675	5.5448E+01	7274	18.61	0
BAXTER (S)	30733	27441	111576	2993	0.0017	-	>100000	>426.65	18
BCDOUT (S)	7078	5412	67344	2	0.1554	3.5431E+01	88663	86.40	0
BEACONFD	295	173	3408	0	0.1561	5.5647E+00	60	0.00	0
BGDBG1	629	348	1662	0	0.0460	1.9660E+01	35	0.00	0
BGETAM	816	400	2537	0	0.0200	1.6322E+01	512	0.03	0
BGINDY	10880	2671	66266	0	0.0060	3.6010E+01	161	0.08	0
BGPRTR	40	20	70	0	0.2000	3.1175E+00	15	0.00	0
BLEND	114	74	522	0	0.2162	6.0635E+00	63	0.00	0
BNL1	1586	642	5532	1	0.0125	2.0313E+01	463	0.05	0
BNL2	4486	2324	14996	0	0.0034	3.7869E+01	1752	0.66	0
BOEING1	726	351	3827	0	0.0912	1.3035E+01	105	0.01	0
BOEING2	305	166	1358	0	0.1386	7.3877E+00	59	0.00	0
BORE3D	334	233	1448	2	0.1202	8.0348E+00	198	0.01	0
BOX1	261	231	651	1	0.0216	1.5955E+01	26	0.00	0
BRANDY	303	193	2202	27	0.1503	8.7556E+00	97	0.00	0
CAPRI	482	271	1896	0	0.0923	1.3828E+01	297	0.01	0
CAR4	33052	16384	63724	0	0.0067	1.8158E+02	5	0.00	0
CARI	1200	400	152800	0	0.9500	3.4641E+01	1	0.00	0
CEP1	4769	1521	8233	0	0.1440	6.1852E+01	11	0.00	0
CERIA3D	4400	3576	21178	0	0.2704	3.0961E+01	47	0.01	0
CH	8291	3700	24102	0	0.0038	5.7926E+01	351	0.18	0
CHEMCOM	744	288	1590	0	0.0208	1.8078E+01	29	0.00	0
CO5	12325	5774	57993	0	0.0048	6.5536E+01	9741	9.60	0
CO9 (S)	22924	10789	109651	0	0.0026	8.9188E+01	22511	42.87	0
COMPLEX	1408	1023	46463	0	0.5005	3.1888E+01	5	0.00	0
CONT1	161589	160792	521181	-	0.5025	4.0197E+02	8	0.05	0
CONT11	201587	160792	521181	0	0.0000	3.0775E+02	12	0.08	0
CONT11_L (S)	1961394	1468599	5382999	0	0.0000	8.0916E+02	206	58.61	0
CONT1_L	1921596	1918399	7031999	-	0.6672	1.3862E+03	3	0.21	0
CONT4	161589	160792	519589	-	0.5025	4.0197E+02	8	0.05	0
CPLEX1	5224	3005	10947	0	0.4995	4.6078E+01	71	0.01	0
CPLEX2	378	224	1215	0	0.0357	2.5454E+00	85	0.00	0
CQ5	11748	5048	51571	0	0.0048	6.1448E+01	666	0.55	0
CQ9	21534	9278	96653	0	0.0026	8.3008E+01	1148	1.85	0
CR42	1513	905	6614	0	0.3337	3.8739E+01	17	0.00	0

Table 2.4: Complete results for LSMR(100) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
CRE_A_PRE	6382	2684	15739	1	0.0060	5.2407E+01	6635	2.86	0
CRE_B_PRE	36222	5176	111434	2	0.0033	8.4734E+01	7487	8.54	0
CRE_C_PRE	5293	2257	13078	1	0.0062	4.9627E+01	6104	2.17	0
CRE_D_PRE	28489	3990	86144	2	0.0043	7.5197E+01	8820	7.71	0
CREW1	6469	135	46950	0	0.1185	4.7500E+00	52	0.01	0
CYCLE	3371	1890	21234	28	0.0148	2.7738E+01	18155	6.11	0
CZPROB	3562	929	10708	0	0.0043	3.3275E+00	42	0.01	0
D2Q06C (S)	5831	2171	33081	0	0.0157	3.4935E+01	29611	12.37	0
D6CUBE	6184	404	37704	11	0.0248	2.8696E+01	56	0.01	0
DANO3MIP	15851	3202	81633	0	0.1952	3.6615E+01	2221	1.59	0
DBIC1	226317	43200	1081843	0	0.0009	2.2488E+02	408	4.56	0
DBIR1 (S)	45775	18804	1077025	103	0.0119	1.6711E+02	784	4.79	0
DBIR2 (S)	45877	18906	1158159	101	0.0123	1.6746E+02	6344	41.69	0
DE063155	1596	852	4913	0	0.0141	3.8032E+01	116	0.01	0
DE063157	1656	936	5119	0	0.0128	4.0603E+01	10	0.00	0
DE080285	1656	936	5082	0	0.0128	2.9637E+01	13950	1.96	0
DEGEN2	757	444	4201	0	0.0495	8.7769E+00	148	0.01	0
DEGEN3	2604	1503	25432	0	0.0326	1.9246E+01	438	0.11	0
DEGENLPA	20	15	82	0	0.4000	8.1997E-01	15	0.00	0
DEGENLPB	20	15	82	0	0.4000	8.1997E-01	15	0.00	0
DEGME	659415	185501	8127528	0	0.0001	3.4604E+02	19	0.87	0
DELF000 (S)	5543	3128	13741	0	0.0029	-	>100000	>46.77	18
DELF001	5514	3098	14322	0	0.0032	-	>100000	>46.47	18
DELF002	5549	3135	14432	0	0.0032	-	>100000	>47.00	18
DELF003	5478	3065	14343	0	0.0033	-	>100000	>46.05	18
DELF004	5558	3142	14696	0	0.0032	-	>100000	>47.34	18
DELF005	5519	3103	14605	0	0.0032	-	>100000	>46.68	18
DELF006	5563	3147	14754	0	0.0032	-	>100000	>47.38	18
DELF007	5555	3137	14898	0	0.0032	-	>100000	>47.33	18
DELF008	5566	3148	14971	0	0.0032	-	>100000	>47.61	18
DELF009	5554	3135	14888	0	0.0032	-	>100000	>47.46	18
DELF010	5566	3147	14952	0	0.0032	-	>100000	>47.41	18
DELF011	5553	3134	14915	0	0.0032	-	>100000	>47.28	18
DELF012	5570	3151	14948	0	0.0032	-	>100000	>47.46	18
DELF013	5535	3116	14928	0	0.0032	-	>100000	>46.90	18
DELF014	5586	3170	15036	0	0.0032	-	>100000	>47.74	18
DELF015	5573	3161	14951	0	0.0032	-	>100000	>47.79	18
DELF017	5587	3176	14904	0	0.0031	-	>100000	>48.28	18
DELF018	5604	3196	14963	0	0.0031	-	>100000	>48.01	18
DELF019	5592	3185	14939	0	0.0031	-	>100000	>48.22	18
DELF020	5616	3213	15270	0	0.0031	-	>100000	>48.33	18
DELF021	5610	3208	15263	0	0.0031	-	>100000	>48.61	18
DELF022	5616	3214	15260	0	0.0031	-	>100000	>48.35	18
DELF023	5616	3214	15298	0	0.0031	-	>100000	>48.22	18
DELF024	5610	3207	15656	0	0.0034	-	>100000	>48.29	18
DELF025	5608	3197	15647	0	0.0034	-	>100000	>48.37	18
DELF026	5606	3190	15420	0	0.0031	-	>100000	>48.00	18
DELF027	5601	3187	15400	0	0.0031	-	>100000	>48.02	18
DELF028	5596	3177	15602	0	0.0035	-	>100000	>48.07	18
DELF029	5598	3179	15602	0	0.0035	-	>100000	>48.09	18
DELF030	5613	3199	15462	0	0.0034	-	>100000	>48.45	18
DELF031	5599	3176	15405	0	0.0035	-	>100000	>47.85	18
DELF032	5611	3196	15451	0	0.0034	-	>100000	>48.36	18
DELF033	5595	3173	15400	0	0.0035	-	>100000	>48.69	18
DELF034	5594	3175	15403	0	0.0035	-	>100000	>49.41	18
DELF035	5607	3193	15479	0	0.0034	-	>100000	>48.49	18
DELF036	5598	3170	15397	0	0.0035	-	>100000	>48.10	18
DETER0	5468	1923	11173	0	0.0099	5.7052E+01	184	0.05	0
DETER1	15737	5527	32187	0	0.0096	9.8357E+01	259	0.20	0
DETER2	17313	6095	35731	0	0.0133	1.0199E+02	235	0.19	0
DETER3	21777	7647	44547	0	0.0095	1.2196E+02	270	0.29	0

Table 2.4: Complete results for LSMR(100) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
DETER4	9133	3235	19231	0	0.0219	7.4270E+01	150	0.06	0
DETER5	14529	5103	29715	0	0.0096	9.8117E+01	256	0.17	0
DETER6	12113	4255	24771	0	0.0096	8.9066E+01	240	0.13	0
DETER7	18153	6375	37131	0	0.0096	1.1073E+02	270	0.22	0
DETER8	10905	3831	22299	0	0.0097	8.4952E+01	227	0.11	0
DF2177	10358	630	22336	0	0.0127	5.4305E+01	10	0.00	0
DFL001	12230	6071	35632	0	0.0023	5.5173E+01	612	0.60	0
DISP3	3990	2182	8541	0	0.0027	4.6507E+01	47	0.01	0
DSBMIP	2667	1182	8156	0	0.0068	2.6848E+01	953	0.17	0
E18	38601	24617	156466	0	0.0040	1.1964E+02	9	0.01	0
E226	472	223	2768	0	0.0942	1.3971E+01	75	0.00	0
ETAMACRO	816	400	2537	0	0.0200	1.6322E+01	512	0.03	0
EX2STA1	17516	17443	68779	0	0.0026	3.5780E+00	4527	12.22	0
EX72A	215	197	467	1	0.0152	1.3687E+01	91	0.00	0
EX73A	211	193	457	1	0.0155	1.3619E+01	89	0.00	0
FARM	17	7	41	0	0.5714	2.6111E+00	7	0.00	0
FFFFF800	1028	524	6401	0	0.0954	1.0704E+01	502	0.04	0
FINNIS	1064	497	2760	0	0.0282	2.1406E+01	117	0.00	0
FIT1D	1049	24	13427	0	0.7500	3.0717E+01	22	0.00	0
FIT1P	1677	627	9868	0	1.0000	4.0153E+01	28	0.00	0
FIT2D	10524	25	129042	0	0.6800	1.0026E+02	24	0.01	0
FIT2P	13525	3000	50284	0	1.0000	1.1051E+02	29	0.01	0
FOME11	24460	12142	71264	0	0.0012	7.8027E+01	613	1.27	0
FOME12	48920	24284	142528	0	0.0006	1.1035E+02	613	2.55	0
FOME13	97840	48568	285056	1	0.0003	1.5605E+02	615	5.02	0
FOME20	108175	33798	232647	77	0.0001	8.8731E+01	252	1.36	0
FOME21	216350	67596	465294	152	0.0000	1.2549E+02	252	2.74	0
FOREST	131	66	246	0	0.0455	5.8417E+00	19	0.00	0
FORPLAN	492	161	4634	0	0.2174	7.4845E+00	56	0.00	0
FXM2_16	7335	3900	32972	0	0.0092	5.0100E+01	253	0.15	0
FXM2_6	2845	1520	12812	0	0.0158	3.1221E+01	250	0.06	0
FXM3_16	85575	41340	392252	0	0.0009	1.7544E+02	262	1.65	0
FXM3_6	12625	6200	57722	0	0.0039	6.6994E+01	250	0.22	0
FXM4_6	47185	22400	265442	0	0.0011	1.4534E+02	244	0.92	0
GALENET	14	8	22	0	0.2500	3.7417E+00	1	0.00	0
GAMS10A	171	114	407	0	0.0614	8.8742E+00	9	0.00	0
GAMS10AM	171	114	407	0	0.0614	8.1798E+00	10	0.00	0
GAMS30A	531	354	1287	0	0.0198	1.3857E+01	19	0.00	0
GAMS30AM	531	354	1287	0	0.0198	1.2209E+01	19	0.00	0
GAMS60AM	1071	714	2607	0	0.0098	1.6497E+01	28	0.00	0
GANGES	1706	1309	6937	0	0.0099	1.4580E+01	118	0.02	0
GAS11	860	459	2166	0	0.0261	1.7536E+01	7609	0.53	0
GE (S)	16369	10099	44825	0	0.0036	7.2589E+01	31178	49.43	0
GEN	2561	769	63086	0	0.0858	2.5015E+00	56	0.01	0
GEN1	2561	769	63086	0	0.0858	2.5015E+00	56	0.02	0
GEN2	3264	1121	81855	0	0.0937	1.6054E+00	51	0.02	0
GEN4	4298	1537	107103	0	0.0625	2.8739E+00	44	0.02	0
GFRD-PNC	1160	616	2445	0	0.0049	2.8248E+01	85	0.00	0
GOFFIN	101	50	2600	0	1.0000	9.8528E+00	2	0.00	0
GOSH	13455	3790	99953	2	0.0045	5.0199E+01	7418	6.23	0
GRAN	2604	2525	20111	471	0.0341	2.1249E+01	39771	16.22	0
GREENBEA	5598	2389	31070	3	0.0100	3.1909E+01	1069	0.46	0
GREENBEB	5598	2389	31070	3	0.0100	3.1909E+01	1069	0.48	0
GREENBEI	5596	2390	31074	3	0.0100	3.1810E+01	1066	0.47	0
GROW15	645	300	5620	0	0.0667	2.1646E+01	34	0.00	0
GROW22	946	440	8252	0	0.0455	2.5881E+01	35	0.00	0
GROW7	301	140	2612	0	0.1429	1.5322E+01	29	0.00	0
IIASA	3639	669	7317	0	0.0105	2.9786E+01	31	0.00	0
IPROB	3001	3001	9000	0	0.9997	2.1389E+01	3	0.00	0
ISRAEL	316	174	2443	0	0.7816	1.0905E+01	79	0.00	0
ITEST2	13	9	26	0	0.5556	3.1922E+00	5	0.00	0

Table 2.4: Complete results for LSMR(100) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
ITEST6	17	11	29	0	0.4545	3.6023E+00	10	0.00	0
JENDREC1	4228	2109	89608	0	0.9886	6.4699E+01	40	0.02	0
KARTED	133115	46502	1770349	0	0.0005	1.1284E+02	29	0.24	0
KB2	68	43	313	0	0.3256	5.7141E+00	32	0.00	0
KEN_07_PRE	2033	887	4354	0	0.0034	2.4960E+01	32	0.00	0
KEN_11_PRE	11984	5511	26538	3	0.0005	7.1971E+01	74	0.03	0
KEN_13_PRE	24818	10962	57238	18	0.0004	9.7208E+01	100	0.11	0
KEN_18_PRE	89439	39867	208594	1	0.0001	1.5484E+02	144	0.71	0
KENT	47920	31300	216010	0	0.0006	7.5567E+01	450	2.18	0
KL02	36699	71	212536	0	0.1127	1.1634E-06	39	0.03	0
KLEEMIN3	6	3	9	0	1.0000	1.4920E+00	3	0.00	0
KLEEMIN4	8	4	14	0	1.0000	1.4351E+00	4	0.00	0
KLEEMIN5	10	5	20	0	1.0000	1.4439E+00	4	0.00	0
KLEEMIN6	12	6	27	0	1.0000	1.4488E+00	5	0.00	0
KLEEMIN7	14	7	35	0	1.0000	1.5542E+00	3	0.00	0
KLEEMIN8	16	8	44	0	1.0000	3.8442E+00	2	0.00	0
KLEIN1	108	54	750	0	0.3889	8.3196E+00	46	0.00	0
KLEIN2	531	477	5062	0	0.3438	1.5238E+01	55	0.00	0
KLEIN3	1082	994	13101	0	0.2767	2.1013E+01	89	0.01	0
L30	16281	2701	52070	0	0.0030	1.2489E+02	207	0.10	0
L9	1483	244	4659	0	0.0328	3.7508E+01	79	0.00	0
LARGE000	7253	4239	18313	0	0.0024	6.1470E+01	35790	22.69	0
LARGE001 (S)	7176	4162	18887	0	0.0026	6.0689E+01	48771	30.47	0
LARGE002	7260	4249	20075	0	0.0028	5.9736E+01	64155	41.17	0
LARGE003	7216	4200	19717	0	0.0029	6.1237E+01	62763	39.83	0
LARGE004	7266	4250	19489	0	0.0028	6.0729E+01	59944	38.35	0
LARGE005	7256	4237	19314	0	0.0026	6.0714E+01	60260	38.20	0
LARGE006	7267	4249	19637	0	0.0026	6.0400E+01	61177	39.08	0
LARGE007	7255	4236	19595	0	0.0026	6.0316E+01	65031	41.52	0
LARGE008	7267	4248	19648	0	0.0026	6.0334E+01	66338	42.60	0
LARGE009	7256	4237	19617	0	0.0026	6.0292E+01	67037	43.11	0
LARGE010	7267	4247	19637	0	0.0026	6.0325E+01	66973	42.92	0
LARGE011	7256	4236	19617	0	0.0026	6.0318E+01	66206	42.08	0
LARGE012	7273	4253	19674	0	0.0026	6.0332E+01	65988	42.18	0
LARGE013	7265	4248	19688	0	0.0026	5.9904E+01	68576	43.77	0
LARGE014	7288	4271	19749	0	0.0026	6.0703E+01	62727	40.24	0
LARGE015	7278	4265	19717	0	0.0026	6.0682E+01	62602	40.07	0
LARGE016	7298	4287	19809	0	0.0026	6.0739E+01	62791	40.58	0
LARGE017	7288	4277	19754	0	0.0026	6.0762E+01	61533	39.69	0
LARGE018	7305	4297	19579	0	0.0026	6.0632E+01	62291	40.13	0
LARGE019	7304	4300	19574	0	0.0026	5.9969E+01	65722	42.62	0
LARGE020	7317	4315	19936	0	0.0025	5.9599E+01	68099	44.22	0
LARGE021	7313	4311	19952	0	0.0026	5.9658E+01	65725	42.59	0
LARGE022	7314	4312	19904	0	0.0026	5.9679E+01	62984	42.26	0
LARGE023	7304	4302	19912	0	0.0026	5.9857E+01	57429	37.35	0
LARGE024	7311	4292	20399	0	0.0028	6.0055E+01	42159	27.31	0
LARGE025	7312	4297	20543	0	0.0028	6.0323E+01	45660	29.51	0
LARGE026	7304	4284	20431	0	0.0028	6.0300E+01	45034	29.01	0
LARGE027	7301	4275	20362	0	0.0028	6.0470E+01	40463	26.07	0
LARGE028	7313	4302	20686	0	0.0028	6.0616E+01	43305	28.33	0
LARGE029	7312	4301	20752	0	0.0028	6.0631E+01	44586	28.74	0
LARGE030	7303	4285	20643	0	0.0028	6.1137E+01	45392	29.28	0
LARGE031	7306	4294	20667	0	0.0028	6.1091E+01	45062	29.21	0
LARGE032	7307	4292	20650	0	0.0028	6.1080E+01	44909	28.98	0
LARGE033	7292	4273	20586	0	0.0028	6.0623E+01	45224	29.12	0
LARGE034	7306	4294	20650	0	0.0028	6.0513E+01	44562	28.94	0
LARGE035	7304	4293	20676	0	0.0028	6.0485E+01	45395	29.28	0
LARGE036	7297	4282	20635	0	0.0028	6.0441E+01	46163	29.95	0
LINSPANH	97	33	194	0	0.0606	4.6238E+00	21	0.00	0
LOTFI	366	153	1136	0	0.0654	9.7302E+00	67	0.00	0
LP22	16392	2958	68518	0	0.0132	6.2250E+01	88	0.05	0

Table 2.4: Complete results for LSMR(100) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
LPL1 (S)	129959	39951	386218	44	0.0004	7.0878E+01	20930	154.53	0
LPL2	10881	3294	32232	5	0.0009	5.7537E+01	68	0.02	0
LPL3	33686	10828	100525	1	0.0003	9.4797E+01	99	0.12	0
LSQPROB	138	56	424	0	0.1964	7.3997E+00	34	0.00	0
LSQROB	138	56	424	0	0.1964	7.3997E+00	34	0.00	0
MAKELA4	61	40	120	0	1.0000	7.4289E+00	2	0.00	0
MAROS-R7	9408	3136	144848	0	0.0147	8.2622E+01	12	0.01	0
MAROS	1966	846	10137	0	0.0236	2.4629E+01	1286	0.20	0
MOD2 (S)	66409	34774	199810	0	0.0005	1.3872E+02	8201	46.47	0
MODEL	80	38	136	0	0.1579	6.7730E+00	24	0.00	0
MODEL1	798	362	3028	0	0.0442	9.6897E+00	67	0.00	0
MODEL10 (S)	16819	4400	150372	0	0.0039	5.3558E+01	19180	21.13	0
MODEL11	20464	7056	58035	0	0.0028	1.2316E+02	82	0.06	0
MODEL2	1321	379	7607	2	0.0369	1.5367E+01	239	0.02	0
MODEL3	4565	1609	23974	0	0.0149	3.5843E+01	1201	0.36	0
MODEL4	4962	1337	45753	0	0.0127	2.7593E+01	7268	2.40	0
MODEL5	11802	1744	89925	144	0.0097	3.3983E+01	2994	1.59	0
MODEL6	5289	2094	27628	2	0.0124	2.5143E+01	1844	0.71	0
MODEL7	9560	3358	51027	0	0.0071	5.1244E+01	3566	2.39	0
MODEL8	6464	2896	25277	0	0.0055	1.7963E+01	263	0.11	0
MODEL9	10939	2787	55956	92	0.0068	6.9788E+01	2275	1.37	0
MODSZK1	1620	686	3168	1	0.0335	3.3236E+01	67	0.00	0
MONDOU2	604	312	1208	0	0.0064	2.2419E+01	129	0.00	0
MPSBCD03 (S)	7078	5412	66210	2	0.1554	-	>100000	>95.97	18
MULTI	160	61	1019	0	0.2131	5.6174E+00	29	0.00	0
NEMSAFM	2348	334	2826	0	0.0120	4.5918E+01	29	0.00	0
NEMSCEM	1712	651	3840	0	0.0061	2.3126E+01	97	0.01	0
NEMSEMM1	75310	3945	1053986	0	0.0352	8.7388E+01	273	1.04	0
NEMSEMM2	48878	6943	182012	0	0.0058	1.0617E+02	191	0.27	0
NEMSPMM1	8903	2362	55867	10	0.0258	4.7785E+01	4910	2.50	0
NEMSPMM2	8734	2301	68225	0	0.0278	3.8815E+01	6169	3.32	0
NEMSWRLD	28550	6647	192283	491	0.0078	6.0760E+01	730	1.15	0
NEOS	515905	479119	1526794	0	0.0339	4.9938E+02	164	10.60	0
NEOS1	133473	131581	599590	0	0.0275	3.5694E+02	95	1.23	0
NEOS2	134128	132568	685087	0	0.0330	3.5375E+02	164	2.73	0
NEOS3	518832	512209	2055024	0	0.0005	2.0785E+01	7	0.14	0
NESM	3105	662	13470	0	0.0151	4.1883E+01	186	0.02	0
EMSDZ	15325	7039	47035	0	0.0021	7.5844E+01	3244	3.65	0
NSCT1	37461	22901	678739	287	0.0269	1.8366E+02	568	2.97	0
NSCT2 (S)	37563	23003	697738	287	0.0273	1.8394E+02	3110	17.57	0
NSIC1	883	451	3273	0	0.0599	2.5158E+01	78	0.01	0
NSIC2	897	465	3449	0	0.0581	2.5435E+01	167	0.01	0
NSIR1	10011	4407	143249	0	0.0517	8.0262E+01	484	0.49	0
NSIR2 (S)	10057	4453	154939	0	0.0528	8.0556E+01	2963	3.21	0
NUG05	225	210	1050	3	0.0476	1.0643E+01	2	0.00	0
NUG06	486	372	2232	1	0.0323	4.0476E-13	3	0.00	0
NUG07	931	602	4214	0	0.0233	7.6004E-13	3	0.00	0
NUG08	1632	912	7296	0	0.0175	3.8653E-13	3	0.00	0
NUG12	8856	3192	38304	0	0.0075	3.8506E-11	3	0.00	0
NUG15	22275	6330	94950	0	0.0047	5.0151E-11	3	0.00	0
NUG20	72600	15240	304800	1	0.0026	7.8274E-11	3	0.01	0
NUG30	379350	52260	1567800	0	0.0011	4.0749E-09	3	0.05	0
NW14	123409	73	904910	0	0.1507	3.8742E+01	66	0.23	0
OET1	1005	1002	4006	0	1.0000	3.1677E+01	2	0.00	0
OET3	1006	1002	5006	0	1.0000	3.1670E+01	4	0.00	0
ORNA1	1764	882	3990	0	0.0170	1.1814E+01	8722	1.20	0
ORNA2	1764	882	3990	0	0.0170	1.2116E+01	8730	1.20	0
ORNA3	1764	882	3990	0	0.0170	1.2142E+01	8738	1.20	0
ORNA4	1764	882	3990	0	0.0170	1.2217E+01	8777	1.21	0
ORNA7	1764	882	3990	0	0.0170	1.2142E+01	8752	1.22	0
ORSWQ2	160	80	344	0	0.1250	8.7296E+00	23	0.00	0

Table 2.4: Complete results for LSMR(100) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
OSA_07_PRE	24062	1047	63037	0	0.0038	4.3640E+01	22	0.01	0
OSA_14_PRE	52723	2266	139136	0	0.0018	6.3861E+01	22	0.01	0
OSA_30_PRE	100396	4279	267149	0	0.0009	8.7145E+01	24	0.03	0
OSA_60_PRE	234334	10209	594462	0	0.0004	1.3992E+02	21	0.06	0
P0033	48	15	113	0	0.3333	3.9213E+00	15	0.00	0
P0040	63	23	133	0	0.1304	3.3924E+00	4	0.00	0
P10	19090	10090	118000	0	0.0020	9.8334E+01	139	0.20	0
P0201	334	133	2056	0	0.1053	6.5816E+00	26	0.00	0
P0282	523	241	2207	0	0.4647	2.1966E+01	30	0.00	0
P0291	543	252	2283	0	0.4167	2.1565E+01	34	0.00	0
P05	9590	5090	59045	0	0.0039	7.0494E+01	127	0.09	0
P0548	724	176	1887	0	0.0284	2.0066E+01	58	0.00	0
P19	851	284	5570	0	0.0458	1.0707E+01	47	0.00	0
P2756	3511	755	9692	0	0.0212	4.7567E+01	105	0.01	0
P6000	7947	2095	19826	0	0.0029	6.5556E+01	4	0.00	0
P80BAU3B	10613	1984	21000	0	0.0055	7.6989E+01	70	0.02	0
PANG	741	361	2933	0	0.0831	1.5295E+01	69	0.00	0
PCB1000	2820	1565	20463	0	0.0166	1.7326E+01	204	0.05	0
PCB3000	7732	3960	57479	0	0.0071	2.7109E+01	339	0.23	0
PDE1 (S)	271792	270595	990587	-	0.6696	3.0302E+02	1528	64.35	0
PDE2	361491	270595	990587	0	0.0000	3.4879E+02	655	26.78	0
PDS_02_PRE	3056	877	7484	1	0.0057	2.2013E+01	53	0.00	0
PDS_06_PRE	18530	2972	42304	0	0.0020	4.2161E+01	114	0.06	0
PDS_10_PRE	33270	4725	76307	1	0.0013	5.3829E+01	144	0.11	0
PDS_20_PRE	81224	10214	184176	0	0.0006	8.0747E+01	198	0.43	0
PDS-100 (S)	514577	156016	1096002	227	0.0000	2.8489E+02	659	18.25	0
PDS-20	108175	33798	232647	76	0.0001	8.8731E+01	252	1.35	0
PDS-30	158489	49788	340635	156	0.0001	1.2041E+02	338	2.81	0
PDS-40	217531	66641	466800	203	0.0000	1.5176E+02	438	5.06	0
PDS-50	275814	82837	590833	223	0.0000	1.8065E+02	483	6.95	0
PDS-60	336421	99204	719557	227	0.0000	2.0695E+02	523	9.18	0
PDS-70	390005	114717	833465	227	0.0000	2.3001E+02	551	11.21	0
PDS-80	434580	128954	927826	227	0.0000	2.5040E+02	582	13.30	0
PDS-90 (S)	475448	142596	1014136	227	0.0000	2.6847E+02	620	15.75	0
PEROLD	1506	625	6148	0	0.0256	2.8421E+01	4322	0.45	0
PF2177	9908	9728	30984	42	0.0038	9.4105E-01	113	0.10	0
PGP2	13254	4034	22474	0	0.1433	9.9046E+01	6	0.00	0
PILOT-JA (S)	2267	940	14977	0	0.0585	3.3279E+01	9140	1.59	0
PILOT-WE	2928	722	9265	0	0.0166	2.7742E+01	7733	0.96	0
PILOT	4860	1441	44375	0	0.0840	4.4917E+01	816	0.27	0
PILOT4	1123	410	5264	0	0.0659	2.5521E+01	1719	0.14	0
PILOT4I	1123	410	5264	0	0.0659	2.5516E+01	1708	0.13	0
PILOT87	6680	2030	74949	0	0.0473	5.2250E+01	2997	1.53	0
PILOTNOV (S)	2446	975	13331	0	0.0410	3.5043E+01	3555	0.64	0
PLDD000B	5049	3069	10762	0	0.0029	4.8552E+01	1657	0.72	0
PLDD001B	5049	3069	10763	0	0.0029	4.8535E+01	1654	0.75	0
PLDD002B	5049	3069	10764	0	0.0029	4.8527E+01	1646	0.72	0
PLDD003B	5049	3069	10765	0	0.0029	4.8524E+01	1642	0.71	0
PLDD004B	5049	3069	10766	0	0.0029	4.8521E+01	1643	0.73	0
PLDD005B	5049	3069	10767	0	0.0029	4.8519E+01	1643	0.74	0
PLDD006B	5049	3069	10768	0	0.0029	4.8517E+01	1643	0.74	0
PLDD007B	5049	3069	10769	0	0.0029	4.8514E+01	1643	0.79	0
PLDD008B	5049	3069	10829	0	0.0029	4.8248E+01	1642	0.78	0
PLDD009B	5049	3069	10832	0	0.0029	4.8240E+01	1640	0.73	0
PLDD010B	5049	3069	10835	0	0.0029	4.8233E+01	1640	0.70	0
PLDD011B	5049	3069	10837	0	0.0029	4.8229E+01	1640	0.73	0
PLDD012B	5049	3069	10839	0	0.0029	4.8224E+01	1640	0.72	0
PLTEXPA2-1	4540	1726	9233	0	0.0104	3.8985E+01	33	0.00	0
PLTEXPA2-6	1820	686	3703	0	0.0117	2.4377E+01	32	0.00	0
PLTEXPA3_1	74172	28350	150801	0	0.0006	1.5888E+02	36	0.06	0
PLTEXPA3_6	11612	4430	23611	0	0.0018	6.2691E+01	36	0.01	0

Table 2.4: Complete results for LSMR(100) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
PLTEXPA4_6	70364	26894	143059	0	0.0003	1.5475E+02	40	0.06	0
PRESOLVE	932	428	5224	0	0.0911	1.3968E+01	384	0.02	0
PRIMAGAZ	10836	1554	21665	0	0.0013	5.2779E+00	2	0.00	0
PROBLEM	46	12	86	0	0.1667	6.7823E+00	0	0.00	0
PROGAS	1900	1650	8897	0	0.0085	2.4639E+01	3498	0.85	0
PT	503	501	1503	0	1.0000	2.2414E+01	2	0.00	0
QAP12	8856	3192	38304	0	0.0075	2.4786E-11	3	0.00	0
QAP15	22275	6330	94950	0	0.0047	2.8432E-11	3	0.00	0
QAP8	1632	912	7296	0	0.0175	3.1159E-13	3	0.00	0
QIU	1900	1192	4492	0	0.0092	1.3884E+01	29	0.00	0
QPBD_OUT	442	211	2589	0	0.0995	1.3154E+01	82	0.00	0
QUAL	464	323	1646	0	0.0960	1.1182E+01	1030	0.05	0
R05	9690	5190	104145	0	0.0058	7.0877E+01	139	0.13	0
RAIL2586 (S)	923269	2586	8011362	0	0.0046	1.4113E+02	696	31.64	0
RAIL4284 (S)	1096894	4284	11284032	0	0.0028	1.6948E+02	716	54.31	0
RAIL507	63516	507	409856	0	0.0237	4.7606E+01	222	0.35	0
RAIL516	47827	516	315412	0	0.0233	3.7721E+01	216	0.29	0
RAIL582	56097	582	402290	0	0.0206	4.5502E+01	210	0.34	0
RAT1	9408	3136	88267	0	0.0086	9.1651E+01	7	0.00	0
RAT5	9408	3136	137413	0	0.0137	9.1537E+01	7	0.00	0
RAT7A	9408	3136	268908	0	0.0281	9.0828E+01	7	0.00	0
REACTOR	808	318	2591	0	0.0314	1.5910E+01	62	0.00	0
READING2	6003	4000	16000	0	0.0010	7.5465E+01	2000	1.14	0
RECIPELP	204	91	687	0	0.1099	1.1855E+01	40	0.00	0
REFINE	62	29	153	0	0.1724	5.2566E+00	23	0.00	0
REFINERY	464	323	1626	0	0.0960	1.1271E+01	828	0.04	0
RLFDDD	61521	4050	264627	0	0.0119	1.5612E+02	91	0.12	0
RLFDUAL	74970	8052	282031	0	0.0055	1.9310E+02	96	0.15	0
RLFPRIM	62712	58866	320591	78	0.0034	1.1503E+02	2405	22.33	0
ROSEN1	1544	520	23794	0	0.0462	2.4644E+01	97	0.01	0
ROSEN10	6152	2056	64192	0	0.0078	5.2010E+01	129	0.05	0
ROSEN2	3080	1032	47536	0	0.0233	3.4740E+01	114	0.03	0
ROSEN7	776	264	8034	0	0.0606	1.8542E+01	96	0.01	0
ROSEN8	1544	520	16058	0	0.0308	2.6097E+01	112	0.01	0
ROUTE	43019	20894	206782	31	0.0021	1.4276E+02	38	0.07	0
S277-280	8	4	20	0	1.0000	2.6966E+00	4	0.00	0
SC105	163	105	340	0	0.0476	8.8268E+00	55	0.00	0
SC2052R100	3923	2213	7739	0	0.0461	5.5573E+01	27	0.00	0
SC2052R16	647	365	1271	0	0.0493	2.2439E+01	26	0.00	0
SC2052R160	62423	35213	123239	0	0.0455	2.2195E+02	26	0.04	0
SC2052R200	7823	4413	15439	0	0.0458	7.8527E+01	27	0.00	0
SC2052R27	1076	607	2118	0	0.0478	2.9013E+01	27	0.00	0
SC2052R32	1271	717	2503	0	0.0474	3.1553E+01	26	0.00	0
SC2052R4	179	101	347	0	0.0594	1.1656E+01	25	0.00	0
SC2052R400	15623	8813	30839	0	0.0456	1.1101E+02	27	0.01	0
SC2052R50	1973	1113	3889	0	0.0467	3.9364E+01	27	0.00	0
SC2052R64	2519	1421	4967	0	0.0464	4.4501E+01	26	0.00	0
SC2052R8	335	189	655	0	0.0529	1.6062E+01	26	0.00	0
SC2052R800	31223	17613	61639	0	0.0455	1.5696E+02	26	0.02	0
SC205	317	205	665	0	0.0244	1.0407E+01	98	0.00	0
SC50A	78	50	160	0	0.1000	7.2153E+00	33	0.00	0
SC50B	78	50	148	0	0.0800	6.5537E+00	33	0.00	0
SCAGR25	671	471	1725	0	0.0191	1.3015E+01	101	0.00	0
SCAGR7CX	887	623	2285	0	0.1814	1.7437E+01	43	0.00	0
SCAGR7AX	239	167	605	0	0.1737	8.2088E+00	40	0.00	0
SCAGR7GX	13847	9743	35885	0	0.1840	7.2243E+01	47	0.02	0
SCAGR7CQ	887	623	2285	0	0.1814	1.7437E+01	43	0.00	0
SCAGR7AQ	239	167	605	0	0.1737	8.2088E+00	40	0.00	0
SCAGR7GQ	3479	2447	9005	0	0.1835	3.5822E+01	45	0.01	0
SCAGR7HH	5855	4119	15057	0	0.1838	4.6739E+01	46	0.01	0
SCAGR7CH	887	623	2285	0	0.1814	1.7437E+01	43	0.00	0

Table 2.4: Complete results for LSMR(100) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
SCAGR7IH	11687	8223	30069	0	0.1840	6.6324E+01	47	0.02	0
SCAGR7DH	1481	1041	3825	0	0.1825	2.2963E+01	44	0.00	0
SCAGR7EH	1751	1231	4525	0	0.1828	2.5083E+01	44	0.00	0
SCAGR7AH	239	167	605	0	0.1737	8.2088E+00	40	0.00	0
SCAGR7JH	23351	16431	60093	0	0.1841	9.3970E+01	48	0.05	0
SCAGR7FH	2939	2067	7605	0	0.1834	3.2843E+01	45	0.00	0
SCAGR7GH	3479	2447	9005	0	0.1835	3.5822E+01	45	0.01	0
SCAGR7BH	455	319	1165	0	0.1787	1.2004E+01	42	0.00	0
SCAGR7KH	46679	32847	120141	0	0.1842	1.3303E+02	48	0.10	0
SCAGR7	185	129	465	0	0.0698	6.4363E+00	55	0.00	0
SCALED	27	15	53	0	0.2667	3.9671E+00	11	0.00	0
SCFXM1B16	4263	2460	14508	0	0.0146	3.3662E+01	150	0.04	0
SCFXM1B4	1179	684	4164	0	0.0322	1.8003E+01	142	0.02	0
SCFXM1B64	33047	19036	111052	0	0.0137	9.3268E+01	150	0.33	0
SCFXM1C4	1179	684	4164	0	0.0322	1.8003E+01	142	0.01	0
SCFXM1R128	33047	19036	111052	0	0.0137	9.3268E+01	150	0.34	0
SCFXM1R16	4263	2460	14508	0	0.0146	3.3662E+01	150	0.04	0
SCFXM1R256	65943	37980	221388	0	0.0136	1.3171E+02	148	0.67	0
SCFXM1R27	7090	4088	23990	0	0.0142	4.3313E+01	151	0.08	0
SCFXM1R32	8375	4828	28300	0	0.0141	4.7050E+01	151	0.09	0
SCFXM1R4	1179	684	4164	0	0.0322	1.8003E+01	142	0.01	0
SCFXM1R64	16599	9564	55884	0	0.0138	6.6147E+01	150	0.19	0
SCFXM1R8	2207	1276	7612	0	0.0204	2.4358E+01	143	0.02	0
SCFXM1R96	24823	14300	83468	0	0.0137	8.0853E+01	149	0.25	0
SCFXM1	600	330	2732	0	0.0606	1.4494E+01	224	0.01	0
SCFXM2	1200	660	5469	0	0.0303	2.0433E+01	599	0.06	0
SCFXM3	1800	990	8206	0	0.0202	2.4998E+01	1026	0.16	0
SCORPION	466	388	1534	29	0.0180	1.6015E+01	110	0.00	0
SCRS8CX	907	476	1895	0	0.1429	2.2166E+01	38	0.00	0
SCRS8AX	259	140	527	0	0.1429	1.1308E+01	38	0.00	0
SCRS8	3499	1820	7367	0	0.1429	4.4843E+01	38	0.00	0
SCRS8CQ	907	476	1895	0	0.1429	2.2166E+01	38	0.00	0
SCRS8EQ	1771	924	3719	0	0.1429	3.1474E+01	38	0.00	0
SCRS8AQ	259	140	527	0	0.1429	1.1308E+01	38	0.00	0
SCRS8FQ	3499	1820	7367	0	0.1429	4.4843E+01	38	0.01	0
SCRS8BQ	475	252	983	0	0.1429	1.5733E+01	38	0.00	0
SCRS8GH	6955	3612	14663	0	0.1429	6.3941E+01	38	0.01	0
SCRS8CH	907	476	1895	0	0.1429	2.2166E+01	38	0.00	0
SCRS8HH	13867	7196	29255	0	0.1429	9.1077E+01	38	0.02	0
SCRS8DH	1501	784	3149	0	0.1429	2.8870E+01	38	0.00	0
SCRS8EH	1771	924	3719	0	0.1429	3.1474E+01	38	0.00	0
SCRS8AH	259	140	527	0	0.1429	1.1308E+01	38	0.00	0
SCRS8IH	27691	14364	58439	0	0.1429	1.2947E+02	38	0.03	0
SCRS8FH	3499	1820	7367	0	0.1429	4.4843E+01	38	0.00	0
SCRS8FHH	3499	1820	7367	0	0.1429	4.4843E+01	38	0.00	0
SCRS8BH	475	252	983	0	0.1429	1.5733E+01	38	0.00	0
SCRS8	1275	490	3288	0	0.0163	1.7598E+01	533	0.05	0
SCSD1	760	77	2388	0	0.0519	2.7568E+01	0	0.00	0
SCSD6	1350	147	4316	0	0.0272	3.6742E+01	0	0.00	0
SCSD8CX	2310	330	7170	0	0.1030	4.8051E+01	30	0.00	0
SCSD8AX	630	90	1890	0	0.1111	2.5085E+01	30	0.00	0
SCSD8GX	35910	5130	112770	0	0.1002	1.8950E+02	30	0.02	0
SCSD8CQ	2310	330	7170	0	0.1030	4.8051E+01	30	0.00	0
SCSD8AQ	630	90	1890	0	0.1111	2.5085E+01	30	0.00	0
SCSD8GQ	35910	5130	112770	0	0.1002	1.8950E+02	30	0.02	0
SCSD8HH	15190	2170	47650	0	0.1005	1.2324E+02	30	0.01	0
SCSD8CH	2310	330	7170	0	0.1030	4.8051E+01	30	0.00	0
SCSD8IH	30310	4330	95170	0	0.1002	1.7409E+02	30	0.02	0
SCSD8DH	3850	550	12010	0	0.1018	6.2039E+01	30	0.00	0
SCSD8EH	4550	650	14210	0	0.1015	6.7444E+01	30	0.00	0
SCSD8AH	630	90	1890	0	0.1111	2.5085E+01	30	0.00	0

Table 2.4: Complete results for LSMR(100) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
SCSD8JH	60550	8650	190210	0	0.1001	2.4607E+02	30	0.03	0
SCSD8FH	7630	1090	23890	0	0.1009	8.7342E+01	30	0.00	0
SCSD8GH	9030	1290	28290	0	0.1008	9.5019E+01	30	0.00	0
SCSD8BH	1190	170	3650	0	0.1059	3.4483E+01	30	0.00	0
SCSD8BHH	1190	170	3650	0	0.1059	3.4483E+01	30	0.00	0
SCSD8	2750	397	8584	0	0.0101	5.2440E+01	0	0.00	0
SCTAP1B16	2178	990	6334	0	0.0515	3.1038E+01	50	0.00	0
SCTAP1B4	594	270	1678	0	0.0556	1.6082E+01	51	0.00	0
SCTAP1B64	33858	15390	99454	0	0.0501	1.2367E+02	50	0.05	0
SCTAP1C16	2178	990	6334	0	0.0515	3.1038E+01	50	0.01	0
SCTAP1C4	594	270	1678	0	0.0556	1.6082E+01	51	0.00	0
SCTAP1C64	7458	3390	21854	0	0.0504	5.7784E+01	49	0.01	0
SCTAP1R108	14322	6510	42030	0	0.0502	8.0267E+01	50	0.02	0
SCTAP1R16	2178	990	6334	0	0.0515	3.1038E+01	50	0.00	0
SCTAP1R216	28578	12990	83934	0	0.0501	1.1358E+02	50	0.05	0
SCTAP1R27	3630	1650	10602	0	0.0509	4.0178E+01	49	0.01	0
SCTAP1R32	4290	1950	12542	0	0.0508	4.3714E+01	49	0.01	0
SCTAP1R4	594	270	1678	0	0.0556	1.6082E+01	51	0.00	0
SCTAP1R480	63426	28830	186366	0	0.0501	1.6941E+02	50	0.11	0
SCTAP1R54	7194	3270	21078	0	0.0505	5.6743E+01	49	0.01	0
SCTAP1R64	8514	3870	24958	0	0.0504	6.1773E+01	49	0.02	0
SCTAP1R8	1122	510	3230	0	0.0529	2.2195E+01	51	0.00	0
SCTAP1R8B	1122	510	3230	0	0.0529	2.2195E+01	51	0.00	0
SCTAP1	660	300	1872	0	0.0200	1.6745E+01	200	0.01	0
SCTAP2	2500	1090	7334	0	0.0055	3.1937E+01	490	0.08	0
SCTAP3	3340	1480	9734	0	0.0041	3.7029E+01	529	0.11	0
SEBA	1036	515	4360	0	0.4466	1.7950E+01	48	0.00	0
SELF	7364	960	1148845	0	1.0000	1.2263E+01	201	0.76	0
SEYMOUR	6316	4944	38493	0	0.0552	7.3269E+01	92	0.05	0
SGPF5Y6	312540	246077	831976	0	0.0000	2.5234E+02	48	0.70	0
SHARE1B	253	117	1179	0	0.0855	6.9160E+00	181	0.00	0
SHARE2B	162	96	777	0	0.1250	6.7659E+00	70	0.00	0
SHELL	1777	536	3558	0	0.0056	2.1346E+01	65	0.00	0
SHIP04L	2166	360	6380	42	0.0167	1.4125E+01	58	0.00	0
SHIP04S	1506	360	4400	42	0.0167	1.4038E+01	66	0.00	0
SHIP08L	4363	712	12882	66	0.0084	1.9832E+01	92	0.01	0
SHIP08S	2467	712	7194	66	0.0084	1.9707E+01	118	0.01	0
SHIP12L	5533	1042	16276	109	0.0058	2.4097E+01	78	0.01	0
SHIP12S	2869	1042	8284	109	0.0058	2.4018E+01	94	0.01	0
SIERRA	2735	1227	8001	2	0.0033	3.9095E+01	47	0.00	0
SIPOW1	2002	2000	6000	0	1.0000	4.4699E-02	3	0.00	0
SIPOW1M	2002	2000	6000	0	1.0000	4.4699E-02	3	0.00	0
SIPOW2	2002	2000	5000	0	1.0000	4.4651E+01	3	0.00	0
SIPOW2M	2002	2000	5000	0	1.0000	4.4651E+01	3	0.00	0
SIPOW3	2004	2000	7992	0	1.0000	4.4734E+01	3	0.00	0
SIPOW4	2004	2000	9000	0	1.0000	4.4733E+01	4	0.00	0
SLP-TSK	3347	2861	72465	0	0.3100	5.6689E+01	72	0.03	0
SMALL000	1215	709	3044	0	0.0141	2.5413E+01	1378	0.16	0
SMALL001	1193	687	3144	0	0.0160	2.4820E+01	2335	0.24	0
SMALL002	1220	713	3246	0	0.0154	2.5271E+01	2988	0.31	0
SMALL003	1215	711	3240	0	0.0155	2.4850E+01	3537	0.37	0
SMALL004	1220	717	3283	0	0.0153	2.5028E+01	3180	0.34	0
SMALL005	1220	717	3317	0	0.0153	2.5458E+01	1695	0.18	0
SMALL006	1213	710	3319	0	0.0169	2.5058E+01	3175	0.34	0
SMALL007	1212	711	3374	0	0.0169	2.4794E+01	3270	0.34	0
SMALL008	1214	712	3342	0	0.0169	2.4952E+01	3031	0.32	0
SMALL009	1213	710	3328	0	0.0169	2.4952E+01	2909	0.33	0
SMALL010	1213	711	3322	0	0.0169	2.5206E+01	2665	0.28	0
SMALL011	1208	705	3300	0	0.0170	2.5491E+01	1613	0.17	0
SMALL012	1209	706	3309	0	0.0170	2.5481E+01	1629	0.18	0
SMALL013	1204	701	3282	0	0.0171	2.5476E+01	1677	0.18	0

Table 2.4: Complete results for LSMR(100) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
SMALL014	1190	687	3207	0	0.0160	2.5330E+01	1667	0.17	0
SMALL015	1186	683	3243	0	0.0161	2.5276E+01	1796	0.18	0
SMALL016	1180	677	3207	0	0.0162	2.5187E+01	1919	0.19	0
SOUTHERN1	36321	18425	112398	0	0.9509	1.8807E+02	108	0.21	0
SPAL_004 (S)	321696	10203	46168124	0	0.0165	-	>2794	>600.00	19
SSEBLIN	218	72	336	0	0.0278	1.2971E+01	18	0.00	0
STAIR	614	356	4003	0	0.0955	1.3875E+01	81	0.00	0
STANDATA	1274	359	3230	0	0.0279	1.3676E+01	69	0.01	0
STANDGUB	1382	360	3338	1	0.0278	1.4397E+01	69	0.00	0
STANDMPS	1274	467	3878	0	0.0214	1.2022E+01	102	0.01	0
STAT96V1	197472	5995	588798	0	0.0030	4.4182E+02	621	1.93	0
STAT96V2 (S)	957432	29089	2852184	0	0.0004	9.7273E+02	858	12.81	0
STAT96V3 (S)	1113780	33841	3317736	0	0.0004	1.0492E+03	907	15.53	0
STAT96V4 (S)	63076	3173	491336	0	0.0028	1.2052E+02	3331	6.86	0
STAT96V5	75779	2305	233921	2	0.3336	2.7479E+02	22	0.02	0
STOCFOR1	165	117	501	0	0.0513	5.2802E+00	46	0.00	0
STOCFOR2	3045	2157	9357	0	0.0046	2.6098E+01	215	0.06	0
STOCFOR3	23541	16675	72721	0	0.0011	7.3948E+01	443	1.02	0
STORMG2125	172431	65935	433256	250	0.0021	3.1685E+02	261	2.53	0
STORMG227	37485	14387	94274	54	0.0028	1.4714E+02	255	0.57	0
STORMG28	11322	4393	28553	16	0.0048	7.9906E+01	243	0.15	0
STORMG21K (S)	1377306	526185	3459881	0	0.0019	8.9636E+02	267	23.94	0
STP3D	336283	159488	793531	0	0.0000	4.8623E+02	211	4.98	0
SWS	26775	14310	107325	0	0.0008	5.4263E+01	50	0.06	0
T0331-4L	46915	664	430982	0	0.0346	7.3313E+01	367	0.67	0
SC205	31223	17613	61639	0	0.0455	1.4370E+02	26	0.02	0
TESTDECK	27	15	53	0	0.2667	3.6108E+00	9	0.00	0
TFI2	104	101	402	0	1.0000	9.9041E+00	3	0.00	0
MPD	1014301	142752	11537419	0	0.0001	3.5588E+02	12	0.66	0
TRUSS	8806	1000	27836	0	0.0040	9.3840E+01	0	0.00	0
TS-PALKO	47235	22002	1076903	0	0.0016	6.1241E+01	34	0.15	0
TUFF	628	302	4561	31	0.0828	1.0262E+01	117	0.01	0
ULEVMIN	46937	6590	164538	0	0.0041	1.0191E+02	23	0.02	0
US04	28016	163	297538	8	0.1104	2.6748E+01	100	0.10	0
VOL1	464	323	1646	0	0.0960	1.1182E+01	1030	0.06	0
VTP-BASE	346	198	1051	0	0.0606	8.2246E+00	92	0.00	0
WATSON_1 (S)	386992	201155	1055093	0	0.0000	2.5495E+02	2051	67.28	0
WATSON_2 (S)	677224	352013	1846391	0	0.0000	3.3569E+02	1707	102.72	0
WOOD1P	2595	244	70216	0	0.1148	1.7252E+00	60	0.01	0
WOODINFE	89	35	140	0	0.0571	8.0289E+00	15	0.00	0
WOODW	8418	1098	37487	0	0.0191	4.0983E+00	309	0.08	0
WORLD (S)	67147	34506	198883	0	0.0005	1.4068E+02	7123	43.39	0
ZED	142	116	666	0	0.4138	9.0308E+00	28	0.00	0
UF Sparse Matrix Collection examples									
12month1 (S)	872622	12471	22624727	-	0.2742	-	>6073	>600.00	19
130bit	584	567	6120	1	0.0247	3.6512E+00	1782	0.17	0
145bit	1002	966	11315	2	0.0155	6.9710E+00	4682	0.73	0
162bit (S)	3606	3476	37118	16	0.0040	1.1788E+01	18581	10.35	0
176bit (S)	7441	7150	82270	40	0.0022	1.8430E+01	83561	98.02	0
192bit (S)	13691	13093	154303	82	0.0012	2.4862E+01	>100000	389.87	0
208bit (S)	24430	23191	299756	199	0.0008	-	>100000	>600.00	19
abb313	313	176	1557	0	0.0341	1.1495E+01	57	0.00	0
abtaha1	14596	209	51307	0	0.0191	8.5472E+01	59	0.01	0
abtaha2	37932	331	137228	0	0.0121	1.3963E+02	39	0.01	0
ash219	219	85	438	0	0.0235	1.2360E+01	31	0.00	0
ash331	331	104	662	0	0.0192	1.5722E+01	36	0.00	0
ash608	608	188	1216	0	0.0106	2.0993E+01	33	0.00	0
ash958	958	292	1916	0	0.0068	2.6425E+01	35	0.00	0
beacxc	489	449	50409	0	0.5635	9.2316E-03	4711	0.66	0
beaflw (S)	500	492	53403	4	0.8130	5.0568E+00	7528	1.17	0

Table 2.4: Complete results for LSMR(100) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
beause	505	492	44551	3	0.8130	4.6888E+00	7362	1.02	0
bibd_11_5	462	55	4620	0	0.1818	2.0126E+01	14	0.00	0
bibd_12_4	495	66	2970	0	0.0909	2.0677E+01	14	0.00	0
bibd_12_5	792	66	7920	0	0.1515	2.6743E+01	12	0.00	0
bibd_13_6	1716	78	25740	0	0.1923	4.0221E+01	10	0.00	0
bibd_14_7	3432	91	72072	0	0.2308	5.7912E+01	9	0.00	0
bibd_15_3	455	105	1365	0	0.0286	1.8238E+01	19	0.00	0
bibd_15_7	6435	105	135135	0	0.2000	7.9658E+01	8	0.00	0
bibd_16_8	12870	120	360360	0	0.2333	1.1286E+02	7	0.01	0
bibd_17_3	680	136	2040	0	0.0221	2.3567E+01	18	0.00	0
bibd_17_4b	2380	136	14280	0	0.0441	4.7340E+01	11	0.00	0
bibd_17_4	2380	136	14280	0	0.0441	4.7340E+01	11	0.00	0
bibd_17_8	24310	136	680680	0	0.2059	1.5546E+02	7	0.01	0
bibd_18_9	48620	153	1750320	0	0.2353	2.2010E+02	6	0.03	0
bibd_19_9	92378	171	3325608	0	0.2105	3.0364E+02	6	0.05	0
bibd_20_10	184756	190	8314020	0	0.2368	4.2958E+02	6	0.12	0
bibd_22_8	319770	231	8953560	0	0.1212	5.6528E+02	5	0.13	0
bibd_49_3	18424	1176	55272	0	0.0026	1.3141E+02	12	0.00	0
bibd_81_3	85320	3240	255960	0	0.0009	2.8646E+02	11	0.01	0
bibd_9_3	84	36	252	0	0.0833	6.5585E+00	24	0.00	0
bibd_9_5	126	36	1260	0	0.2778	9.5326E+00	19	0.00	0
c8_mat11_I	5761	4562	2462970	0	0.5298	2.2179E+01	16062	79.35	0
c8_mat11 (S)	5761	4562	2462970	0	0.5298	2.2179E+01	16131	79.61	0
cat_ears_2_4	2689	1009	7982	0	0.0030	4.1328E+01	118	0.02	0
cat_ears_3_1	204	181	542	4	0.0331	5.2776E+00	261	0.01	0
cat_ears_3_4	13271	5226	39592	0	0.0006	8.9890E+01	391	0.29	0
cat_ears_4_1	377	313	938	4	0.0192	9.1810E+00	471	0.02	0
cat_ears_4_4	44448	19020	132888	0	0.0002	1.5904E+02	441	1.22	0
ch3-3-b1	18	9	36	0	0.2222	1.9181E+00	2	0.00	0
ch3-3-b2	18	6	18	0	0.1667	4.2426E+00	1	0.00	0
ch4-4-b1	72	16	144	0	0.1250	4.3706E+00	2	0.00	0
ch4-4-b2	96	72	288	1	0.0417	5.9093E-15	5	0.00	0
ch4-4-b3	96	24	96	0	0.0417	9.7980E+00	0	0.00	0
ch5-5-b1	200	25	400	0	0.0800	7.4754E+00	2	0.00	0
ch5-5-b2	600	200	1800	0	0.0150	7.2959E-15	5	0.00	0
ch5-5-b4	600	120	600	0	0.0083	2.4495E+01	1	0.00	0
ch6-6-b1	450	36	900	0	0.0556	1.1320E+01	2	0.00	0
ch6-6-b2	2400	450	7200	0	0.0067	1.3730E-13	5	0.00	0
ch6-6-b3	5400	2400	21600	0	0.0017	2.3959E+01	9	0.00	0
ch6-6-b4	5400	4320	21600	19	0.0009	6.9478E+01	10	0.00	0
ch6-6-b5	4320	720	4320	0	0.0014	6.5727E+01	0	0.00	0
ch7-6-b1	630	42	1260	0	0.0476	1.3254E+01	3	0.00	0
ch7-6-b2	4200	630	12600	0	0.0048	2.6043E-13	9	0.00	0
ch7-6-b3	12600	4200	50400	0	0.0010	3.8393E+01	11	0.00	0
ch7-6-b4	15120	12600	75600	0	0.0004	3.1020E-12	18	0.01	0
ch7-6-b5	15120	5040	30240	0	0.0004	1.2296E+02	0	0.00	0
ch7-7-b1	882	49	1764	0	0.0408	1.5951E+01	2	0.00	0
ch7-7-b2	7350	882	22050	0	0.0034	6.0134E-13	5	0.00	0
ch7-7-b5	52920	35280	211680	-	0.0001	2.3004E+02	0	0.00	0
ch7-8-b1	1176	56	2352	0	0.0357	1.8284E+01	4	0.00	0
ch7-8-b2	11760	1176	35280	0	0.0026	1.8966E-12	9	0.00	0
ch7-8-b3	58800	11760	235200	0	0.0003	8.7888E+01	10	0.01	0
ch7-8-b4	141120	58800	705600	-	0.0001	2.1233E-06	16	0.05	0
ch7-9-b1	1512	63	3024	0	0.0317	2.0709E+01	3	0.00	0
ch7-9-b2	17640	1512	52920	0	0.0020	1.8002E-12	8	0.00	0
ch7-9-b3	105840	17640	423360	0	0.0002	1.1794E+02	10	0.01	0
ch7-9-b4	317520	105840	1587600	-	0.0000	3.3137E-06	15	0.10	0
ch7-9-b5	423360	317520	2540160	-	0.0000	1.3659E+02	20	0.29	0
ch8-8-b1	1568	64	3136	0	0.0312	2.1385E+01	2	0.00	0
ch8-8-b2	18816	1568	56448	0	0.0019	2.1606E-12	5	0.00	0
ch8-8-b3	117600	18816	470400	0	0.0002	1.2701E+02	9	0.01	0

Table 2.4: Complete results for LSMR(100) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
ch8-8-b4	376320	117600	1881600	-	0.0000	3.2821E-06	13	0.10	0
ch8-8-b5	564480	376320	3386880	-	0.0000	1.7776E+02	16	0.29	0
Chem97Zt	31022	2541	62044	0	0.0008	1.6859E+02	2804	1.42	0
cis-n4c6-b13	25605	6300	88200	0	0.0013	1.6002E+02	0	0.00	0
cis-n4c6-b14	6300	920	13800	1	0.0065	7.9018E+01	9	0.00	0
cis-n4c6-b15	920	60	960	0	0.0500	3.0332E+01	0	0.00	0
cis-n4c6-b1	210	21	420	0	0.0952	1.4491E+01	1	0.00	0
cis-n4c6-b2	1330	210	3990	0	0.0143	2.0203E-14	2	0.00	0
cis-n4c6-b3	5970	1330	23880	0	0.0030	3.0999E+01	2	0.00	0
cis-n4c6-b4	20058	5970	100290	0	0.0008	1.1372E-06	9	0.00	0
Cities	55	46	1342	0	0.9783	6.4485E-01	46	0.00	0
connectus (S)	394707	458	1127525	0	0.1594	6.2791E+02	1129	4.73	0
D_10	814	459	7614	7	0.0283	2.1638E+01	50	0.00	0
D_11	457	169	2952	1	0.0710	1.7019E+01	37	0.00	0
D_5	430	114	1832	1	0.0702	1.8623E+01	25	0.00	0
D6-6	50760	18660	146520	1417	0.0003	2.1290E+02	24	0.02	0
D_6	967	433	6491	1	0.0300	2.5961E+01	37	0.00	0
D_7	1270	970	12714	4	0.0206	2.6062E+01	49	0.00	0
D_8	1266	1126	14966	7	0.0187	2.4223E+01	32	0.00	0
D_9	1129	814	12395	28	0.0197	2.3798E+01	34	0.00	0
deltaX	68600	21961	247424	0	0.0038	2.7677E+01	1263	4.65	0
divorce	50	9	225	0	1.0000	6.6094E+00	9	0.00	0
ESOC (S)	327062	37349	6019939	0	0.0005	4.0438E+02	2749	73.41	0
EternityII_A_b	358	1	358	0	1.0000	1.8921E+01	1	0.00	0
EternityII_A	150638	7362	782087	0	0.0008	3.7817E-06	673	2.69	0
EternityII_E_b	513	1	513	0	1.0000	2.2650E+01	1	0.00	0
EternityII_E	262144	11077	1503732	0	0.0006	4.6719E-06	89	0.80	0
EternityII_Etilde_ b	512	1	512	0	1.0000	2.2627E+01	1	0.00	0
EternityII_Etilde (S)	204304	10054	1170516	0	0.0007	4.2297E-06	1317	8.00	0
f855_mat9_I	2511	2456	171214	0	0.3375	1.7981E+01	9352	5.68	0
f855_mat9 (S)	2511	2456	171214	0	0.3375	1.7981E+01	9340	5.69	0
flower_4_1	129	121	386	0	0.0248	2.7316E+00	258	0.01	0
flower_4_4	5529	1837	16466	0	0.0016	6.0690E+01	109	0.03	0
flower_5_1	211	201	602	4	0.0249	3.6716E+00	416	0.01	0
flower_5_4	14721	5226	43942	0	0.0006	9.7567E+01	146	0.09	0
flower_7_1	463	393	1178	4	0.0127	9.0402E+00	736	0.04	0
flower_7_4	67593	27693	202218	0	0.0001	1.9933E+02	548	2.28	0
flower_8_1	625	513	1538	5	0.0097	1.1543E+01	874	0.07	0
flower_8_4	125361	55081	375266	0	0.0001	2.6505E+02	838	7.28	0
Franz10	19588	4164	97508	0	0.0012	6.7612E-11	14	0.01	0
Franz11	47104	30144	329728	-	0.0002	1.8222E-11	5	0.01	0
Franz1	2240	768	5120	1	0.0052	2.6503E+01	11	0.00	0
Franz2	4480	4032	21504	375	0.0015	4.9227E+01	23	0.00	0
Franz3	2800	1280	11520	0	0.0250	5.0671E+01	4	0.00	0
Franz4	6784	5252	46528	1049	0.0013	5.2207E-12	10	0.00	0
Franz5	7382	2882	44056	0	0.0021	1.6623E+01	13	0.00	0
Franz6	7576	3016	45456	1	0.0020	1.8468E+01	13	0.01	0
Franz7	10160	1740	40424	0	0.0023	1.8573E+01	11	0.00	0
Franz8	16728	7176	100368	0	0.0008	2.7319E+01	14	0.01	0
Franz9	19588	4164	97508	0	0.0012	1.6643E-10	14	0.00	0
gemat1	10595	4929	46591	0	0.0057	8.7317E+01	3565	2.70	0
GL6_D_10	339	162	2053	5	0.0741	1.4334E+01	34	0.00	0
GL6_D_6	465	199	2526	1	0.0553	1.8285E+01	24	0.00	0
GL6_D_7	636	469	5378	4	0.0341	1.8138E+01	38	0.00	0
GL6_D_8	632	542	6153	32	0.0277	1.7407E+01	28	0.00	0
GL6_D_9	542	339	4349	25	0.0413	1.7578E+01	27	0.00	0
GL7d10	8	1	8	0	1.0000	2.8284E+00	1	0.00	0
GL7d11	783	60	1513	1	0.1333	2.6905E+01	24	0.00	0
GL7d12	8769	1019	37519	0	0.0128	8.7516E+01	46	0.01	0
GL7d13	47221	8899	356232	13	0.0016	1.9394E+02	55	0.08	0
GL7d14	171369	47268	1831183	-	0.0005	3.5107E+02	50	0.71	0

Table 2.4: Complete results for LSMR(100) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
GL7d15	460259	171373	6080381	-	0.0002	5.4847E+02	66	3.47	0
GL7d16 (S)	955127	460260	14488881	-	0.0001	7.4875E+02	59	9.01	0
GL7d17 (S)	1548649	955127	25978098	-	0.0001	8.9897E+02	51	31.06	0
GL7d18 (S)	1955309	1548645	35590540	-	0.0000	9.3184E+02	68	51.30	0
GL7d19 (S)	1955296	1911130	37322725	-	0.0000	1.0426E+03	111	87.19	0
GL7d20 (S)	1911124	1437546	29893084	-	0.0000	1.0916E+03	83	52.22	0
GL7d21 (S)	1437546	822922	18174775	-	0.0000	1.0029E+03	91	33.26	0
GL7d22 (S)	822906	349443	8251000	-	0.0001	7.8940E+02	139	18.70	0
GL7d23 (S)	349443	105054	2695430	-	0.0002	5.3569E+02	172	5.96	0
GL7d24	105049	21074	593892	-	0.0006	3.0259E+02	102	0.50	0
GL7d25	21013	2798	81671	6	0.0029	1.3888E+02	61	0.03	0
GL7d26	2748	303	7412	1	0.0132	5.0381E+01	53	0.00	0
graphics (S)	29493	11822	117954	0	0.0003	-	>100000	>600.00	19
HFE18_96_in (S)	2372	2371	933343	0	0.5065	4.9100E-01	30429	60.01	0
IG5-10	652	527	10273	0	0.1347	1.0425E+01	1047	0.10	0
IG5-11	1227	902	22110	0	0.1231	1.5923E+01	956	0.16	0
IG5-12	2296	1578	46260	0	0.0741	2.3085E+01	1681	0.50	0
IG5-13	3994	2532	91209	0	0.0470	3.1249E+01	2143	1.08	0
IG5-14	6735	3906	173337	0	0.0307	4.1470E+01	1922	1.59	0
IG5-15 (S)	11369	6146	323509	0	0.0195	5.4856E+01	3010	4.34	0
IG5-16 (S)	18846	9519	588326	0	0.0126	7.1510E+01	4733	12.12	0
IG5-17 (S)	30162	14060	1035008	0	0.0085	9.1039E+01	4993	21.94	0
IG5-18 (S)	47894	20818	1790490	0	0.0058	1.1518E+02	4885	41.28	0
IG5-6	43	30	251	0	0.5333	1.1332E+00	30	0.00	0
IG5-7	75	62	549	0	0.3871	1.8887E+00	62	0.00	0
IG5-8	158	156	1711	2	0.3141	2.6588E-01	428	0.02	0
IG5-9	342	310	4570	0	0.1871	5.9084E+00	823	0.06	0
illc1033	1033	320	4719	0	0.0156	2.2535E+03	1769	0.11	0
illc1850	1850	712	8636	0	0.0070	1.0300E+03	1253	0.16	0
image_interp	232485	120000	711683	0	0.0000	0.0000E+00	0	0.00	0
IMDB (S)	896302	303617	3782463	-	0.0052	-	>6064	>600.00	19
Kemelmacher	28452	9693	100875	0	0.0007	1.1394E+02	3192	4.83	0
klein-b1	30	10	60	0	0.2000	2.8271E+00	9	0.00	0
klein-b2	30	20	60	0	0.1000	4.7876E+00	20	0.00	0
kneser_10_4_1 (S)	349651	330751	992252	-	0.0000	-	>9745	>600.00	19
kneser_6_2_1	676	601	2027	0	0.0050	8.5632E+00	1818	0.15	0
kneser_8_3_1	15737	15681	47042	449	0.0007	2.9040E+01	9351	21.26	0
landmark (S)	71952	2673	1146848	2	0.0060	1.3198E-05	20425	51.12	0
LargeRegFile (S)	2111154	801374	4944201	0	0.0000	4.4422E+02	132	19.30	0
lutz30-23-b6	3003	1716	12012	0	0.0035	5.2529E+01	91	0.01	0
Maragal_1	32	14	234	1	1.0000	1.0249E+00	10	0.00	0
Maragal_2	536	260	4357	81	0.3000	3.0681E+00	224	0.01	0
Maragal_3	1682	858	18391	127	0.5455	4.2081E+00	826	0.13	0
Maragal_4	1964	1027	26719	110	0.5706	5.7947E+00	577	0.11	0
Maragal_5	4654	3296	93091	610	0.4524	9.1207E+00	2544	1.54	0
Maragal_6 (S)	21251	10144	537694	516	0.5857	1.0695E+01	4582	11.04	0
Maragal_7 (S)	46845	26525	1200537	2046	0.3604	1.3690E+01	2572	16.89	0
Maragal_8 (S)	60845	33093	1308415	7107	0.0503	-	>70579	>600.00	19
mesh_deform_D	234023	234023	234023	0	0.0000	4.5050E-06	416	13.80	0
mesh_deform	234023	9393	853829	0	0.0004	0.0000E+00	0	0.00	0
mk10-b1	630	45	1260	0	0.0444	1.2909E+01	2	0.00	0
mk10-b2	3150	630	9450	0	0.0048	3.2679E-13	5	0.00	0
mk10-b3	4725	3150	18900	0	0.0013	1.6323E+01	7	0.00	0
mk10-b4	4725	945	4725	0	0.0011	6.8739E+01	1	0.00	0
mk11-b1	990	55	1980	0	0.0364	1.6275E+01	2	0.00	0
mk11-b2	6930	990	20790	0	0.0030	5.0195E-13	5	0.00	0
mk11-b3	17325	6930	69300	0	0.0006	3.7435E+01	6	0.00	0
mk11-b4b	17325	9450	47250	0	0.0003	1.2667E+02	9	0.00	0
mk11-b4	17325	10395	51975	0	0.0003	1.2634E+02	8	0.01	0
mk12-b1	1485	66	2970	1	0.0303	2.0043E+01	2	0.00	0
mk12-b2	13860	1485	41580	0	0.0020	2.5425E-12	5	0.00	0

Table 2.4: Complete results for LSMR(100) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
mk12-b3	51975	13860	207900	0	0.0003	7.0503E+01	7	0.01	0
mk12-b4	62370	51975	311850	-	0.0001	1.8269E-10	12	0.02	0
mk12-b5	62370	10395	62370	0	0.0001	2.4974E+02	0	0.00	0
mk13-b5	270270	135135	810810	-	0.0000	5.1987E+02	0	0.00	0
mk9-b1	378	36	756	0	0.0556	9.9635E+00	2	0.00	0
mk9-b2	1260	378	3780	0	0.0079	8.8454E-14	5	0.00	0
mk9-b3	1260	945	3780	0	0.0032	3.5496E+01	0	0.00	0
mri1 (S)	114637	65536	589824	603	0.0037	2.6742E+01	4568	51.32	0
mri2 (S)	104597	63240	569160	-	0.0660	1.4126E+02	7015	74.28	0
n2c6-b10	306	30	330	0	0.1667	1.7426E+01	2	0.00	0
n2c6-b1	105	15	210	0	0.1333	5.5076E+00	2	0.00	0
n2c6-b2	455	105	1365	0	0.0286	7.5068E-15	2	0.00	0
n2c6-b3	1365	455	5460	0	0.0088	1.4149E+01	2	0.00	0
n2c6-b4	3003	1365	15015	0	0.0037	7.3962E-13	2	0.00	0
n2c6-b5	4945	3003	29670	0	0.0020	2.0512E+01	3	0.00	0
n2c6-b6	5715	4945	40005	27	0.0014	3.0831E-07	19	0.00	0
n2c6-b7	5715	3990	31920	9	0.0020	7.5598E+01	0	0.00	0
n2c6-b8	3990	1470	13230	1	0.0048	6.2175E+01	6	0.00	0
n2c6-b9	1410	306	3060	1	0.0196	3.7550E+01	0	0.00	0
n3c4-b1	15	6	30	1	0.3333	3.8730E+00	1	0.00	0
n3c4-b2	20	15	60	2	0.2000	4.4721E+00	1	0.00	0
n3c4-b3	20	15	60	2	0.2000	4.4721E+00	0	0.00	0
n3c4-b4	15	6	30	1	0.3333	3.8730E+00	1	0.00	0
n3c5-b1	45	10	90	0	0.2000	3.4641E+00	2	0.00	0
n3c5-b2	120	45	360	0	0.0667	3.6095E-15	2	0.00	0
n3c5-b3	210	120	840	0	0.0333	5.0200E+00	2	0.00	0
n3c5-b4	252	210	1260	0	0.0238	3.7010E-14	2	0.00	0
n3c5-b5	252	210	1260	0	0.0238	1.5875E+01	0	0.00	0
n3c5-b6	210	120	840	0	0.0333	1.4491E+01	1	0.00	0
n3c5-b7	120	30	240	0	0.1000	1.0954E+01	0	0.00	0
n3c6-b10	2511	675	7425	0	0.0074	4.9539E+01	16	0.00	0
n3c6-b11	630	60	720	0	0.0667	2.5100E+01	0	0.00	0
n3c6-b2	455	105	1365	0	0.0286	7.5068E-15	2	0.00	0
n3c6-b3	1365	455	5460	0	0.0088	1.4149E+01	2	0.00	0
n3c6-b4	3003	1365	15015	0	0.0037	7.3962E-13	2	0.00	0
n3c6-b5	5005	3003	30030	0	0.0020	2.0712E+01	2	0.00	0
n3c6-b6	6435	5005	45045	0	0.0014	2.6527E-12	2	0.00	0
n3c6-b8	6435	4935	44415	0	0.0014	7.8129E+01	2	0.00	0
n3c6-b9	4935	2511	25110	0	0.0024	7.0250E+01	0	0.00	0
n4c5-b10	630	120	1320	2	0.0333	2.4902E+01	5	0.00	0
n4c5-b11	120	10	120	0	0.1000	1.0954E+01	0	0.00	0
n4c5-b1	105	15	210	0	0.1333	5.5076E+00	2	0.00	0
n4c5-b2	455	105	1365	0	0.0286	7.5068E-15	2	0.00	0
n4c5-b3	1350	455	5400	0	0.0088	1.3972E+01	4	0.00	0
n4c5-b4	2852	1350	14260	0	0.0037	2.9243E-07	11	0.00	0
n4c5-b5	4340	2852	26040	1	0.0021	1.8576E+01	10	0.00	0
n4c5-b6	4735	4340	33145	57	0.0016	4.4160E-07	15	0.00	0
n4c5-b7	4735	3635	29080	26	0.0022	6.8811E+01	0	0.00	0
n4c5-b8	3635	1895	17055	0	0.0037	5.9042E+01	14	0.00	0
n4c5-b9	1895	630	6300	0	0.0095	4.3532E+01	0	0.00	0
n4c6-b10	186558	132402	1456422	-	0.0001	4.2339E+02	14	0.09	0
n4c6-b11	132402	69235	830820	-	0.0001	3.6387E+02	0	0.00	0
n4c6-b12	69235	25605	332865	0	0.0004	2.6025E+02	13	0.01	0
n4c6-b13	25605	6300	88200	0	0.0013	1.6002E+02	0	0.00	0
n4c6-b14	6300	920	13800	1	0.0065	7.9018E+01	9	0.00	0
n4c6-b15	920	60	960	0	0.0500	3.0332E+01	0	0.00	0
n4c6-b1	210	21	420	0	0.0952	1.4491E+01	1	0.00	0
n4c6-b2	1330	210	3990	0	0.0143	2.0203E-14	2	0.00	0
n4c6-b3	5970	1330	23880	0	0.0030	3.0999E+01	2	0.00	0
n4c6-b4	20058	5970	100290	0	0.0008	1.1372E-06	9	0.00	0
n4c6-b5	51813	20058	310878	0	0.0003	7.1632E+01	9	0.01	0

Table 2.4: Complete results for LSMR(100) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
n4c6-b6	104115	51813	728805	-	0.0001	2.5905E-06	12	0.04	0
n4c6-b7	163215	104115	1305720	-	0.0001	1.0147E+02	11	0.06	0
n4c6-b8	198895	163215	1790055	-	0.0001	3.5572E-06	15	0.14	0
n4c6-b9	198895	186558	1865580	-	0.0001	4.4598E+02	0	0.01	0
NotreDame_actors (S)	383640	127823	1470404	-	0.0051	-	>19245	>600.00	19
Pd_rhs	5804	4371	6323	0	0.0069	3.6187E+01	273	0.14	0
photogrammetry2	4472	936	37056	7	0.0096	3.0388E+02	137	0.02	0
photogrammetry	1388	390	11816	7	0.0231	9.0895E+01	737	0.06	0
psse0 (S)	26722	11028	102432	0	0.0004	6.6360E+01	56090	101.44	0
psse1 (S)	14318	11028	57376	0	0.0016	3.5979E+01	45700	78.38	0
psse2 (S)	28634	11028	115262	0	0.0025	7.8597E+01	58262	107.56	0
QRpivot_b	391	1	391	0	1.0000	1.9774E+01	1	0.00	0
QRpivot	749	660	3808	0	0.0152	1.5593E+01	854	0.08	0
rel3	6	3	18	2	1.0000	2.4495E+00	1	0.00	0
rel4	28	10	104	5	0.4000	8.9676E-01	5	0.00	0
rel5	172	33	656	2	0.1212	5.3439E+00	23	0.00	0
rel6	1300	155	5101	2	0.0258	1.8073E+01	51	0.00	0
rel7	12770	1043	50636	2	0.0038	6.4132E+01	66	0.01	0
rel8	206040	12345	821839	2	0.0003	2.7707E+02	87	0.50	0
rel9 (S)	5921786	274667	23667183	-	0.0000	1.5416E+03	104	34.85	0
relat3	8	3	24	2	1.0000	2.8284E+00	1	0.00	0
relat4	46	10	172	5	0.4000	5.7639E+00	5	0.00	0
relat5	276	33	1058	2	0.1212	1.4900E+01	23	0.00	0
relat6	2063	155	8108	2	0.0258	4.1070E+01	42	0.00	0
relat7b	20500	1043	81355	1	0.0038	1.3429E+02	54	0.01	0
relat7	20500	1043	81355	1	0.0038	1.3429E+02	54	0.02	0
relat8	334362	12345	1334038	1	0.0003	5.5522E+02	73	0.68	0
relat9 (S)	9746232	274667	38955420	-	0.0000	3.0561E+03	86	56.10	0
rkat7_mat5	738	694	38114	0	0.3703	1.3057E+01	2537	0.41	0
robot24c1_mat5_J	404	302	15118	0	0.3013	6.4682E+00	571	0.04	0
robot24c1_mat5	404	302	15118	0	0.3013	6.4682E+00	573	0.04	0
Rucci1 (S)	1977885	109900	7791168	0	0.0000	-	>10308	>600.00	19
Sandi_sandi	360	314	613	66	0.0191	1.1104E+01	342	0.01	0
shar_te2-b1	17160	286	34320	0	0.0070	6.1422E+01	4	0.00	0
shar_te2-b2	200200	17160	600600	0	0.0002	2.3032E-11	11	0.04	0
sls (S)	1748122	62729	6804304	0	0.0001	1.2387E-05	272	16.29	0
TF10	106	99	622	0	0.0909	9.4180E-04	99	0.00	0
TF11	235	216	1607	0	0.0463	1.5113E-07	805	0.03	0
TF12	551	488	4231	0	0.0225	2.0632E-07	2926	0.22	0
TF13	1301	1121	11185	0	0.0107	3.5780E-07	9854	1.76	0
TF14 (S)	3159	2644	29862	0	0.0049	5.6016E-07	32812	13.80	0
TF15 (S)	7741	6334	80057	0	0.0022	8.7825E-07	>100000	108.49	0
TF16 (S)	19320	15437	216173	0	0.0010	-	>100000	>600.00	19
TF17 (S)	48629	38132	586218	-	0.0004	-	>84716	>600.00	19
TF18 (S)	123867	95368	1597545	-	0.0002	-	>31601	>600.00	19
TF19 (S)	317955	241029	4370721	-	0.0001	-	>11221	>600.00	19
tomographic1 (S)	59360	45908	647495	3436	0.0003	4.2070E+01	62492	540.83	0
Trec10	475	106	8612	0	0.7453	1.6372E+01	86	0.00	0
Trec11	1136	235	35705	0	0.7617	2.6544E+01	192	0.03	0
Trec12	2724	551	151219	0	0.7586	4.3372E+01	516	0.17	0
Trec13	6560	1301	654517	0	0.7656	6.9694E+01	784	1.10	0
Trec14 (S)	15904	3159	2872265	0	0.7914	1.1217E+02	1148	8.26	0
Trec3	1	1	1	0	1.0000	1.0000E+00	1	0.00	0
Trec4	2	2	3	0	1.0000	2.1505E-01	2	0.00	0
Trec5	6	3	12	0	1.0000	7.2162E-01	3	0.00	0
Trec6	14	6	40	0	0.8333	1.8260E+00	6	0.00	0
Trec7	35	11	147	0	0.8182	2.9716E+00	11	0.00	0
Trec8	83	23	549	0	0.7826	5.8826E+00	23	0.00	0
Trec9	200	47	2147	0	0.7660	9.7112E+00	44	0.00	0
well1033	1033	320	4732	0	0.0156	2.2534E+03	98	0.01	0
well1850	1850	712	8755	0	0.0070	1.0300E+03	362	0.05	0

Table 2.4: Complete results for LSMR(100) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
wheel_3_1	25	21	74	0	0.1429	2.2738E+00	21	0.00	0
wheel_4_1	41	36	122	0	0.0833	1.5091E+00	36	0.00	0
wheel_5_1	61	57	182	0	0.0526	1.1630E+00	57	0.00	0
wheel_601 (S)	902103	723605	2170814	-	0.0008	-	>3345	>600.00	19
wheel_6_1	85	83	254	2	0.0361	2.5734E+00	80	0.00	0
wheel_7_1	114	113	338	4	0.0708	2.3883E+00	159	0.00	0
wm1	260	207	2909	0	0.2415	8.1946E+00	74	0.00	0
wm2	259	207	2942	0	0.2415	8.4071E+00	96	0.00	0
wm3	259	207	2948	0	0.2705	8.1940E+00	96	0.01	0
WorldCities	313	100	7518	0	0.9900	5.3353E+00	44	0.00	0

Table 2.5: Complete LSMR(1000) results for all problems with no preconditioning.

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
CUTEst examples									
25FV47	1876	820	10705	1	0.0256	2.0432E+01	308	0.07	0
80BAU3B	11934	2262	23264	0	0.0053	8.2705E+01	65	0.02	0
AA01	8904	823	72965	15	0.0182	1.9002E+01	179	0.07	0
AA03	8627	825	70806	25	0.0206	1.9090E+01	187	0.07	0
AA3	8627	825	70806	27	0.0206	1.9090E+01	187	0.07	0
AA4	7195	426	52121	10	0.0329	1.5866E+01	132	0.03	0
AA5	8308	801	65953	22	0.0187	1.8653E+01	177	0.06	0
AA6	7292	646	51728	14	0.0217	1.6804E+01	149	0.04	0
ADLITTL2	138	56	424	0	0.1964	7.3997E+00	34	0.00	0
ADLITTLE	138	56	424	0	0.1964	7.3997E+00	34	0.00	0
AFIRO	51	27	102	0	0.1481	5.2189E+00	21	0.00	0
AFIROE	24	8	34	0	0.2500	4.1055E+00	8	0.00	0
AGG	615	488	2862	0	0.0881	1.1455E+01	54	0.00	0
AGG2	758	516	4740	0	0.0833	1.3214E+01	71	0.00	0
AGG3	758	516	4756	0	0.0833	1.3214E+01	73	0.00	0
AIR02	6774	50	61555	0	0.3400	1.5416E+01	27	0.01	0
AIR03	10757	124	91028	0	0.1129	1.7479E+01	90	0.03	0
AIR04	8904	823	72965	23	0.0182	1.9002E+01	179	0.06	0
AIR05	7195	426	52121	11	0.0329	1.5866E+01	132	0.03	0
AIR06	8627	825	70806	30	0.0206	1.9090E+01	187	0.06	0
AIR	7517	3754	20267	0	0.2001	8.6603E+01	9	0.00	0
ALLINLP	687500	250000	687500	0	0.0000	7.1249E+02	2	0.03	0
BANDM	472	305	2494	0	0.0721	9.8785E+00	168	0.01	0
BAS1LP (S)	9825	5411	587775	0	0.0675	5.5448E+01	953	5.00	0
BAXTER (S)	30733	27441	111576	2993	0.0017	9.7609E+01	9064	321.80	0
BCDOUT (S)	7078	5412	67344	2	0.1554	3.5431E+01	29576	215.11	0
BEACONFD	295	173	3408	0	0.1561	5.5647E+00	60	0.00	0
BGDBG1	629	348	1662	0	0.0460	1.9660E+01	35	0.00	0
BGETAM	816	400	2537	0	0.0200	1.6322E+01	282	0.03	0
BGINDY	10880	2671	66266	0	0.0060	3.6010E+01	132	0.07	0
BGPRTR	40	20	70	0	0.2000	3.1175E+00	15	0.00	0
BLEND	114	74	522	0	0.2162	6.0635E+00	63	0.00	0
BNL1	1586	642	5532	1	0.0125	2.0313E+01	259	0.04	0
BNL2	4486	2324	14996	0	0.0034	3.7869E+01	506	0.42	0
BOEING1	726	351	3827	0	0.0912	1.3035E+01	104	0.01	0
BOEING2	305	166	1358	0	0.1386	7.3877E+00	59	0.00	0
BORE3D	334	233	1448	2	0.1202	8.0348E+00	152	0.00	0
BOX1	261	231	651	1	0.0216	1.5955E+01	26	0.00	0
BRANDY	303	193	2202	27	0.1503	8.7556E+00	97	0.00	0
CAPRI	482	271	1896	0	0.0923	1.3828E+01	174	0.01	0
CAR4	33052	16384	63724	0	0.0067	1.8158E+02	5	0.00	0
CARI	1200	400	152800	0	0.9500	3.4641E+01	1	0.00	0
CEP1	4769	1521	8233	0	0.1440	6.1852E+01	11	0.00	0
CERIA3D	4400	3576	21178	0	0.2704	3.0961E+01	47	0.01	0
CH	8291	3700	24102	0	0.0038	5.7926E+01	251	0.19	0
CHEMCOM	744	288	1590	0	0.0208	1.8078E+01	29	0.00	0
CO5	12325	5774	57993	0	0.0048	6.5536E+01	880	3.19	0
CO9 (S)	22924	10789	109651	0	0.0026	8.9188E+01	8356	115.64	0
COMPLEX	1408	1023	46463	0	0.5005	3.1888E+01	5	0.00	0
CONT1	161589	160792	521181	-	0.5025	4.0197E+02	8	0.04	0
CONT11	201587	160792	521181	0	0.0000	3.0775E+02	12	0.08	0
CONT11_L (S)	1961394	1468599	5382999	0	0.0000	8.0916E+02	206	82.82	0
CONT1_L	1921596	1918399	7031999	-	0.6672	1.3862E+03	3	0.22	0
CONT4	161589	160792	519589	-	0.5025	4.0197E+02	8	0.04	0
CPLEX1	5224	3005	10947	0	0.4995	4.6078E+01	71	0.02	0
CPLEX2	378	224	1215	0	0.0357	2.5454E+00	85	0.00	0
CQ5	11748	5048	51571	0	0.0048	6.1448E+01	317	0.43	0
CQ9	21534	9278	96653	0	0.0026	8.3008E+01	481	1.68	0
CR42	1513	905	6614	0	0.3337	3.8739E+01	17	0.00	0

Table 2.5: Complete results for LSMR(1000) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
CRE_A_PRE	6382	2684	15739	1	0.0060	5.2407E+01	2858	9.32	0
CRE_B_PRE	36222	5176	111434	2	0.0033	8.4734E+01	4231	27.90	0
CRE_C_PRE	5293	2257	13078	1	0.0062	4.9627E+01	1951	4.49	0
CRE_D_PRE	28489	3990	86144	2	0.0043	7.5197E+01	4567	23.52	0
CREW1	6469	135	46950	0	0.1185	4.7500E+00	52	0.01	0
CYCLE	3371	1890	21234	28	0.0148	2.7738E+01	556	0.41	0
CZPROB	3562	929	10708	0	0.0043	3.3275E+00	42	0.00	0
D2Q06C (S)	5831	2171	33081	0	0.0157	3.4935E+01	616	0.62	0
D6CUBE	6184	404	37704	11	0.0248	2.8696E+01	56	0.01	0
DANO3MIP	15851	3202	81633	0	0.1952	3.6615E+01	775	1.53	0
DBIC1	226317	43200	1081843	0	0.0009	2.2486E+02	378	6.61	0
DBIR1 (S)	45775	18804	1077025	103	0.0119	1.6711E+02	364	3.13	0
DBIR2 (S)	45877	18906	1158159	101	0.0123	1.6746E+02	563	6.44	0
DE063155	1596	852	4913	0	0.0141	3.8031E+01	103	0.01	0
DE063157	1656	936	5119	0	0.0128	4.0603E+01	10	0.00	0
DE080285	1656	936	5082	0	0.0128	2.9637E+01	784	0.38	0
DEGEN2	757	444	4201	0	0.0495	8.7769E+00	126	0.01	0
DEGEN3	2604	1503	25432	0	0.0326	1.9246E+01	281	0.11	0
DEGENLPA	20	15	82	0	0.4000	8.1997E-01	15	0.00	0
DEGENLPB	20	15	82	0	0.4000	8.1997E-01	15	0.00	0
DEGME	659415	185501	8127528	0	0.0001	3.4604E+02	19	0.76	0
DELF000 (S)	5543	3128	13741	0	0.0029	5.3817E+01	1498	4.21	0
DELF001	5514	3098	14322	0	0.0032	5.4393E+01	955	1.94	0
DELF002	5549	3135	14432	0	0.0032	5.3790E+01	958	2.02	0
DELF003	5478	3065	14343	0	0.0033	5.3237E+01	994	2.04	0
DELF004	5558	3142	14696	0	0.0032	5.4412E+01	1287	3.37	0
DELF005	5519	3103	14605	0	0.0032	5.3733E+01	1583	4.55	0
DELF006	5563	3147	14754	0	0.0032	5.3368E+01	1535	4.43	0
DELF007	5555	3137	14898	0	0.0032	5.3337E+01	1624	4.76	0
DELF008	5566	3148	14971	0	0.0032	5.3275E+01	1610	4.77	0
DELF009	5554	3135	14888	0	0.0032	5.3227E+01	1635	4.79	0
DELF010	5566	3147	14952	0	0.0032	5.3224E+01	1615	4.74	0
DELF011	5553	3134	14915	0	0.0032	5.3179E+01	1635	4.79	0
DELF012	5570	3151	14948	0	0.0032	5.3215E+01	1618	4.74	0
DELF013	5535	3116	14928	0	0.0032	5.3096E+01	1628	4.77	0
DELF014	5586	3170	15036	0	0.0032	5.3479E+01	1579	4.66	0
DELF015	5573	3161	14951	0	0.0032	5.3189E+01	1649	4.98	0
DELF017	5587	3176	14904	0	0.0031	5.3293E+01	1655	5.00	0
DELF018	5604	3196	14963	0	0.0031	5.3277E+01	1643	4.95	0
DELF019	5592	3185	14939	0	0.0031	5.3201E+01	1657	5.00	0
DELF020	5616	3213	15270	0	0.0031	5.2652E+01	1708	5.38	0
DELF021	5610	3208	15263	0	0.0031	5.2291E+01	1727	5.41	0
DELF022	5616	3214	15260	0	0.0031	5.2483E+01	1661	5.04	0
DELF023	5616	3214	15298	0	0.0031	5.2535E+01	1638	4.94	0
DELF024	5610	3207	15656	0	0.0034	5.3134E+01	1566	4.67	0
DELF025	5608	3197	15647	0	0.0034	5.2689E+01	1581	4.66	0
DELF026	5606	3190	15420	0	0.0031	5.3245E+01	1564	4.65	0
DELF027	5601	3187	15400	0	0.0031	5.3268E+01	1511	4.40	0
DELF028	5596	3177	15602	0	0.0035	5.3238E+01	1506	4.33	0
DELF029	5598	3179	15602	0	0.0035	5.3201E+01	1497	4.48	0
DELF030	5613	3199	15462	0	0.0034	5.3091E+01	1546	4.54	0
DELF031	5599	3176	15405	0	0.0035	5.3240E+01	1528	4.54	0
DELF032	5611	3196	15451	0	0.0034	5.3137E+01	1528	4.53	0
DELF033	5595	3173	15400	0	0.0035	5.3185E+01	1524	4.38	0
DELF034	5594	3175	15403	0	0.0035	5.3145E+01	1523	4.43	0
DELF035	5607	3193	15479	0	0.0034	5.3086E+01	1551	4.55	0
DELF036	5598	3170	15397	0	0.0035	5.3258E+01	1555	4.56	0
DETER0	5468	1923	11173	0	0.0099	5.7052E+01	176	0.05	0
DETER1	15737	5527	32187	0	0.0096	9.8357E+01	239	0.26	0
DETER2	17313	6095	35731	0	0.0133	1.0199E+02	221	0.25	0
DETER3	21777	7647	44547	0	0.0095	1.2196E+02	246	0.37	0

Table 2.5: Complete results for LSMR(1000) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
DETER4	9133	3235	19231	0	0.0219	7.4270E+01	141	0.06	0
DETER5	14529	5103	29715	0	0.0096	9.8117E+01	236	0.22	0
DETER6	12113	4255	24771	0	0.0096	8.9066E+01	223	0.17	0
DETER7	18153	6375	37131	0	0.0096	1.1073E+02	247	0.31	0
DETER8	10905	3831	22299	0	0.0097	8.4952E+01	209	0.14	0
DF2177	10358	630	22336	0	0.0127	5.4305E+01	10	0.00	0
DFL001	12230	6071	35632	0	0.0023	5.5173E+01	427	0.84	0
DISP3	3990	2182	8541	0	0.0027	4.6507E+01	47	0.01	0
DSBMIP	2667	1182	8156	0	0.0068	2.6848E+01	288	0.07	0
E18	38601	24617	156466	0	0.0040	1.1964E+02	9	0.01	0
E226	472	223	2768	0	0.0942	1.3971E+01	75	0.00	0
ETAMACRO	816	400	2537	0	0.0200	1.6322E+01	282	0.03	0
EX2STA1	17516	17443	68779	0	0.0026	3.5780E+00	4165	87.30	0
EX72A	215	197	467	1	0.0152	1.3687E+01	91	0.00	0
EX73A	211	193	457	1	0.0155	1.3619E+01	89	0.00	0
FARM	17	7	41	0	0.5714	2.6111E+00	7	0.00	0
FFFFF800	1028	524	6401	0	0.0954	1.0704E+01	161	0.01	0
FINNIS	1064	497	2760	0	0.0282	2.1406E+01	110	0.01	0
FIT1D	1049	24	13427	0	0.7500	3.0717E+01	22	0.00	0
FIT1P	1677	627	9868	0	1.0000	4.0153E+01	28	0.00	0
FIT2D	10524	25	129042	0	0.6800	1.0026E+02	24	0.01	0
FIT2P	13525	3000	50284	0	1.0000	1.1051E+02	29	0.01	0
FOME11	24460	12142	71264	0	0.0012	7.8027E+01	427	1.74	0
FOME12	48920	24284	142528	0	0.0006	1.1035E+02	427	3.51	0
FOME13	97840	48568	285056	1	0.0003	1.5605E+02	427	7.05	0
FOME20	108175	33798	232647	77	0.0001	8.8731E+01	237	1.70	0
FOME21	216350	67596	465294	152	0.0000	1.2549E+02	237	3.47	0
FOREST	131	66	246	0	0.0455	5.8417E+00	19	0.00	0
FORPLAN	492	161	4634	0	0.2174	7.4845E+00	56	0.00	0
FXM2_16	7335	3900	32972	0	0.0092	5.0100E+01	155	0.08	0
FXM2_6	2845	1520	12812	0	0.0158	3.1221E+01	155	0.04	0
FXM3_16	85575	41340	392252	0	0.0009	1.7544E+02	153	0.98	0
FXM3_6	12625	6200	57722	0	0.0039	6.6994E+01	152	0.13	0
FXM4_6	47185	22400	265442	0	0.0011	1.4534E+02	149	0.51	0
GALENET	14	8	22	0	0.2500	3.7417E+00	1	0.00	0
GAMS10A	171	114	407	0	0.0614	8.8742E+00	9	0.00	0
GAMS10AM	171	114	407	0	0.0614	8.1798E+00	10	0.00	0
GAMS30A	531	354	1287	0	0.0198	1.3857E+01	19	0.00	0
GAMS30AM	531	354	1287	0	0.0198	1.2209E+01	19	0.00	0
GAMS60AM	1071	714	2607	0	0.0098	1.6497E+01	28	0.00	0
GANGES	1706	1309	6937	0	0.0099	1.4580E+01	118	0.02	0
GAS11	860	459	2166	0	0.0261	1.7530E+01	435	0.07	0
GE (S)	16369	10099	44825	0	0.0036	7.2589E+01	1498	14.02	0
GEN	2561	769	63086	0	0.0858	2.5015E+00	56	0.02	0
GEN1	2561	769	63086	0	0.0858	2.5015E+00	56	0.01	0
GEN2	3264	1121	81855	0	0.0937	1.6054E+00	51	0.02	0
GEN4	4298	1537	107103	0	0.0625	2.8739E+00	44	0.02	0
GFRD-PNC	1160	616	2445	0	0.0049	2.8248E+01	85	0.01	0
GOFFIN	101	50	2600	0	1.0000	9.8528E+00	2	0.00	0
GOSH	13455	3790	99953	2	0.0045	5.0199E+01	1648	6.30	0
GRAN	2604	2525	20111	471	0.0341	2.1248E+01	660	0.78	0
GREENBEA	5598	2389	31070	3	0.0100	3.1909E+01	410	0.34	0
GREENBEB	5598	2389	31070	3	0.0100	3.1909E+01	410	0.34	0
GREENBEI	5596	2390	31074	3	0.0100	3.1810E+01	410	0.31	0
GROW15	645	300	5620	0	0.0667	2.1646E+01	34	0.00	0
GROW22	946	440	8252	0	0.0455	2.5881E+01	35	0.00	0
GROW7	301	140	2612	0	0.1429	1.5322E+01	29	0.00	0
IIASA	3639	669	7317	0	0.0105	2.9786E+01	31	0.00	0
IPROB	3001	3001	9000	0	0.9997	2.1389E+01	3	0.00	0
ISRAEL	316	174	2443	0	0.7816	1.0905E+01	79	0.00	0
ITEST2	13	9	26	0	0.5556	3.1922E+00	5	0.00	0

Table 2.5: Complete results for LSMR(1000) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
ITEST6	17	11	29	0	0.4545	3.6023E+00	10	0.00	0
JENDREC1	4228	2109	89608	0	0.9886	6.4699E+01	40	0.03	0
KARTED	133115	46502	1770349	0	0.0005	1.1284E+02	29	0.25	0
KB2	68	43	313	0	0.3256	5.7141E+00	32	0.00	0
KEN_07_PRE	2033	887	4354	0	0.0034	2.4960E+01	32	0.00	0
KEN_11_PRE	11984	5511	26538	3	0.0005	7.1971E+01	74	0.03	0
KEN_13_PRE	24818	10962	57238	18	0.0004	9.7208E+01	100	0.11	0
KEN_18_PRE	89439	39867	208594	1	0.0001	1.5484E+02	144	0.76	0
KENT	47920	31300	216010	0	0.0006	7.5567E+01	238	1.48	0
KL02	36699	71	212536	0	0.1127	1.1634E-06	39	0.03	0
KLEEMIN3	6	3	9	0	1.0000	1.4920E+00	3	0.00	0
KLEEMIN4	8	4	14	0	1.0000	1.4351E+00	4	0.00	0
KLEEMIN5	10	5	20	0	1.0000	1.4439E+00	4	0.00	0
KLEEMIN6	12	6	27	0	1.0000	1.4488E+00	5	0.00	0
KLEEMIN7	14	7	35	0	1.0000	1.5542E+00	3	0.00	0
KLEEMIN8	16	8	44	0	1.0000	3.8442E+00	2	0.00	0
KLEIN1	108	54	750	0	0.3889	8.3196E+00	46	0.00	0
KLEIN2	531	477	5062	0	0.3438	1.5238E+01	55	0.00	0
KLEIN3	1082	994	13101	0	0.2767	2.1013E+01	89	0.01	0
L30	16281	2701	52070	0	0.0030	1.2489E+02	205	0.12	0
L9	1483	244	4659	0	0.0328	3.7508E+01	79	0.01	0
LARGE000	7253	4239	18313	0	0.0024	6.1470E+01	913	2.42	0
LARGE001 (S)	7176	4162	18887	0	0.0026	6.0689E+01	1246	4.21	0
LARGE002	7260	4249	20075	0	0.0028	5.9736E+01	1580	6.21	0
LARGE003	7216	4200	19717	0	0.0029	6.1237E+01	1731	7.02	0
LARGE004	7266	4250	19489	0	0.0028	6.0728E+01	1668	6.74	0
LARGE005	7256	4237	19314	0	0.0026	6.0714E+01	1765	7.26	0
LARGE006	7267	4249	19637	0	0.0026	6.0400E+01	1792	7.53	0
LARGE007	7255	4236	19595	0	0.0026	6.0316E+01	1815	7.59	0
LARGE008	7267	4248	19648	0	0.0026	6.0334E+01	1814	7.74	0
LARGE009	7256	4237	19617	0	0.0026	6.0292E+01	1825	7.97	0
LARGE010	7267	4247	19637	0	0.0026	6.0325E+01	1817	7.67	0
LARGE011	7256	4236	19617	0	0.0026	6.0318E+01	1822	7.54	0
LARGE012	7273	4253	19674	0	0.0026	6.0332E+01	1814	7.56	0
LARGE013	7265	4248	19688	0	0.0026	5.9904E+01	1850	7.83	0
LARGE014	7288	4271	19749	0	0.0026	6.0703E+01	1797	7.57	0
LARGE015	7278	4265	19717	0	0.0026	6.0682E+01	1813	7.58	0
LARGE016	7298	4287	19809	0	0.0026	6.0739E+01	1809	7.65	0
LARGE017	7288	4277	19754	0	0.0026	6.0762E+01	1822	7.72	0
LARGE018	7305	4297	19579	0	0.0026	6.0632E+01	1815	7.73	0
LARGE019	7304	4300	19574	0	0.0026	5.9969E+01	1854	7.97	0
LARGE020	7317	4315	19936	0	0.0025	5.9599E+01	1871	8.09	0
LARGE021	7313	4311	19952	0	0.0026	5.9658E+01	1903	8.28	0
LARGE022	7314	4312	19904	0	0.0026	5.9679E+01	1800	7.65	0
LARGE023	7304	4302	19912	0	0.0026	5.9857E+01	1666	6.82	0
LARGE024	7311	4292	20399	0	0.0028	6.0055E+01	1556	6.18	0
LARGE025	7312	4297	20543	0	0.0028	6.0323E+01	1615	6.61	0
LARGE026	7304	4284	20431	0	0.0028	6.0300E+01	1595	6.48	0
LARGE027	7301	4275	20362	0	0.0028	6.0470E+01	1483	5.77	0
LARGE028	7313	4302	20686	0	0.0028	6.0616E+01	1470	5.81	0
LARGE029	7312	4301	20752	0	0.0028	6.0631E+01	1508	5.88	0
LARGE030	7303	4285	20643	0	0.0028	6.1137E+01	1537	6.02	0
LARGE031	7306	4294	20667	0	0.0028	6.1091E+01	1528	6.00	0
LARGE032	7307	4292	20650	0	0.0028	6.1080E+01	1523	5.90	0
LARGE033	7292	4273	20586	0	0.0028	6.0623E+01	1517	5.88	0
LARGE034	7306	4294	20650	0	0.0028	6.0513E+01	1532	6.03	0
LARGE035	7304	4293	20676	0	0.0028	6.0485E+01	1577	6.25	0
LARGE036	7297	4282	20635	0	0.0028	6.0441E+01	1599	6.39	0
LINSPANH	97	33	194	0	0.0606	4.6238E+00	21	0.00	0
LOTFI	366	153	1136	0	0.0654	9.7302E+00	67	0.00	0
LP22	16392	2958	68518	0	0.0132	6.2250E+01	88	0.04	0

Table 2.5: Complete results for LSMR(1000) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
LPL1 (S)	129959	39951	386218	44	0.0004	7.0878E+01	1740	71.63	0
LPL2	10881	3294	32232	5	0.0009	5.7537E+01	68	0.02	0
LPL3	33686	10828	100525	1	0.0003	9.4797E+01	99	0.12	0
LSQPROB	138	56	424	0	0.1964	7.3997E+00	34	0.00	0
LSQROB	138	56	424	0	0.1964	7.3997E+00	34	0.00	0
MAKELA4	61	40	120	0	1.0000	7.4289E+00	2	0.00	0
MAROS-R7	9408	3136	144848	0	0.0147	8.2622E+01	12	0.01	0
MAROS	1966	846	10137	0	0.0236	2.4628E+01	224	0.04	0
MOD2 (S)	66409	34774	199810	0	0.0005	1.3872E+02	650	10.67	0
MODEL	80	38	136	0	0.1579	6.7730E+00	24	0.00	0
MODEL1	798	362	3028	0	0.0442	9.6897E+00	67	0.00	0
MODEL10 (S)	16819	4400	150372	0	0.0039	5.3558E+01	758	2.15	0
MODEL11	20464	7056	58035	0	0.0028	1.2316E+02	82	0.05	0
MODEL2	1321	379	7607	2	0.0369	1.5367E+01	133	0.01	0
MODEL3	4565	1609	23974	0	0.0149	3.5843E+01	220	0.07	0
MODEL4	4962	1337	45753	0	0.0127	2.7593E+01	357	0.16	0
MODEL5	11802	1744	89925	144	0.0097	3.3983E+01	404	0.29	0
MODEL6	5289	2094	27628	2	0.0124	2.5143E+01	334	0.19	0
MODEL7	9560	3358	51027	0	0.0071	5.1244E+01	382	0.41	0
MODEL8	6464	2896	25277	0	0.0055	1.7963E+01	242	0.15	0
MODEL9	10939	2787	55956	92	0.0068	6.9788E+01	456	0.50	0
MODSZK1	1620	686	3168	1	0.0335	3.3236E+01	67	0.00	0
MONDOU2	604	312	1208	0	0.0064	2.2419E+01	128	0.01	0
MPSBCD03 (S)	7078	5412	66210	2	0.1554	3.5371E+01	35179	256.39	0
MULTI	160	61	1019	0	0.2131	5.6174E+00	29	0.00	0
NEMSAFM	2348	334	2826	0	0.0120	4.5918E+01	29	0.00	0
NEMSCEM	1712	651	3840	0	0.0061	2.3126E+01	97	0.01	0
NEMSEMM1	75310	3945	1053986	0	0.0352	8.7388E+01	178	0.72	0
NEMSEMM2	48878	6943	182012	0	0.0058	1.0617E+02	132	0.18	0
NEMSPMM1	8903	2362	55867	10	0.0258	4.7784E+01	427	0.37	0
NEMSPMM2	8734	2301	68225	0	0.0278	3.8814E+01	414	0.36	0
NEMSWRLD	28550	6647	192283	491	0.0078	6.0760E+01	375	0.91	0
NEOS	515905	479119	1526794	0	0.0339	4.9938E+02	141	10.32	0
NEOS1	133473	131581	599590	0	0.0275	3.5694E+02	95	1.21	0
NEOS2	134128	132568	685087	0	0.0330	3.5375E+02	135	2.26	0
NEOS3	518832	512209	2055024	0	0.0005	2.0785E+01	7	0.14	0
NESM	3105	662	13470	0	0.0151	4.1883E+01	185	0.03	0
EMSDZ	15325	7039	47035	0	0.0021	7.5844E+01	627	2.02	0
NSCT1	37461	22901	678739	287	0.0269	1.8366E+02	275	1.95	0
NSCT2 (S)	37563	23003	697738	287	0.0273	1.8394E+02	317	2.42	0
NSIC1	883	451	3273	0	0.0599	2.5158E+01	78	0.01	0
NSIC2	897	465	3449	0	0.0581	2.5435E+01	117	0.01	0
NSIR1	10011	4407	143249	0	0.0517	8.0262E+01	270	0.35	0
NSIR2 (S)	10057	4453	154939	0	0.0528	8.0556E+01	362	0.58	0
NUG05	225	210	1050	3	0.0476	1.0643E+01	2	0.00	0
NUG06	486	372	2232	1	0.0323	4.0476E-13	3	0.00	0
NUG07	931	602	4214	0	0.0233	7.6004E-13	3	0.00	0
NUG08	1632	912	7296	0	0.0175	3.8653E-13	3	0.00	0
NUG12	8856	3192	38304	0	0.0075	3.8506E-11	3	0.00	0
NUG15	22275	6330	94950	0	0.0047	5.0151E-11	3	0.00	0
NUG20	72600	15240	304800	1	0.0026	7.8274E-11	3	0.01	0
NUG30	379350	52260	1567800	0	0.0011	4.0749E-09	3	0.04	0
NW14	123409	73	904910	0	0.1507	3.8742E+01	66	0.22	0
OET1	1005	1002	4006	0	1.0000	3.1677E+01	2	0.00	0
OET3	1006	1002	5006	0	1.0000	3.1670E+01	4	0.00	0
ORNA1	1764	882	3990	0	0.0170	1.1814E+01	594	0.21	0
ORNA2	1764	882	3990	0	0.0170	1.2116E+01	596	0.21	0
ORNA3	1764	882	3990	0	0.0170	1.2142E+01	595	0.21	0
ORNA4	1764	882	3990	0	0.0170	1.2217E+01	595	0.22	0
ORNA7	1764	882	3990	0	0.0170	1.2142E+01	595	0.21	0
ORSWQ2	160	80	344	0	0.1250	8.7296E+00	23	0.00	0

Table 2.5: Complete results for LSMR(1000) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
OSA_07_PRE	24062	1047	63037	0	0.0038	4.3640E+01	22	0.00	0
OSA_14_PRE	52723	2266	139136	0	0.0018	6.3861E+01	22	0.01	0
OSA_30_PRE	100396	4279	267149	0	0.0009	8.7145E+01	24	0.03	0
OSA_60_PRE	234334	10209	594462	0	0.0004	1.3992E+02	21	0.07	0
P0033	48	15	113	0	0.3333	3.9213E+00	15	0.00	0
P0040	63	23	133	0	0.1304	3.3924E+00	4	0.00	0
P10	19090	10090	118000	0	0.0020	9.8334E+01	131	0.18	0
P0201	334	133	2056	0	0.1053	6.5816E+00	26	0.00	0
P0282	523	241	2207	0	0.4647	2.1966E+01	30	0.00	0
P0291	543	252	2283	0	0.4167	2.1565E+01	34	0.00	0
P05	9590	5090	59045	0	0.0039	7.0494E+01	123	0.08	0
P0548	724	176	1887	0	0.0284	2.0066E+01	58	0.00	0
P19	851	284	5570	0	0.0458	1.0707E+01	47	0.00	0
P2756	3511	755	9692	0	0.0212	4.7567E+01	105	0.01	0
P6000	7947	2095	19826	0	0.0029	6.5556E+01	4	0.00	0
P80BAU3B	10613	1984	21000	0	0.0055	7.6989E+01	70	0.01	0
PANG	741	361	2933	0	0.0831	1.5295E+01	69	0.00	0
PCB1000	2820	1565	20463	0	0.0166	1.7326E+01	163	0.05	0
PCB3000	7732	3960	57479	0	0.0071	2.7109E+01	239	0.21	0
PDE1 (S)	271792	270595	990587	-	0.6696	3.0302E+02	1515	414.67	0
PDE2	361491	270595	990587	0	0.0000	3.4879E+02	655	89.96	0
PDS_02_PRE	3056	877	7484	1	0.0057	2.2013E+01	53	0.00	0
PDS_06_PRE	18530	2972	42304	0	0.0020	4.2161E+01	114	0.05	0
PDS_10_PRE	33270	4725	76307	1	0.0013	5.3829E+01	137	0.11	0
PDS_20_PRE	81224	10214	184176	0	0.0006	8.0747E+01	195	0.49	0
PDS-100 (S)	514577	156016	1096002	227	0.0000	2.8489E+02	566	40.42	0
PDS-20	108175	33798	232647	76	0.0001	8.8731E+01	237	1.70	0
PDS-30	158489	49788	340635	156	0.0001	1.2041E+02	317	4.32	0
PDS-40	217531	66641	466800	203	0.0000	1.5176E+02	415	9.36	0
PDS-50	275814	82837	590833	223	0.0000	1.8065E+02	454	13.99	0
PDS-60	336421	99204	719557	227	0.0000	2.0695E+02	485	19.07	0
PDS-70	390005	114717	833465	227	0.0000	2.3001E+02	508	24.25	0
PDS-80	434580	128954	927826	227	0.0000	2.5040E+02	522	28.80	0
PDS-90 (S)	475448	142596	1014136	227	0.0000	2.6847E+02	543	34.19	0
PEROLD	1506	625	6148	0	0.0256	2.8421E+01	270	0.04	0
PF2177	9908	9728	30984	42	0.0038	9.4105E-01	113	0.10	0
PGP2	13254	4034	22474	0	0.1433	9.9046E+01	6	0.00	0
PILOT-JA (S)	2267	940	14977	0	0.0585	3.3251E+01	258	0.06	0
PILOT-WE	2928	722	9265	0	0.0166	2.7742E+01	320	0.07	0
PILOT	4860	1441	44375	0	0.0840	4.4917E+01	331	0.16	0
PILOT4	1123	410	5264	0	0.0659	2.5520E+01	195	0.01	0
PILOT4I	1123	410	5264	0	0.0659	2.5515E+01	195	0.02	0
PILOT87	6680	2030	74949	0	0.0473	5.2250E+01	440	0.35	0
PILOTNOV (S)	2446	975	13331	0	0.0410	3.5035E+01	264	0.06	0
PLDD000B	5049	3069	10762	0	0.0029	4.8552E+01	767	1.23	0
PLDD001B	5049	3069	10763	0	0.0029	4.8535E+01	766	1.24	0
PLDD002B	5049	3069	10764	0	0.0029	4.8527E+01	763	1.23	0
PLDD003B	5049	3069	10765	0	0.0029	4.8524E+01	762	1.23	0
PLDD004B	5049	3069	10766	0	0.0029	4.8521E+01	762	1.22	0
PLDD005B	5049	3069	10767	0	0.0029	4.8519E+01	762	1.21	0
PLDD006B	5049	3069	10768	0	0.0029	4.8517E+01	762	1.23	0
PLDD007B	5049	3069	10769	0	0.0029	4.8514E+01	762	1.22	0
PLDD008B	5049	3069	10829	0	0.0029	4.8248E+01	763	1.23	0
PLDD009B	5049	3069	10832	0	0.0029	4.8240E+01	762	1.21	0
PLDD010B	5049	3069	10835	0	0.0029	4.8233E+01	762	1.21	0
PLDD011B	5049	3069	10837	0	0.0029	4.8229E+01	762	1.21	0
PLDD012B	5049	3069	10839	0	0.0029	4.8224E+01	762	1.22	0
PLTEXPA2-1	4540	1726	9233	0	0.0104	3.8985E+01	33	0.00	0
PLTEXPA2-6	1820	686	3703	0	0.0117	2.4377E+01	32	0.00	0
PLTEXPA3_1	74172	28350	150801	0	0.0006	1.5888E+02	36	0.06	0
PLTEXPA3_6	11612	4430	23611	0	0.0018	6.2691E+01	36	0.01	0

Table 2.5: Complete results for LSMR(1000) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
PLTEXPA4_6	70364	26894	143059	0	0.0003	1.5475E+02	40	0.06	0
PRESOLVE	932	428	5224	0	0.0911	1.3968E+01	142	0.01	0
PRIMAGAZ	10836	1554	21665	0	0.0013	5.2779E+00	2	0.00	0
PROBLEM	46	12	86	0	0.1667	6.7823E+00	0	0.00	0
PROGAS	1900	1650	8897	0	0.0085	2.4639E+01	507	0.29	0
PT	503	501	1503	0	1.0000	2.2414E+01	2	0.00	0
QAP12	8856	3192	38304	0	0.0075	2.4786E-11	3	0.00	0
QAP15	22275	6330	94950	0	0.0047	2.8432E-11	3	0.00	0
QAP8	1632	912	7296	0	0.0175	3.1159E-13	3	0.00	0
QIU	1900	1192	4492	0	0.0092	1.3884E+01	29	0.00	0
QPBD_OUT	442	211	2589	0	0.0995	1.3154E+01	82	0.00	0
QUAL	464	323	1646	0	0.0960	1.1182E+01	160	0.01	0
R05	9690	5190	104145	0	0.0058	7.0877E+01	131	0.11	0
RAIL2586 (S)	923269	2586	8011362	0	0.0046	1.4113E+02	441	20.63	0
RAIL4284 (S)	1096894	4284	11284032	0	0.0028	1.6948E+02	489	38.63	0
RAIL507	63516	507	409856	0	0.0237	4.7606E+01	187	0.29	0
RAIL516	47827	516	315412	0	0.0233	3.7721E+01	182	0.23	0
RAIL582	56097	582	402290	0	0.0206	4.5502E+01	172	0.27	0
RAT1	9408	3136	88267	0	0.0086	9.1651E+01	7	0.00	0
RAT5	9408	3136	137413	0	0.0137	9.1537E+01	7	0.00	0
RAT7A	9408	3136	268908	0	0.0281	9.0828E+01	7	0.01	0
REACTOR	808	318	2591	0	0.0314	1.5910E+01	62	0.00	0
READING2	6003	4000	16000	0	0.0010	7.5465E+01	2000	8.03	0
RECIPELP	204	91	687	0	0.1099	1.1855E+01	40	0.00	0
REFINE	62	29	153	0	0.1724	5.2566E+00	23	0.00	0
REFINERY	464	323	1626	0	0.0960	1.1271E+01	157	0.01	0
RLFDDD	61521	4050	264627	0	0.0119	1.5612E+02	91	0.11	0
RLFDUAL	74970	8052	282031	0	0.0055	1.9310E+02	96	0.17	0
RLFPRIM	62712	58866	320591	78	0.0034	1.1503E+02	1461	80.14	0
ROSEN1	1544	520	23794	0	0.0462	2.4644E+01	97	0.01	0
ROSEN10	6152	2056	64192	0	0.0078	5.2010E+01	121	0.05	0
ROSEN2	3080	1032	47536	0	0.0233	3.4740E+01	111	0.03	0
ROSEN7	776	264	8034	0	0.0606	1.8542E+01	96	0.00	0
ROSEN8	1544	520	16058	0	0.0308	2.6097E+01	110	0.01	0
ROUTE	43019	20894	206782	31	0.0021	1.4276E+02	38	0.06	0
S277-280	8	4	20	0	1.0000	2.6966E+00	4	0.00	0
SC105	163	105	340	0	0.0476	8.8268E+00	55	0.00	0
SC2052R100	3923	2213	7739	0	0.0461	5.5573E+01	27	0.00	0
SC2052R16	647	365	1271	0	0.0493	2.2439E+01	26	0.00	0
SC2052R160	62423	35213	123239	0	0.0455	2.2195E+02	26	0.04	0
SC2052R200	7823	4413	15439	0	0.0458	7.8527E+01	27	0.01	0
SC2052R27	1076	607	2118	0	0.0478	2.9013E+01	27	0.00	0
SC2052R32	1271	717	2503	0	0.0474	3.1553E+01	26	0.00	0
SC2052R4	179	101	347	0	0.0594	1.1656E+01	25	0.00	0
SC2052R400	15623	8813	30839	0	0.0456	1.1101E+02	27	0.01	0
SC2052R50	1973	1113	3889	0	0.0467	3.9364E+01	27	0.00	0
SC2052R64	2519	1421	4967	0	0.0464	4.4501E+01	26	0.00	0
SC2052R8	335	189	655	0	0.0529	1.6062E+01	26	0.00	0
SC2052R800	31223	17613	61639	0	0.0455	1.5696E+02	26	0.02	0
SC205	317	205	665	0	0.0244	1.0407E+01	98	0.00	0
SC50A	78	50	160	0	0.1000	7.2153E+00	33	0.00	0
SC50B	78	50	148	0	0.0800	6.5537E+00	33	0.00	0
SCAGR25	671	471	1725	0	0.0191	1.3015E+01	101	0.01	0
SCAGR7CX	887	623	2285	0	0.1814	1.7437E+01	43	0.00	0
SCAGR7AX	239	167	605	0	0.1737	8.2088E+00	40	0.00	0
SCAGR7GX	13847	9743	35885	0	0.1840	7.2243E+01	47	0.03	0
SCAGR7CQ	887	623	2285	0	0.1814	1.7437E+01	43	0.00	0
SCAGR7AQ	239	167	605	0	0.1737	8.2088E+00	40	0.00	0
SCAGR7GQ	3479	2447	9005	0	0.1835	3.5822E+01	45	0.01	0
SCAGR7HH	5855	4119	15057	0	0.1838	4.6739E+01	46	0.01	0
SCAGR7CH	887	623	2285	0	0.1814	1.7437E+01	43	0.00	0

Table 2.5: Complete results for LSMR(1000) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
SCAGR7IH	11687	8223	30069	0	0.1840	6.6324E+01	47	0.02	0
SCAGR7DH	1481	1041	3825	0	0.1825	2.2963E+01	44	0.00	0
SCAGR7EH	1751	1231	4525	0	0.1828	2.5083E+01	44	0.00	0
SCAGR7AH	239	167	605	0	0.1737	8.2088E+00	40	0.00	0
SCAGR7JH	23351	16431	60093	0	0.1841	9.3970E+01	48	0.04	0
SCAGR7FH	2939	2067	7605	0	0.1834	3.2843E+01	45	0.00	0
SCAGR7GH	3479	2447	9005	0	0.1835	3.5822E+01	45	0.01	0
SCAGR7BH	455	319	1165	0	0.1787	1.2004E+01	42	0.00	0
SCAGR7KH	46679	32847	120141	0	0.1842	1.3303E+02	48	0.09	0
SCAGR7	185	129	465	0	0.0698	6.4363E+00	55	0.00	0
SCALED	27	15	53	0	0.2667	3.9671E+00	11	0.00	0
SCFXM1B16	4263	2460	14508	0	0.0146	3.3662E+01	117	0.03	0
SCFXM1B4	1179	684	4164	0	0.0322	1.8003E+01	116	0.01	0
SCFXM1B64	33047	19036	111052	0	0.0137	9.3268E+01	116	0.24	0
SCFXM1C4	1179	684	4164	0	0.0322	1.8003E+01	116	0.01	0
SCFXM1R128	33047	19036	111052	0	0.0137	9.3268E+01	116	0.24	0
SCFXM1R16	4263	2460	14508	0	0.0146	3.3662E+01	117	0.03	0
SCFXM1R256	65943	37980	221388	0	0.0136	1.3171E+02	116	0.49	0
SCFXM1R27	7090	4088	23990	0	0.0142	4.3313E+01	118	0.06	0
SCFXM1R32	8375	4828	28300	0	0.0141	4.7050E+01	118	0.06	0
SCFXM1R4	1179	684	4164	0	0.0322	1.8003E+01	116	0.01	0
SCFXM1R64	16599	9564	55884	0	0.0138	6.6147E+01	117	0.12	0
SCFXM1R8	2207	1276	7612	0	0.0204	2.4358E+01	117	0.02	0
SCFXM1R96	24823	14300	83468	0	0.0137	8.0853E+01	117	0.19	0
SCFXM1	600	330	2732	0	0.0606	1.4494E+01	154	0.01	0
SCFXM2	1200	660	5469	0	0.0303	2.0433E+01	216	0.03	0
SCFXM3	1800	990	8206	0	0.0202	2.4998E+01	269	0.06	0
SCORPION	466	388	1534	29	0.0180	1.6015E+01	110	0.01	0
SCRS8CX	907	476	1895	0	0.1429	2.2166E+01	38	0.00	0
SCRS8AX	259	140	527	0	0.1429	1.1308E+01	38	0.00	0
SCRS8	3499	1820	7367	0	0.1429	4.4843E+01	38	0.01	0
SCRS8CQ	907	476	1895	0	0.1429	2.2166E+01	38	0.00	0
SCRS8EQ	1771	924	3719	0	0.1429	3.1474E+01	38	0.00	0
SCRS8AQ	259	140	527	0	0.1429	1.1308E+01	38	0.00	0
SCRS8FQ	3499	1820	7367	0	0.1429	4.4843E+01	38	0.01	0
SCRS8BQ	475	252	983	0	0.1429	1.5733E+01	38	0.00	0
SCRS8GH	6955	3612	14663	0	0.1429	6.3941E+01	38	0.01	0
SCRS8CH	907	476	1895	0	0.1429	2.2166E+01	38	0.00	0
SCRS8HH	13867	7196	29255	0	0.1429	9.1077E+01	38	0.02	0
SCRS8DH	1501	784	3149	0	0.1429	2.8870E+01	38	0.00	0
SCRS8EH	1771	924	3719	0	0.1429	3.1474E+01	38	0.00	0
SCRS8AH	259	140	527	0	0.1429	1.1308E+01	38	0.00	0
SCRS8IH	27691	14364	58439	0	0.1429	1.2947E+02	38	0.03	0
SCRS8FH	3499	1820	7367	0	0.1429	4.4843E+01	38	0.00	0
SCRS8FHH	3499	1820	7367	0	0.1429	4.4843E+01	38	0.00	0
SCRS8BH	475	252	983	0	0.1429	1.5733E+01	38	0.00	0
SCRS8	1275	490	3288	0	0.0163	1.7598E+01	301	0.04	0
SCSD1	760	77	2388	0	0.0519	2.7568E+01	0	0.00	0
SCSD6	1350	147	4316	0	0.0272	3.6742E+01	0	0.00	0
SCSD8CX	2310	330	7170	0	0.1030	4.8051E+01	30	0.00	0
SCSD8AX	630	90	1890	0	0.1111	2.5085E+01	30	0.00	0
SCSD8GX	35910	5130	112770	0	0.1002	1.8950E+02	30	0.02	0
SCSD8CQ	2310	330	7170	0	0.1030	4.8051E+01	30	0.00	0
SCSD8AQ	630	90	1890	0	0.1111	2.5085E+01	30	0.00	0
SCSD8GQ	35910	5130	112770	0	0.1002	1.8950E+02	30	0.01	0
SCSD8HH	15190	2170	47650	0	0.1005	1.2324E+02	30	0.01	0
SCSD8CH	2310	330	7170	0	0.1030	4.8051E+01	30	0.00	0
SCSD8IH	30310	4330	95170	0	0.1002	1.7409E+02	30	0.01	0
SCSD8DH	3850	550	12010	0	0.1018	6.2039E+01	30	0.00	0
SCSD8EH	4550	650	14210	0	0.1015	6.7444E+01	30	0.00	0
SCSD8AH	630	90	1890	0	0.1111	2.5085E+01	30	0.00	0

Table 2.5: Complete results for LSMR(1000) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
SCSD8JH	60550	8650	190210	0	0.1001	2.4607E+02	30	0.04	0
SCSD8FH	7630	1090	23890	0	0.1009	8.7342E+01	30	0.01	0
SCSD8GH	9030	1290	28290	0	0.1008	9.5019E+01	30	0.01	0
SCSD8BH	1190	170	3650	0	0.1059	3.4483E+01	30	0.00	0
SCSD8BHH	1190	170	3650	0	0.1059	3.4483E+01	30	0.00	0
SCSD8	2750	397	8584	0	0.0101	5.2440E+01	0	0.00	0
SCTAP1B16	2178	990	6334	0	0.0515	3.1038E+01	50	0.00	0
SCTAP1B4	594	270	1678	0	0.0556	1.6082E+01	51	0.00	0
SCTAP1B64	33858	15390	99454	0	0.0501	1.2367E+02	50	0.06	0
SCTAP1C16	2178	990	6334	0	0.0515	3.1038E+01	50	0.01	0
SCTAP1C4	594	270	1678	0	0.0556	1.6082E+01	51	0.00	0
SCTAP1C64	7458	3390	21854	0	0.0504	5.7784E+01	49	0.02	0
SCTAP1R108	14322	6510	42030	0	0.0502	8.0267E+01	50	0.02	0
SCTAP1R16	2178	990	6334	0	0.0515	3.1038E+01	50	0.00	0
SCTAP1R216	28578	12990	83934	0	0.0501	1.1358E+02	50	0.05	0
SCTAP1R27	3630	1650	10602	0	0.0509	4.0178E+01	49	0.01	0
SCTAP1R32	4290	1950	12542	0	0.0508	4.3714E+01	49	0.01	0
SCTAP1R4	594	270	1678	0	0.0556	1.6082E+01	51	0.00	0
SCTAP1R480	63426	28830	186366	0	0.0501	1.6941E+02	50	0.11	0
SCTAP1R54	7194	3270	21078	0	0.0505	5.6743E+01	49	0.01	0
SCTAP1R64	8514	3870	24958	0	0.0504	6.1773E+01	49	0.01	0
SCTAP1R8	1122	510	3230	0	0.0529	2.2195E+01	51	0.00	0
SCTAP1R8B	1122	510	3230	0	0.0529	2.2195E+01	51	0.00	0
SCTAP1	660	300	1872	0	0.0200	1.6745E+01	144	0.00	0
SCTAP2	2500	1090	7334	0	0.0055	3.1937E+01	308	0.09	0
SCTAP3	3340	1480	9734	0	0.0041	3.7029E+01	330	0.13	0
SEBA	1036	515	4360	0	0.4466	1.7950E+01	48	0.00	0
SELF	7364	960	1148845	0	1.0000	1.2263E+01	165	0.64	0
SEYMOUR	6316	4944	38493	0	0.0552	7.3269E+01	92	0.05	0
SGPF5Y6	312540	246077	831976	0	0.0000	2.5234E+02	48	0.81	0
SHARE1B	253	117	1179	0	0.0855	6.9160E+00	114	0.01	0
SHARE2B	162	96	777	0	0.1250	6.7659E+00	70	0.00	0
SHELL	1777	536	3558	0	0.0056	2.1346E+01	65	0.00	0
SHIP04L	2166	360	6380	42	0.0167	1.4125E+01	58	0.00	0
SHIP04S	1506	360	4400	42	0.0167	1.4038E+01	66	0.00	0
SHIP08L	4363	712	12882	66	0.0084	1.9832E+01	92	0.01	0
SHIP08S	2467	712	7194	66	0.0084	1.9707E+01	115	0.01	0
SHIP12L	5533	1042	16276	109	0.0058	2.4097E+01	78	0.01	0
SHIP12S	2869	1042	8284	109	0.0058	2.4018E+01	94	0.01	0
SIERRA	2735	1227	8001	2	0.0033	3.9095E+01	47	0.00	0
SIPOW1	2002	2000	6000	0	1.0000	4.4699E-02	3	0.00	0
SIPOW1M	2002	2000	6000	0	1.0000	4.4699E-02	3	0.00	0
SIPOW2	2002	2000	5000	0	1.0000	4.4651E+01	3	0.00	0
SIPOW2M	2002	2000	5000	0	1.0000	4.4651E+01	3	0.00	0
SIPOW3	2004	2000	7992	0	1.0000	4.4734E+01	3	0.00	0
SIPOW4	2004	2000	9000	0	1.0000	4.4733E+01	4	0.00	0
SLP-TSK	3347	2861	72465	0	0.3100	5.6689E+01	72	0.03	0
SMALL000	1215	709	3044	0	0.0141	2.5413E+01	372	0.07	0
SMALL001	1193	687	3144	0	0.0160	2.4820E+01	417	0.09	0
SMALL002	1220	713	3246	0	0.0154	2.5271E+01	434	0.10	0
SMALL003	1215	711	3240	0	0.0155	2.4850E+01	439	0.11	0
SMALL004	1220	717	3283	0	0.0153	2.5028E+01	432	0.10	0
SMALL005	1220	717	3317	0	0.0153	2.5458E+01	404	0.08	0
SMALL006	1213	710	3319	0	0.0169	2.5058E+01	504	0.12	0
SMALL007	1212	711	3374	0	0.0169	2.4794E+01	511	0.13	0
SMALL008	1214	712	3342	0	0.0169	2.4951E+01	507	0.13	0
SMALL009	1213	710	3328	0	0.0169	2.4952E+01	497	0.12	0
SMALL010	1213	711	3322	0	0.0169	2.5205E+01	499	0.12	0
SMALL011	1208	705	3300	0	0.0170	2.5491E+01	404	0.08	0
SMALL012	1209	706	3309	0	0.0170	2.5481E+01	411	0.09	0
SMALL013	1204	701	3282	0	0.0171	2.5476E+01	413	0.09	0

Table 2.5: Complete results for LSMR(1000) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
SMALL014	1190	687	3207	0	0.0160	2.5330E+01	426	0.10	0
SMALL015	1186	683	3243	0	0.0161	2.5276E+01	435	0.09	0
SMALL016	1180	677	3207	0	0.0162	2.5187E+01	445	0.10	0
SOUTHERN1	36321	18425	112398	0	0.9509	1.8807E+02	106	0.20	0
SPAL_004 (S)	321696	10203	46168124	0	0.0165	-	>2452	>600.00	19
SSEBLIN	218	72	336	0	0.0278	1.2971E+01	18	0.00	0
STAIR	614	356	4003	0	0.0955	1.3875E+01	81	0.00	0
STANDATA	1274	359	3230	0	0.0279	1.3676E+01	69	0.00	0
STANDGUB	1382	360	3338	1	0.0278	1.4397E+01	69	0.00	0
STANDMPS	1274	467	3878	0	0.0214	1.2022E+01	102	0.01	0
STAT96V1	197472	5995	588798	0	0.0030	4.4182E+02	547	2.62	0
STAT96V2 (S)	957432	29089	2852184	0	0.0004	9.7273E+02	820	24.65	0
STAT96V3 (S)	1113780	33841	3317736	0	0.0004	1.0492E+03	865	31.31	0
STAT96V4 (S)	63076	3173	491336	0	0.0028	1.2052E+02	1929	9.71	0
STAT96V5	75779	2305	233921	2	0.3336	2.7479E+02	22	0.02	0
STOCFOR1	165	117	501	0	0.0513	5.2802E+00	46	0.00	0
STOCFOR2	3045	2157	9357	0	0.0046	2.6098E+01	199	0.07	0
STOCFOR3	23541	16675	72721	0	0.0011	7.3948E+01	367	1.78	0
STORMG2125	172431	65935	433256	250	0.0021	3.1685E+02	143	1.39	0
STORMG227	37485	14387	94274	54	0.0028	1.4714E+02	145	0.30	0
STORMG28	11322	4393	28553	16	0.0048	7.9906E+01	146	0.09	0
STORMG21K (S)	1377306	526185	3459881	0	0.0019	8.9636E+02	142	13.58	0
STP3D	336283	159488	793531	0	0.0000	4.8623E+02	211	6.66	0
SWS	26775	14310	107325	0	0.0008	5.4263E+01	50	0.05	0
T0331-4L	46915	664	430982	0	0.0346	7.3313E+01	274	0.52	0
SC205	31223	17613	61639	0	0.0455	1.4370E+02	26	0.02	0
TESTDECK	27	15	53	0	0.2667	3.6108E+00	9	0.00	0
TFI2	104	101	402	0	1.0000	9.9041E+00	3	0.00	0
MPD	1014301	142752	11537419	0	0.0001	3.5588E+02	12	0.70	0
TRUSS	8806	1000	27836	0	0.0040	9.3840E+01	0	0.00	0
TS-PALKO	47235	22002	1076903	0	0.0016	6.1241E+01	34	0.16	0
TUFF	628	302	4561	31	0.0828	1.0262E+01	106	0.01	0
ULEVMIN	46937	6590	164538	0	0.0041	1.0191E+02	23	0.02	0
US04	28016	163	297538	8	0.1104	2.6748E+01	100	0.11	0
VOL1	464	323	1646	0	0.0960	1.1182E+01	160	0.01	0
VTP-BASE	346	198	1051	0	0.0606	8.2246E+00	92	0.00	0
WATSON_1 (S)	386992	201155	1055093	0	0.0000	2.5495E+02	1724	383.92	0
WATSON_2 (S)	677224	352013	1846391	0	0.0000	3.3569E+02	1462	530.50	0
WOOD1P	2595	244	70216	0	0.1148	1.7252E+00	60	0.02	0
WOODINFE	89	35	140	0	0.0571	8.0289E+00	15	0.00	0
WOODW	8418	1098	37487	0	0.0191	4.0983E+00	218	0.06	0
WORLD (S)	67147	34506	198883	0	0.0005	1.4068E+02	594	8.92	0
ZED	142	116	666	0	0.4138	9.0308E+00	28	0.00	0
UF Sparse Matrix Collection examples									
12month1 (S)	872622	12471	22624727	-	0.2742	-	>5279	>600.00	19
130bit	584	567	6120	1	0.0247	3.9867E+00	566	0.13	0
145bit	1002	966	11315	2	0.0155	6.9710E+00	964	0.59	0
162bit (S)	3606	3476	37118	16	0.0040	1.1788E+01	8719	37.55	0
176bit (S)	7441	7150	82270	40	0.0022	1.8430E+01	38860	370.48	0
192bit (S)	13691	13093	154303	82	0.0012	-	>34320	>600.00	19
208bit (S)	24430	23191	299756	199	0.0008	-	>19603	>600.00	19
abb313	313	176	1557	0	0.0341	1.1495E+01	57	0.00	0
abtaha1	14596	209	51307	0	0.0191	8.5472E+01	59	0.01	0
abtaha2	37932	331	137228	0	0.0121	1.3963E+02	39	0.03	0
ash219	219	85	438	0	0.0235	1.2360E+01	31	0.00	0
ash331	331	104	662	0	0.0192	1.5722E+01	36	0.00	0
ash608	608	188	1216	0	0.0106	2.0993E+01	33	0.00	0
ash958	958	292	1916	0	0.0068	2.6425E+01	35	0.00	0
beacxc	489	449	50409	0	0.5635	9.2302E-03	419	0.10	0
beaflw (S)	500	492	53403	4	0.8130	5.0539E+00	373	0.09	0

Table 2.5: Complete results for LSMR(1000) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
beause	505	492	44551	3	0.8130	4.6842E+00	378	0.08	0
bibd_11_5	462	55	4620	0	0.1818	2.0126E+01	14	0.00	0
bibd_12_4	495	66	2970	0	0.0909	2.0677E+01	14	0.00	0
bibd_12_5	792	66	7920	0	0.1515	2.6743E+01	12	0.00	0
bibd_13_6	1716	78	25740	0	0.1923	4.0221E+01	10	0.00	0
bibd_14_7	3432	91	72072	0	0.2308	5.7912E+01	9	0.00	0
bibd_15_3	455	105	1365	0	0.0286	1.8238E+01	19	0.00	0
bibd_15_7	6435	105	135135	0	0.2000	7.9658E+01	8	0.00	0
bibd_16_8	12870	120	360360	0	0.2333	1.1286E+02	7	0.01	0
bibd_17_3	680	136	2040	0	0.0221	2.3567E+01	18	0.00	0
bibd_17_4b	2380	136	14280	0	0.0441	4.7340E+01	11	0.00	0
bibd_17_4	2380	136	14280	0	0.0441	4.7340E+01	11	0.00	0
bibd_17_8	24310	136	680680	0	0.2059	1.5546E+02	7	0.01	0
bibd_18_9	48620	153	1750320	0	0.2353	2.2010E+02	6	0.03	0
bibd_19_9	92378	171	3325608	0	0.2105	3.0364E+02	6	0.05	0
bibd_20_10	184756	190	8314020	0	0.2368	4.2958E+02	6	0.12	0
bibd_22_8	319770	231	8953560	0	0.1212	5.6528E+02	5	0.13	0
bibd_49_3	18424	1176	55272	0	0.0026	1.3141E+02	12	0.00	0
bibd_81_3	85320	3240	255960	0	0.0009	2.8646E+02	11	0.01	0
bibd_9_3	84	36	252	0	0.0833	6.5585E+00	24	0.00	0
bibd_9_5	126	36	1260	0	0.2778	9.5326E+00	19	0.00	0
c8_mat11_I	5761	4562	2462970	0	0.5298	2.2179E+01	8121	81.09	0
c8_mat11 (S)	5761	4562	2462970	0	0.5298	2.2179E+01	8129	81.28	0
cat_ears_2_4	2689	1009	7982	0	0.0030	4.1328E+01	118	0.02	0
cat_ears_3_1	204	181	542	4	0.0331	5.2776E+00	175	0.01	0
cat_ears_3_4	13271	5226	39592	0	0.0006	8.9890E+01	380	0.57	0
cat_ears_4_1	377	313	938	4	0.0192	9.1810E+00	304	0.03	0
cat_ears_4_4	44448	19020	132888	0	0.0002	1.5904E+02	433	2.64	0
ch3-3-b1	18	9	36	0	0.2222	1.9181E+00	2	0.00	0
ch3-3-b2	18	6	18	0	0.1667	4.2426E+00	1	0.00	0
ch4-4-b1	72	16	144	0	0.1250	4.3706E+00	2	0.00	0
ch4-4-b2	96	72	288	1	0.0417	5.9093E-15	5	0.00	0
ch4-4-b3	96	24	96	0	0.0417	9.7980E+00	0	0.00	0
ch5-5-b1	200	25	400	0	0.0800	7.4754E+00	2	0.00	0
ch5-5-b2	600	200	1800	0	0.0150	7.2959E-15	5	0.00	0
ch5-5-b4	600	120	600	0	0.0083	2.4495E+01	1	0.00	0
ch6-6-b1	450	36	900	0	0.0556	1.1320E+01	2	0.00	0
ch6-6-b2	2400	450	7200	0	0.0067	1.3730E-13	5	0.00	0
ch6-6-b3	5400	2400	21600	0	0.0017	2.3959E+01	9	0.00	0
ch6-6-b4	5400	4320	21600	19	0.0009	6.9478E+01	10	0.00	0
ch6-6-b5	4320	720	4320	0	0.0014	6.5727E+01	0	0.00	0
ch7-6-b1	630	42	1260	0	0.0476	1.3254E+01	3	0.00	0
ch7-6-b2	4200	630	12600	0	0.0048	2.6043E-13	9	0.00	0
ch7-6-b3	12600	4200	50400	0	0.0010	3.8393E+01	11	0.00	0
ch7-6-b4	15120	12600	75600	0	0.0004	3.1020E-12	18	0.01	0
ch7-6-b5	15120	5040	30240	0	0.0004	1.2296E+02	0	0.00	0
ch7-7-b1	882	49	1764	0	0.0408	1.5951E+01	2	0.00	0
ch7-7-b2	7350	882	22050	0	0.0034	6.0134E-13	5	0.00	0
ch7-7-b5	52920	35280	211680	-	0.0001	2.3004E+02	0	0.00	0
ch7-8-b1	1176	56	2352	0	0.0357	1.8284E+01	4	0.00	0
ch7-8-b2	11760	1176	35280	0	0.0026	1.8966E-12	9	0.00	0
ch7-8-b3	58800	11760	235200	0	0.0003	8.7888E+01	10	0.01	0
ch7-8-b4	141120	58800	705600	-	0.0001	2.1233E-06	16	0.05	0
ch7-9-b1	1512	63	3024	0	0.0317	2.0709E+01	3	0.00	0
ch7-9-b2	17640	1512	52920	0	0.0020	1.8002E-12	8	0.00	0
ch7-9-b3	105840	17640	423360	0	0.0002	1.1794E+02	10	0.01	0
ch7-9-b4	317520	105840	1587600	-	0.0000	3.3137E-06	15	0.11	0
ch7-9-b5	423360	317520	2540160	-	0.0000	1.3659E+02	20	0.34	0
ch8-8-b1	1568	64	3136	0	0.0312	2.1385E+01	2	0.00	0
ch8-8-b2	18816	1568	56448	0	0.0019	2.1606E-12	5	0.00	0
ch8-8-b3	117600	18816	470400	0	0.0002	1.2701E+02	9	0.01	0

Table 2.5: Complete results for LSMR(1000) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
ch8-8-b4	376320	117600	1881600	-	0.0000	3.2821E-06	13	0.10	0
ch8-8-b5	564480	376320	3386880	-	0.0000	1.7776E+02	16	0.30	0
Chem97Zt	31022	2541	62044	0	0.0008	1.6859E+02	1139	2.29	0
cis-n4c6-b13	25605	6300	88200	0	0.0013	1.6002E+02	0	0.00	0
cis-n4c6-b14	6300	920	13800	1	0.0065	7.9018E+01	9	0.00	0
cis-n4c6-b15	920	60	960	0	0.0500	3.0332E+01	0	0.00	0
cis-n4c6-b1	210	21	420	0	0.0952	1.4491E+01	1	0.00	0
cis-n4c6-b2	1330	210	3990	0	0.0143	2.0203E-14	2	0.00	0
cis-n4c6-b3	5970	1330	23880	0	0.0030	3.0999E+01	2	0.00	0
cis-n4c6-b4	20058	5970	100290	0	0.0008	1.1372E-06	9	0.01	0
Cities	55	46	1342	0	0.9783	6.4485E-01	46	0.00	0
connectus (S)	394707	458	1127525	0	0.1594	6.2791E+02	342	1.55	0
D_10	814	459	7614	7	0.0283	2.1638E+01	50	0.01	0
D_11	457	169	2952	1	0.0710	1.7019E+01	37	0.00	0
D_5	430	114	1832	1	0.0702	1.8623E+01	25	0.00	0
D6-6	50760	18660	146520	1417	0.0003	2.1290E+02	24	0.02	0
D_6	967	433	6491	1	0.0300	2.5961E+01	37	0.00	0
D_7	1270	970	12714	4	0.0206	2.6062E+01	49	0.00	0
D_8	1266	1126	14966	7	0.0187	2.4223E+01	32	0.00	0
D_9	1129	814	12395	28	0.0197	2.3798E+01	34	0.01	0
deltaX	68600	21961	247424	0	0.0038	2.7677E+01	918	12.99	0
divorce	50	9	225	0	1.0000	6.6094E+00	9	0.00	0
ESOC (S)	327062	37349	6019939	0	0.0005	4.0438E+02	356	11.29	0
EternityII_A_b	358	1	358	0	1.0000	1.8921E+01	1	0.00	0
EternityII_A	150638	7362	782087	0	0.0008	3.5677E-06	518	3.09	0
EternityII_E_b	513	1	513	0	1.0000	2.2650E+01	1	0.00	0
EternityII_E	262144	11077	1503732	0	0.0006	4.6719E-06	89	0.77	0
EternityII_Etilde_ b	512	1	512	0	1.0000	2.2627E+01	1	0.00	0
EternityII_Etilde (S)	204304	10054	1170516	0	0.0007	4.3764E-06	843	9.07	0
f855_mat9_I	2511	2456	171214	0	0.3375	1.7981E+01	3355	10.02	0
f855_mat9 (S)	2511	2456	171214	0	0.3375	1.7981E+01	3349	10.17	0
flower_4_1	129	121	386	0	0.0248	2.7324E+00	121	0.01	0
flower_4_4	5529	1837	16466	0	0.0016	6.0690E+01	109	0.03	0
flower_5_1	211	201	602	4	0.0249	3.6888E+00	191	0.01	0
flower_5_4	14721	5226	43942	0	0.0006	9.7567E+01	146	0.10	0
flower_7_1	463	393	1178	4	0.0127	9.0407E+00	379	0.04	0
flower_7_4	67593	27693	202218	0	0.0001	1.9933E+02	533	5.71	0
flower_8_1	625	513	1538	5	0.0097	1.1544E+01	497	0.10	0
flower_8_4	125361	55081	375266	0	0.0001	2.6505E+02	807	25.54	0
Franz10	19588	4164	97508	0	0.0012	6.7612E-11	14	0.01	0
Franz11	47104	30144	329728	-	0.0002	1.8222E-11	5	0.01	0
Franz1	2240	768	5120	1	0.0052	2.6503E+01	11	0.00	0
Franz2	4480	4032	21504	375	0.0015	4.9227E+01	23	0.00	0
Franz3	2800	1280	11520	0	0.0250	5.0671E+01	4	0.00	0
Franz4	6784	5252	46528	1049	0.0013	5.2207E-12	10	0.00	0
Franz5	7382	2882	44056	0	0.0021	1.6623E+01	13	0.00	0
Franz6	7576	3016	45456	1	0.0020	1.8468E+01	13	0.00	0
Franz7	10160	1740	40424	0	0.0023	1.8573E+01	11	0.00	0
Franz8	16728	7176	100368	0	0.0008	2.7319E+01	14	0.01	0
Franz9	19588	4164	97508	0	0.0012	1.6643E-10	14	0.01	0
gemat1	10595	4929	46591	0	0.0057	8.7317E+01	1598	7.30	0
GL6_D_10	339	162	2053	5	0.0741	1.4334E+01	34	0.00	0
GL6_D_6	465	199	2526	1	0.0553	1.8285E+01	24	0.00	0
GL6_D_7	636	469	5378	4	0.0341	1.8138E+01	38	0.00	0
GL6_D_8	632	542	6153	32	0.0277	1.7407E+01	28	0.00	0
GL6_D_9	542	339	4349	25	0.0413	1.7578E+01	27	0.00	0
GL7d10	8	1	8	0	1.0000	2.8284E+00	1	0.00	0
GL7d11	783	60	1513	1	0.1333	2.6905E+01	24	0.00	0
GL7d12	8769	1019	37519	0	0.0128	8.7516E+01	46	0.01	0
GL7d13	47221	8899	356232	13	0.0016	1.9394E+02	55	0.09	0
GL7d14	171369	47268	1831183	-	0.0005	3.5107E+02	50	0.72	0

Table 2.5: Complete results for LSMR(1000) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
GL7d15	460259	171373	6080381	-	0.0002	5.4847E+02	66	3.64	0
GL7d16 (S)	955127	460260	14488881	-	0.0001	7.4875E+02	59	9.47	0
GL7d17 (S)	1548649	955127	25978098	-	0.0001	8.9897E+02	51	21.50	0
GL7d18 (S)	1955309	1548645	35590540	-	0.0000	9.3184E+02	68	41.99	0
GL7d19 (S)	1955296	1911130	37322725	-	0.0000	1.0426E+03	110	82.69	0
GL7d20 (S)	1911124	1437546	29893084	-	0.0000	1.0916E+03	83	46.79	0
GL7d21 (S)	1437546	822922	18174775	-	0.0000	1.0029E+03	91	26.73	0
GL7d22 (S)	822906	349443	8251000	-	0.0001	7.8940E+02	125	13.81	0
GL7d23 (S)	349443	105054	2695430	-	0.0002	5.3569E+02	143	4.58	0
GL7d24	105049	21074	593892	-	0.0006	3.0259E+02	102	0.51	0
GL7d25	21013	2798	81671	6	0.0029	1.3888E+02	61	0.03	0
GL7d26	2748	303	7412	1	0.0132	5.0381E+01	53	0.00	0
graphics (S)	29493	11822	117954	0	0.0003	-	>37695	>600.00	19
HFE18_96_in (S)	2372	2371	933343	0	0.5065	4.9100E-01	24116	112.55	0
IG5-10	652	527	10273	0	0.1347	1.0425E+01	405	0.09	0
IG5-11	1227	902	22110	0	0.1231	1.5923E+01	470	0.16	0
IG5-12	2296	1578	46260	0	0.0741	2.3085E+01	719	0.58	0
IG5-13	3994	2532	91209	0	0.0470	3.1249E+01	939	1.63	0
IG5-14	6735	3906	173337	0	0.0307	4.1470E+01	922	2.48	0
IG5-15 (S)	11369	6146	323509	0	0.0195	5.4856E+01	1613	9.89	0
IG5-16 (S)	18846	9519	588326	0	0.0126	7.1510E+01	2559	28.49	0
IG5-17 (S)	30162	14060	1035008	0	0.0085	9.1039E+01	2825	50.14	0
IG5-18 (S)	47894	20818	1790490	0	0.0058	1.1518E+02	2776	78.44	0
IG5-6	43	30	251	0	0.5333	1.1332E+00	30	0.00	0
IG5-7	75	62	549	0	0.3871	1.8887E+00	62	0.00	0
IG5-8	158	156	1711	2	0.3141	2.6590E-01	154	0.01	0
IG5-9	342	310	4570	0	0.1871	5.9084E+00	281	0.03	0
illc1033	1033	320	4719	0	0.0156	2.2534E+03	263	0.02	0
illc1850	1850	712	8636	0	0.0070	1.0300E+03	697	0.24	0
image_interp	232485	120000	711683	0	0.0000	0.0000E+00	0	0.00	0
IMDB (S)	896302	303617	3782463	-	0.0052	-	>1698	>600.00	19
Kemelmacher	28452	9693	100875	0	0.0007	1.1394E+02	2867	30.74	0
klein-b1	30	10	60	0	0.2000	2.8271E+00	9	0.00	0
klein-b2	30	20	60	0	0.1000	4.7876E+00	20	0.00	0
kneser_10_4_1 (S)	349651	330751	992252	-	0.0000	-	>1683	>600.00	19
kneser_6_2_1	676	601	2027	0	0.0050	8.5726E+00	601	0.14	0
kneser_8_3_1	15737	15681	47042	449	0.0007	2.9040E+01	8927	175.07	0
landmark (S)	71952	2673	1146848	2	0.0060	1.3198E-05	18053	99.05	0
LargeRegFile (S)	2111154	801374	4944201	0	0.0000	4.4422E+02	112	13.81	0
lutz30-23-b6	3003	1716	12012	0	0.0035	5.2529E+01	91	0.01	0
Maragal_1	32	14	234	1	1.0000	1.0249E+00	10	0.00	0
Maragal_2	536	260	4357	81	0.3000	3.0681E+00	165	0.01	0
Maragal_3	1682	858	18391	127	0.5455	4.2081E+00	468	0.14	0
Maragal_4	1964	1027	26719	110	0.5706	5.7947E+00	381	0.11	0
Maragal_5	4654	3296	93091	610	0.4524	9.1207E+00	1261	3.49	0
Maragal_6 (S)	21251	10144	537694	516	0.5857	1.0695E+01	2609	30.44	0
Maragal_7 (S)	46845	26525	1200537	2046	0.3604	1.3690E+01	1477	38.76	0
Maragal_8 (S)	60845	33093	1308415	7107	0.0503	-	>12904	>600.00	19
mesh_deform_D	234023	234023	234023	0	0.0000	4.7538E-06	376	24.37	0
mesh_deform	234023	9393	853829	0	0.0004	0.0000E+00	0	0.00	0
mk10-b1	630	45	1260	0	0.0444	1.2909E+01	2	0.00	0
mk10-b2	3150	630	9450	0	0.0048	3.2679E-13	5	0.00	0
mk10-b3	4725	3150	18900	0	0.0013	1.6323E+01	7	0.00	0
mk10-b4	4725	945	4725	0	0.0011	6.8739E+01	1	0.00	0
mk11-b1	990	55	1980	0	0.0364	1.6275E+01	2	0.00	0
mk11-b2	6930	990	20790	0	0.0030	5.0195E-13	5	0.00	0
mk11-b3	17325	6930	69300	0	0.0006	3.7435E+01	6	0.00	0
mk11-b4b	17325	9450	47250	0	0.0003	1.2667E+02	9	0.00	0
mk11-b4	17325	10395	51975	0	0.0003	1.2634E+02	8	0.00	0
mk12-b1	1485	66	2970	1	0.0303	2.0043E+01	2	0.00	0
mk12-b2	13860	1485	41580	0	0.0020	2.5425E-12	5	0.00	0

Table 2.5: Complete results for LSMR(1000) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
mk12-b3	51975	13860	207900	0	0.0003	7.0503E+01	7	0.01	0
mk12-b4	62370	51975	311850	-	0.0001	1.8269E-10	12	0.02	0
mk12-b5	62370	10395	62370	0	0.0001	2.4974E+02	0	0.00	0
mk13-b5	270270	135135	810810	-	0.0000	5.1987E+02	0	0.00	0
mk9-b1	378	36	756	0	0.0556	9.9635E+00	2	0.00	0
mk9-b2	1260	378	3780	0	0.0079	8.8454E-14	5	0.00	0
mk9-b3	1260	945	3780	0	0.0032	3.5496E+01	0	0.00	0
mri1 (S)	114637	65536	589824	603	0.0037	2.6742E+01	3356	259.80	0
mri2 (S)	104597	63240	569160	-	0.0660	1.4126E+02	3439	256.39	0
n2c6-b10	306	30	330	0	0.1667	1.7426E+01	2	0.00	0
n2c6-b1	105	15	210	0	0.1333	5.5076E+00	2	0.00	0
n2c6-b2	455	105	1365	0	0.0286	7.5068E-15	2	0.00	0
n2c6-b3	1365	455	5460	0	0.0088	1.4149E+01	2	0.00	0
n2c6-b4	3003	1365	15015	0	0.0037	7.3962E-13	2	0.00	0
n2c6-b5	4945	3003	29670	0	0.0020	2.0512E+01	3	0.00	0
n2c6-b6	5715	4945	40005	27	0.0014	3.0831E-07	19	0.00	0
n2c6-b7	5715	3990	31920	9	0.0020	7.5598E+01	0	0.00	0
n2c6-b8	3990	1470	13230	1	0.0048	6.2175E+01	6	0.00	0
n2c6-b9	1410	306	3060	1	0.0196	3.7550E+01	0	0.00	0
n3c4-b1	15	6	30	1	0.3333	3.8730E+00	1	0.00	0
n3c4-b2	20	15	60	2	0.2000	4.4721E+00	1	0.00	0
n3c4-b3	20	15	60	2	0.2000	4.4721E+00	0	0.00	0
n3c4-b4	15	6	30	1	0.3333	3.8730E+00	1	0.00	0
n3c5-b1	45	10	90	0	0.2000	3.4641E+00	2	0.00	0
n3c5-b2	120	45	360	0	0.0667	3.6095E-15	2	0.00	0
n3c5-b3	210	120	840	0	0.0333	5.0200E+00	2	0.00	0
n3c5-b4	252	210	1260	0	0.0238	3.7010E-14	2	0.00	0
n3c5-b5	252	210	1260	0	0.0238	1.5875E+01	0	0.00	0
n3c5-b6	210	120	840	0	0.0333	1.4491E+01	1	0.00	0
n3c5-b7	120	30	240	0	0.1000	1.0954E+01	0	0.00	0
n3c6-b10	2511	675	7425	0	0.0074	4.9539E+01	16	0.00	0
n3c6-b11	630	60	720	0	0.0667	2.5100E+01	0	0.00	0
n3c6-b2	455	105	1365	0	0.0286	7.5068E-15	2	0.00	0
n3c6-b3	1365	455	5460	0	0.0088	1.4149E+01	2	0.00	0
n3c6-b4	3003	1365	15015	0	0.0037	7.3962E-13	2	0.00	0
n3c6-b5	5005	3003	30030	0	0.0020	2.0712E+01	2	0.00	0
n3c6-b6	6435	5005	45045	0	0.0014	2.6527E-12	2	0.00	0
n3c6-b8	6435	4935	44415	0	0.0014	7.8129E+01	2	0.00	0
n3c6-b9	4935	2511	25110	0	0.0024	7.0250E+01	0	0.00	0
n4c5-b10	630	120	1320	2	0.0333	2.4902E+01	5	0.00	0
n4c5-b11	120	10	120	0	0.1000	1.0954E+01	0	0.00	0
n4c5-b1	105	15	210	0	0.1333	5.5076E+00	2	0.00	0
n4c5-b2	455	105	1365	0	0.0286	7.5068E-15	2	0.00	0
n4c5-b3	1350	455	5400	0	0.0088	1.3972E+01	4	0.00	0
n4c5-b4	2852	1350	14260	0	0.0037	2.9243E-07	11	0.00	0
n4c5-b5	4340	2852	26040	1	0.0021	1.8576E+01	10	0.00	0
n4c5-b6	4735	4340	33145	57	0.0016	4.4160E-07	15	0.01	0
n4c5-b7	4735	3635	29080	26	0.0022	6.8811E+01	0	0.00	0
n4c5-b8	3635	1895	17055	0	0.0037	5.9042E+01	14	0.00	0
n4c5-b9	1895	630	6300	0	0.0095	4.3532E+01	0	0.00	0
n4c6-b10	186558	132402	1456422	-	0.0001	4.2339E+02	14	0.09	0
n4c6-b11	132402	69235	830820	-	0.0001	3.6387E+02	0	0.00	0
n4c6-b12	69235	25605	332865	0	0.0004	2.6025E+02	13	0.01	0
n4c6-b13	25605	6300	88200	0	0.0013	1.6002E+02	0	0.00	0
n4c6-b14	6300	920	13800	1	0.0065	7.9018E+01	9	0.00	0
n4c6-b15	920	60	960	0	0.0500	3.0332E+01	0	0.00	0
n4c6-b1	210	21	420	0	0.0952	1.4491E+01	1	0.00	0
n4c6-b2	1330	210	3990	0	0.0143	2.0203E-14	2	0.00	0
n4c6-b3	5970	1330	23880	0	0.0030	3.0999E+01	2	0.00	0
n4c6-b4	20058	5970	100290	0	0.0008	1.1372E-06	9	0.00	0
n4c6-b5	51813	20058	310878	0	0.0003	7.1632E+01	9	0.01	0

Table 2.5: Complete results for LSMR(1000) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
n4c6-b6	104115	51813	728805	-	0.0001	2.5905E-06	12	0.03	0
n4c6-b7	163215	104115	1305720	-	0.0001	1.0147E+02	11	0.06	0
n4c6-b8	198895	163215	1790055	-	0.0001	3.5572E-06	15	0.13	0
n4c6-b9	198895	186558	1865580	-	0.0001	4.4598E+02	0	0.01	0
NotreDame_actors (S)	383640	127823	1470404	-	0.0051	-	>3719	>600.00	19
Pd_rhs	5804	4371	6323	0	0.0069	3.6187E+01	161	0.08	0
photogrammetry2	4472	936	37056	7	0.0096	3.0388E+02	136	0.02	0
photogrammetry	1388	390	11816	7	0.0231	9.0895E+01	367	0.04	0
psse0 (S)	26722	11028	102432	0	0.0004	6.6360E+01	20991	298.90	0
psse1 (S)	14318	11028	57376	0	0.0016	3.5979E+01	17058	240.16	0
psse2 (S)	28634	11028	115262	0	0.0025	7.8597E+01	24225	347.81	0
QRpivot_b	391	1	391	0	1.0000	1.9774E+01	1	0.00	0
QRpivot	749	660	3808	0	0.0152	1.5593E+01	440	0.10	0
rel3	6	3	18	2	1.0000	2.4495E+00	1	0.00	0
rel4	28	10	104	5	0.4000	8.9676E-01	5	0.00	0
rel5	172	33	656	2	0.1212	5.3439E+00	23	0.00	0
rel6	1300	155	5101	2	0.0258	1.8073E+01	51	0.00	0
rel7	12770	1043	50636	2	0.0038	6.4132E+01	66	0.02	0
rel8	206040	12345	821839	2	0.0003	2.7707E+02	87	0.44	0
rel9 (S)	5921786	274667	23667183	-	0.0000	1.5416E+03	104	33.61	0
relat3	8	3	24	2	1.0000	2.8284E+00	1	0.00	0
relat4	46	10	172	5	0.4000	5.7639E+00	5	0.00	0
relat5	276	33	1058	2	0.1212	1.4900E+01	23	0.00	0
relat6	2063	155	8108	2	0.0258	4.1070E+01	42	0.00	0
relat7b	20500	1043	81355	1	0.0038	1.3429E+02	54	0.02	0
relat7	20500	1043	81355	1	0.0038	1.3429E+02	54	0.02	0
relat8	334362	12345	1334038	1	0.0003	5.5522E+02	73	0.59	0
relat9 (S)	9746232	274667	38955420	-	0.0000	3.0561E+03	86	49.01	0
rkat7_mat5	738	694	38114	0	0.3703	1.3022E+01	512	0.16	0
robot24c1_mat5_J	404	302	15118	0	0.3013	6.4681E+00	259	0.03	0
robot24c1_mat5	404	302	15118	0	0.3013	6.4681E+00	259	0.03	0
Rucci1 (S)	1977885	109900	7791168	0	0.0000	-	>3641	>600.00	19
Sandi_sandi	360	314	613	66	0.0191	1.1104E+01	242	0.01	0
shar_te2-b1	17160	286	34320	0	0.0070	6.1422E+01	4	0.00	0
shar_te2-b2	200200	17160	600600	0	0.0002	2.3032E-11	11	0.03	0
sls (S)	1748122	62729	6804304	0	0.0001	1.2376E-05	188	10.68	0
TF10	106	99	622	0	0.0909	9.4180E-04	99	0.00	0
TF11	235	216	1607	0	0.0463	2.1046E-14	217	0.01	0
TF12	551	488	4231	0	0.0225	1.7034E-04	488	0.09	0
TF13	1301	1121	11185	0	0.0107	3.5507E-07	5511	7.37	0
TF14 (S)	3159	2644	29862	0	0.0049	5.5730E-07	25235	87.75	0
TF15 (S)	7741	6334	80057	0	0.0022	-	>72421	>600.00	19
TF16 (S)	19320	15437	216173	0	0.0010	-	>29040	>600.00	19
TF17 (S)	48629	38132	586218	-	0.0004	-	>11921	>600.00	19
TF18 (S)	123867	95368	1597545	-	0.0002	-	>4964	>600.00	19
TF19 (S)	317955	241029	4370721	-	0.0001	-	>2167	>600.00	19
tomographic1 (S)	59360	45908	647495	3436	0.0003	-	>9992	>600.00	19
Trec10	475	106	8612	0	0.7453	1.6372E+01	86	0.00	0
Trec11	1136	235	35705	0	0.7617	2.6544E+01	145	0.02	0
Trec12	2724	551	151219	0	0.7586	4.3372E+01	273	0.09	0
Trec13	6560	1301	654517	0	0.7656	6.9694E+01	381	0.55	0
Trec14 (S)	15904	3159	2872265	0	0.7914	1.1217E+02	518	3.77	0
Trec3	1	1	1	0	1.0000	1.0000E+00	1	0.00	0
Trec4	2	2	3	0	1.0000	2.1505E-01	2	0.00	0
Trec5	6	3	12	0	1.0000	7.2162E-01	3	0.00	0
Trec6	14	6	40	0	0.8333	1.8260E+00	6	0.00	0
Trec7	35	11	147	0	0.8182	2.9716E+00	11	0.00	0
Trec8	83	23	549	0	0.7826	5.8826E+00	23	0.00	0
Trec9	200	47	2147	0	0.7660	9.7112E+00	44	0.00	0
well1033	1033	320	4732	0	0.0156	2.2534E+03	98	0.01	0
well1850	1850	712	8755	0	0.0070	1.0300E+03	341	0.08	0

Table 2.5: Complete results for LSMR(1000) all problems with no preconditioning (continued).

name	m	n	$nz(A)$	nullity	density	$\|r\|$	iterations	time	status
wheel_3_1	25	21	74	0	0.1429	2.2738E+00	21	0.00	0
wheel_4_1	41	36	122	0	0.0833	1.5091E+00	36	0.00	0
wheel_5_1	61	57	182	0	0.0526	1.1630E+00	57	0.00	0
wheel_601 (S)	902103	723605	2170814	-	0.0008	-	>948	>600.00	19
wheel_6_1	85	83	254	2	0.0361	2.5734E+00	80	0.00	0
wheel_7_1	114	113	338	4	0.0708	2.4398E+00	107	0.00	0
wm1	260	207	2909	0	0.2415	8.1946E+00	74	0.00	0
wm2	259	207	2942	0	0.2415	8.4071E+00	96	0.00	0
wm3	259	207	2948	0	0.2705	8.1940E+00	96	0.00	0
WorldCities	313	100	7518	0	0.9900	5.3353E+00	44	0.00	0

3 Subset results for all solution methods

In Tables 3.1–3.29, we provide statistics for runs of each of our solution methods on the subset of problems that were identified in Table 2.3 as being difficult for LSMR(10) without preconditioning. We compare un-preconditioned and diagonal, MIQR, RIF, and `HSL_MI35` (`lsize=rsize`=20) preconditioned LSMR, with `localsize`=0, 10, 100 and 1000, as well as `HSL_MI35`((`lsize=rsize`=10) using LSMR(10), BA-GMRES with the restart parameter `gmres_its` set to 100, 500 and 1000, and `HSL_MI30` preconditioned GMRES (restarted every 1000 iterations) and MINRES, as well as direct methods using `HSL_MA97` for both the normal equations and augmented system and SPQR. Here, additional columns marked "factors", "factor time" and "total time" give, respectively the storage required to hold the factors of the preconditioner, the elapsed time needed to compute the preconditioner, and the total elapsed time needed to solve the problem (including the construction of the preconditioner). Note that for BA-GMRES, the factor time is given as 0.00 since an explicit preconditioner is not constructed for this method and "storage" is the storage required by the underlying GMRES method (which, if restarting is needed, increases with the restart parameter `gmres_its`). For `HSL_MI30`, "factors" includes the storage required for the factors and running GMRES.

A − indicates that the statistic is not available, either because the particular method does not provide it, or an earlier phase has terminated the run. Status codes are described in Section 1.

In Tables 3.25 and 3.26, statistics $\|r\|/\|r_0\|$ and $\|A^Tr\|\|r_0\|/\|A^Tr_0\|$ $\|r\|$ are provided to indicate how large these quantities are compared to the tolerances 10^{-8} and 10^{-6} used by the other iterative methods.

In Tables 3.30–3.33, we rearrange data from the previous tables to allow a direct comparison of a particular statistic across the range of methods considered. We remove SPQR and `HSL_MA97` (for the augmented system) as these perform less well than `HSL_MA97` (for the normal equations). Similarly, MINRES preconditioned by `HSL_MI30` is included (and denoted by `MI30-MIN`) while GMRES preconditioned by `HSL_MI30` is omitted. For the iterative methods, we have selected what appears to be the "best" global choice of `localsize` or `gmres_its` as appropriate; these are `localsize`=0 for the un-preconditioned and diagonal LSMR, `localsize`=10 for the MIQR, RIF, and `HSL_MI35` versions, and `gmres_its`=1000 for BA-GMRES (denoted by BA-G). We report on the storage required for the factors (and for GMRES), the number of iterations performed, the elapsed time required to build the preconditioner and the total elapsed time to solve the problem. Note that, in Table 3.31, the iteration count for BA-GMRES is the number of GMRES iterations whereas for the other methods it is the number of LSMR iterations; the direct solvers are not included in this table since the iteration count is always 1. Finally, in Table 3.34, we summarize the computed residuals.

Table 3.1: Complete LSMR(0) results for subset CUTEst problems with no preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
BAS1LP	9825	5411	587775	0	14870	0.00	27.18	0	5.5448E+01
BAXTER	30733	27441	111576	0	>100000	0.00	>67.29	18	-
BCDOUT	7078	5412	67344	0	>100000	0.00	>28.51	18	-
CO9	22924	10789	109651	0	24925	0.00	12.93	0	8.9188E+01
CONT11_L	1961394	1468599	5382999	0	206	0.00	8.47	0	8.0916E+02
DBIR1	45775	18804	1077025	0	58936	0.00	8.87	0	3.4935E+01
DBIR2	45877	18906	1158159	0	1451	0.00	5.44	0	1.6711E+02
D2Q06C	5831	2171	33081	0	19090	0.00	82.11	0	1.6746E+02
DELF000	5543	3128	13741	0	>100000	0.00	>7.77	18	-
GE	16369	10099	44825	0	69445	0.00	20.64	0	7.2589E+01
LARGE001	7176	4162	18887	0	52505	0.00	5.55	0	6.0689E+01
LPL1	129959	39951	386218	0	30201	0.00	65.54	0	7.0878E+01
MOD2	66409	34774	199810	0	10664	0.00	11.92	0	1.3872E+02
MODEL10	16819	4400	150372	0	34369	0.00	18.64	0	5.3558E+01
MPSBCD03	7078	5412	66210	0	>100000	0.00	>28.30	18	-
NSCT2	37563	23003	697738	0	9991	0.00	25.19	0	1.8394E+02
NSIR2	10057	4453	154939	0	9611	0.00	5.12	0	8.0556E+01
PDE1	271792	270595	990587	0	906	0.00	6.27	0	3.0302E+02
PDS-100	514577	156016	1096002	0	681	0.00	6.08	0	2.8489E+02
PDS-90	475448	142596	1014136	0	639	0.00	5.18	0	2.6847E+02
PILOT-JA	2267	940	14977	0	>100000	0.00	>5.76	18	-
PILOTNOV	2446	975	13331	0	83448	0.00	4.47	0	3.5044E+01
RAIL2586	923269	2586	8011362	0	919	0.00	40.50	0	1.4113E+02
RAIL4284	1096894	4284	11284032	0	887	0.00	70.04	0	1.6948E+02
SPAL_004	321696	10203	46168124	0	>2572	0.00	>600.00	19	-
STAT96V2	957432	29089	2852184	0	986	0.00	11.18	0	9.7273E+02
STAT96V3	1113780	33841	3317736	0	1055	0.00	13.93	0	1.0492E+03
STAT96V4	63076	3173	491336	0	4144	0.00	6.63	0	1.2052E+02
STORMG21K	1377306	526185	3459881	0	1383	0.00	30.85	0	8.9636E+02
WATSON_1	386992	201155	1055093	0	2160	0.00	14.67	0	2.5495E+02
WATSON_2	677224	352013	1846391	0	1812	0.00	22.73	0	3.3569E+02
WORLD	67147	34506	198883	0	9811	0.00	10.53	0	1.4068E+02

Table 3.1: Complete LSMR(0) results for subset UF problems with no preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
12month1	872622	12471	22624727	0	>6310	0.00	>600.00	19	-
162bit	3606	3476	37118	0	29396	0.00	3.76	0	1.1788E+01
176bit	7441	7150	82270	0	>100000	0.00	40.30	0	1.8430E+01
192bit	13691	13093	154303	0	>100000	0.00	173.37	0	2.4862E+01
208bit	24430	23191	299756	0	>100000	0.00	>600.00	19	-
beaflw	500	492	53403	0	43875	0.00	4.07	0	5.0570E+00
c8_mat11	5761	4562	2462970	0	40787	0.00	175.75	0	2.2179E+01
connectus	394707	458	1127525	0	1748	0.00	7.56	0	6.2791E+02
ESOC	327062	37349	6019939	0	5604	0.00	157.20	0	4.0438E+02
EternityII_Etilde	204304	10054	1170516	0	1354	0.00	6.67	0	4.4561E-06
f855_mat9	2511	2456	171214	0	19017	0.00	6.03	0	1.7981E+01
GL7d16	955127	460260	14488881	0	61	0.00	13.99	0	7.4875E+02
GL7d17	1548649	955127	25978098	0	58	0.00	23.38	0	8.9897E+02
GL7d18	1955309	1548645	35590540	0	80	0.00	57.09	0	9.3184E+02
GL7d19	1955296	1911130	37322725	0	205	0.00	100.66	0	1.0426E+03
GL7d20	1911124	1437546	29893084	0	136	0.00	56.31	0	1.0916E+03
GL7d21	1437546	822922	18174775	0	143	0.00	33.19	0	1.0029E+03
GL7d22	822906	349443	8251000	0	238	0.00	20.68	0	7.8940E+02
GL7d23	349443	105054	2695430	0	340	0.00	6.90	0	5.3569E+02
graphics	29493	11822	117954	0	>100000	0.00	>600.00	19	-
HFE18_96_in	2372	2371	933343	0	30697	0.00	48.69	0	4.9100E-01
IG5-15	11369	6146	323509	0	4577	0.00	3.08	0	5.4856E+01
IG5-16	18846	9519	588326	0	7406	0.00	9.53	0	7.1510E+01
IG5-17	30162	14060	1035008	0	7264	0.00	18.04	0	9.1039E+01
IG5-18	47894	20818	1790490	0	7282	0.00	40.50	0	1.1518E+02
IMDB	896302	303617	3782463	0	>12955	0.00	>600.00	19	-
kneser_10_4_1	349651	330751	992252	0	17209	0.00	186.42	0	1.6241E+02
landmark	71952	2673	1146848	0	19937	0.00	43.35	0	1.3198E-05
LargeRegFile	2111154	801374	4944201	0	795	0.00	29.43	0	4.4422E+02
Maragal_6	21251	10144	537694	0	5178	0.00	5.87	0	1.0695E+01
Maragal_7	46845	26525	1200537	0	2769	0.00	8.76	0	1.3690E+01
Maragal_8	60845	33093	1308415	0	>100000	0.00	>600.00	19	-
mri1	114637	65536	589824	0	6108	0.00	16.60	0	2.6742E+01
mri2	104597	63240	569160	0	11852	0.00	24.04	0	1.4126E+02
NotreDame_actors	383640	127823	1470404	0	>52691	0.00	>600.00	19	-
psse0	26722	11028	102432	0	82324	0.00	31.74	0	6.6360E+01
psse1	14318	11028	57376	0	64151	0.00	18.95	0	3.5979E+01
psse2	28634	11028	115262	0	81831	0.00	34.75	0	7.8597E+01
rel9	5921786	274667	23667183	0	110	0.00	34.16	0	1.5416E+03
relat9	9746232	274667	38955420	0	88	0.00	48.46	0	3.0561E+03
Rucci1	1977885	109900	7791168	0	17837	0.00	596.42	0	7.2798E+02
sls	1748122	62729	6804304	0	638	0.00	33.75	0	1.3099E-05
TF14	3159	2644	29862	0	34727	0.00	3.42	0	5.5790E-07
TF15	7741	6334	80057	0	>100000	0.00	26.85	0	8.7869E-07
TF16	19320	15437	216173	0	>100000	0.00	209.74	0	1.3895E-06
TF17	48629	38132	586218	0	>100000	0.00	>600.00	19	-
TF18	123867	95368	1597545	0	>100000	0.00	>600.00	19	-
TF19	317955	241029	4370721	0	>32164	0.00	>600.00	19	-
tomographic1	59360	45908	647495	0	65455	0.00	145.39	0	4.2070E+01
Trec14	15904	3159	2872265	0	2007	0.00	14.54	0	1.1217E+02
wheel_601	902103	723605	2170814	0	>19475	0.00	>600.00	19	-

Table 3.2: Complete LSMR(10) results for subset CUTEst problems with no preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
BAS1LP	9825	5411	587775	0	13282	0.00	54.97	0	5.5448E+01
BAXTER	30733	27441	111576	0	>100000	0.00	>151.52	18	-
BCDOUT	7078	5412	67344	0	>100000	0.00	>63.78	18	-
CO9	22924	10789	109651	0	24677	0.00	27.44	0	8.9188E+01
CONT11_L	1961394	1468599	5382999	0	206	0.00	20.31	0	8.0916E+02
DBIR1	45775	18804	1077025	0	54090	0.00	17.77	0	3.4935E+01
DBIR2	45877	18906	1158159	0	1316	0.00	11.03	0	1.6711E+02
D2Q06C	5831	2171	33081	0	16969	0.00	152.19	0	1.6746E+02
DELF000	5543	3128	13741	0	>100000	0.00	>17.45	18	-
GE	16369	10099	44825	0	71285	0.00	45.74	0	7.2589E+01
LARGE001	7176	4162	18887	0	54427	0.00	12.85	0	6.0689E+01
LPL1	129959	39951	386218	0	29751	0.00	133.21	0	7.0878E+01
MOD2	66409	34774	199810	0	10665	0.00	25.76	0	1.3872E+02
MODEL10	16819	4400	150372	0	35115	0.00	42.68	0	5.3558E+01
MPSBCD03	7078	5412	66210	0	>100000	0.00	>63.41	18	-
NSCT2	37563	23003	697738	0	9120	0.00	51.19	0	1.8394E+02
NSIR2	10057	4453	154939	0	8695	0.00	10.44	0	8.0556E+01
PDE1	271792	270595	990587	0	1624	0.00	24.21	0	3.0302E+02
PDS-100	514577	156016	1096002	0	680	0.00	11.77	0	2.8489E+02
PDS-90	475448	142596	1014136	0	638	0.00	10.18	0	2.6847E+02
PILOT-JA	2267	940	14977	0	>100000	0.00	>13.02	18	-
PILOTNOV	2446	975	13331	0	95219	0.00	11.45	0	3.5044E+01
RAIL2586	923269	2586	8011362	0	880	0.00	75.90	0	1.4113E+02
RAIL4284	1096894	4284	11284032	0	864	0.00	122.27	0	1.6948E+02
SPAL_004	321696	10203	46168124	0	>1449	0.00	>600.00	19	-
STAT96V2	957432	29089	2852184	0	905	0.00	22.09	0	9.7273E+02
STAT96V3	1113780	33841	3317736	0	957	0.00	26.89	0	1.0492E+03
STAT96V4	63076	3173	491336	0	3883	0.00	13.83	0	1.2052E+02
STORMG21K	1377306	526185	3459881	0	1473	0.00	72.18	0	8.9636E+02
WATSON_1	386992	201155	1055093	0	2155	0.00	31.07	0	2.5495E+02
WATSON_2	677224	352013	1846391	0	1805	0.00	48.30	0	3.3569E+02
WORLD	67147	34506	198883	0	9811	0.00	24.03	0	1.4068E+02

Table 3.2: Complete LSMR(10) results for subset UF problems with no preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
12month1	872622	12471	22624727	0	>2597	0.00	>600.00	19	-
162bit	3606	3476	37118	0	26921	0.00	11.37	0	1.1788E+01
176bit	7441	7150	82270	0	>100000	0.00	>90.45	18	-
192bit	13691	13093	154303	0	>100000	0.00	>171.41	18	-
208bit	24430	23191	299756	0	>100000	0.00	>331.49	18	-
beaflw	500	492	53403	0	35466	0.00	13.25	0	5.0570E+00
c8_mat11	5761	4562	2462970	0	35084	0.00	598.16	0	2.2179E+01
connectus	394707	458	1127525	0	1651	0.00	17.96	0	6.2791E+02
ESOC	327062	37349	6019939	0	5476	0.00	323.33	0	4.0438E+02
EternityII_Etilde	204304	10054	1170516	0	1346	0.00	17.39	0	4.2976E-06
f855_mat9	2511	2456	171214	0	17681	0.00	21.91	0	1.7981E+01
GL7d16	955127	460260	14488881	0	60	0.00	16.19	0	7.4875E+02
GL7d17	1548649	955127	25978098	0	53	0.00	31.90	0	8.9897E+02
GL7d18	1955309	1548645	35590540	0	77	0.00	73.18	0	9.3184E+02
GL7d19	1955296	1911130	37322725	0	186	0.00	192.60	0	1.0426E+03
GL7d20	1911124	1437546	29893084	0	127	0.00	102.71	0	1.0916E+03
GL7d21	1437546	822922	18174775	0	133	0.00	56.79	0	1.0029E+03
GL7d22	822906	349443	8251000	0	215	0.00	34.74	0	7.8940E+02
GL7d23	349443	105054	2695430	0	309	0.00	14.10	0	5.3569E+02
graphics	29493	11822	117954	0	>100000	0.00	>126.24	18	-
HFE18_96_in	2372	2371	933343	0	30649	0.00	195.62	0	4.9100E-01
IG5-15	11369	6146	323509	0	4245	0.00	10.53	0	5.4856E+01
IG5-16	18846	9519	588326	0	6853	0.00	31.16	0	7.1510E+01
IG5-17	30162	14060	1035008	0	6732	0.00	56.32	0	9.1039E+01
IG5-18	47894	20818	1790490	0	6765	0.00	106.63	0	1.1518E+02
IMDB	896302	303617	3782463	0	>6037	0.00	>600.00	19	-
kneser_10_4_1	349651	330751	992252	0	17201	0.00	450.84	0	1.6241E+02
landmark	71952	2673	1146848	0	19532	0.00	159.79	0	1.3198E-05
LargeRegFile	2111154	801374	4944201	0	536	0.00	48.95	0	4.4422E+02
Maragal_6	21251	10144	537694	0	5105	0.00	21.22	0	1.0695E+01
Maragal_7	46845	26525	1200537	0	2750	0.00	28.44	0	1.3690E+01
Maragal_8	60845	33093	1308415	0	>50797	0.00	>600.00	19	-
mri1	114637	65536	589824	0	5723	0.00	43.56	0	2.6742E+01
mri2	104597	63240	569160	0	10639	0.00	65.80	0	1.4126E+02
NotreDame_actors	383640	127823	1470404	0	>22439	0.00	>600.00	19	-
psse0	26722	11028	102432	0	79853	0.00	95.63	0	6.6360E+01
psse1	14318	11028	57376	0	63802	0.00	57.91	0	3.5979E+01
psse2	28634	11028	115262	0	80282	0.00	109.24	0	7.8597E+01
rel9	5921786	274667	23667183	0	109	0.00	73.15	0	1.5416E+03
relat9	9746232	274667	38955420	0	88	0.00	108.24	0	3.0561E+03
Rucci1	1977885	109900	7791168	0	>7116	0.00	>600.00	19	-
sls	1748122	62729	6804304	0	546	0.00	56.34	0	1.3097E-05
TF14	3159	2644	29862	0	34660	0.00	11.09	0	5.6203E-07
TF15	7741	6334	80057	0	>100000	0.00	>81.99	18	-
TF16	19320	15437	216173	0	>100000	0.00	>215.04	18	-
TF17	48629	38132	586218	0	>99274	0.00	>600.00	19	-
TF18	123867	95368	1597545	0	>35408	0.00	>600.00	19	-
TF19	317955	241029	4370721	0	>12216	0.00	>600.00	19	-
tomographic1	59360	45908	647495	0	65150	0.00	457.79	0	4.2070E+01
Trec14	15904	3159	2872265	0	1797	0.00	37.15	0	1.1217E+02
wheel_601	902103	723605	2170814	0	>9255	0.00	>600.00	19	-

Table 3.3: Complete LSMR(100) results for subset CUTEst problems with no preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
BAS1LP	9825	5411	587775	0	7274	0.00	18.85	0	5.5448E+01
BAXTER	30733	27441	111576	0	>100000	0.00	>429.47	18	-
BCDOUT	7078	5412	67344	0	88663	0.00	86.19	0	3.5431E+01
CO9	22924	10789	109651	0	22511	0.00	43.06	0	8.9188E+01
CONT11_L	1961394	1468599	5382999	0	206	0.00	60.34	0	8.0916E+02
DBIR1	45775	18804	1077025	0	29611	0.00	12.35	0	3.4935E+01
DBIR2	45877	18906	1158159	0	784	0.00	4.85	0	1.6711E+02
D2Q06C	5831	2171	33081	0	6344	0.00	41.21	0	1.6746E+02
DELF000	5543	3128	13741	0	>100000	0.00	>46.80	18	-
GE	16369	10099	44825	0	31178	0.00	50.65	0	7.2589E+01
LARGE001	7176	4162	18887	0	48771	0.00	30.36	0	6.0689E+01
LPL1	129959	39951	386218	0	20930	0.00	158.44	0	7.0878E+01
MOD2	66409	34774	199810	0	8201	0.00	46.42	0	1.3872E+02
MODEL10	16819	4400	150372	0	19180	0.00	20.93	0	5.3558E+01
MPSBCD03	7078	5412	66210	0	>100000	0.00	>95.83	18	-
NSCT2	37563	23003	697738	0	3110	0.00	17.61	0	1.8394E+02
NSIR2	10057	4453	154939	0	2963	0.00	3.20	0	8.0556E+01
PDE1	271792	270595	990587	0	1528	0.00	64.25	0	3.0302E+02
PDS-100	514577	156016	1096002	0	659	0.00	21.79	0	2.8489E+02
PDS-90	475448	142596	1014136	0	620	0.00	16.23	0	2.6847E+02
PILOT-JA	2267	940	14977	0	9140	0.00	1.60	0	3.3279E+01
PILOTNOV	2446	975	13331	0	3555	0.00	0.62	0	3.5043E+01
RAIL2586	923269	2586	8011362	0	696	0.00	33.48	0	1.4113E+02
RAIL4284	1096894	4284	11284032	0	716	0.00	55.30	0	1.6948E+02
SPAL_004	321696	10203	46168124	0	>2498	0.00	>600.00	19	-
STAT96V2	957432	29089	2852184	0	858	0.00	12.80	0	9.7273E+02
STAT96V3	1113780	33841	3317736	0	907	0.00	15.86	0	1.0492E+03
STAT96V4	63076	3173	491336	0	3331	0.00	6.74	0	1.2052E+02
STORMG21K	1377306	526185	3459881	0	267	0.00	23.80	0	8.9636E+02
WATSON_1	386992	201155	1055093	0	2051	0.00	67.75	0	2.5495E+02
WATSON_2	677224	352013	1846391	0	1707	0.00	101.16	0	3.3569E+02
WORLD	67147	34506	198883	0	7123	0.00	39.88	0	1.4068E+02

Table 3.3: Complete LSMR(100) results for subset UF problems with no preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
12month1	872622	12471	22624727	0	>5907	0.00	>600.00	19	-
162bit	3606	3476	37118	0	18581	0.00	10.28	0	1.1788E+01
176bit	7441	7150	82270	0	83561	0.00	98.11	0	1.8430E+01
192bit	13691	13093	154303	0	>100000	0.00	378.86	0	2.4862E+01
208bit	24430	23191	299756	0	>100000	0.00	>600.00	19	-
beaflw	500	492	53403	0	7528	0.00	1.14	0	5.0568E+00
c8_mat11	5761	4562	2462970	0	16131	0.00	80.16	0	2.2179E+01
connectus	394707	458	1127525	0	1129	0.00	4.79	0	6.2791E+02
ESOC	327062	37349	6019939	0	2749	0.00	77.11	0	4.0438E+02
EternityII_Etilde	204304	10054	1170516	0	1317	0.00	8.06	0	4.2297E-06
f855_mat9	2511	2456	171214	0	9340	0.00	5.81	0	1.7981E+01
GL7d16	955127	460260	14488881	0	59	0.00	12.83	0	7.4875E+02
GL7d17	1548649	955127	25978098	0	51	0.00	21.37	0	8.9897E+02
GL7d18	1955309	1548645	35590540	0	68	0.00	49.26	0	9.3184E+02
GL7d19	1955296	1911130	37322725	0	111	0.00	86.74	0	1.0426E+03
GL7d20	1911124	1437546	29893084	0	83	0.00	47.53	0	1.0916E+03
GL7d21	1437546	822922	18174775	0	91	0.00	28.76	0	1.0029E+03
GL7d22	822906	349443	8251000	0	139	0.00	16.20	0	7.8940E+02
GL7d23	349443	105054	2695430	0	172	0.00	5.39	0	5.3569E+02
graphics	29493	11822	117954	0	>100000	0.00	>600.00	19	-
HFE18_96_in	2372	2371	933343	0	30429	0.00	58.36	0	4.9100E-01
IG5-15	11369	6146	323509	0	3010	0.00	4.31	0	5.4856E+01
IG5-16	18846	9519	588326	0	4733	0.00	11.71	0	7.1510E+01
IG5-17	30162	14060	1035008	0	4993	0.00	21.63	0	9.1039E+01
IG5-18	47894	20818	1790490	0	4885	0.00	40.40	0	1.1518E+02
IMDB	896302	303617	3782463	0	>5914	0.00	>600.00	19	-
kneser_10_4_1	349651	330751	992252	0	>9806	0.00	>600.00	19	-
landmark	71952	2673	1146848	0	20425	0.00	51.71	0	1.3198E-05
LargeRegFile	2111154	801374	4944201	0	132	0.00	18.40	0	4.4422E+02
Maragal_6	21251	10144	537694	0	4582	0.00	10.93	0	1.0695E+01
Maragal_7	46845	26525	1200537	0	2572	0.00	16.57	0	1.3690E+01
Maragal_8	60845	33093	1308415	0	>70142	0.00	>600.00	19	-
mri1	114637	65536	589824	0	4568	0.00	51.72	0	2.6742E+01
mri2	104597	63240	569160	0	7015	0.00	74.62	0	1.4126E+02
NotreDame_actors	383640	127823	1470404	0	>20780	0.00	>600.00	19	-
psse0	26722	11028	102432	0	56090	0.00	100.67	0	6.6360E+01
psse1	14318	11028	57376	0	45700	0.00	78.32	0	3.5979E+01
psse2	28634	11028	115262	0	58262	0.00	107.39	0	7.8597E+01
rel9	5921786	274667	23667183	0	104	0.00	34.77	0	1.5416E+03
relat9	9746232	274667	38955420	0	86	0.00	50.62	0	3.0561E+03
Rucci1	1977885	109900	7791168	0	>12348	0.00	>600.00	19	-
sls	1748122	62729	6804304	0	272	0.00	14.55	0	1.2387E-05
TF14	3159	2644	29862	0	32812	0.00	14.49	0	5.6016E-07
TF15	7741	6334	80057	0	>100000	0.00	105.23	0	8.7825E-07
TF16	19320	15437	216173	0	>100000	0.00	>600.00	19	-
TF17	48629	38132	586218	0	>87330	0.00	>600.00	19	-
TF18	123867	95368	1597545	0	>32744	0.00	>600.00	19	-
TF19	317955	241029	4370721	0	>11875	0.00	>600.00	19	-
tomographic1	59360	45908	647495	0	62492	0.00	515.29	0	4.2070E+01
Trec14	15904	3159	2872265	0	1148	0.00	7.49	0	1.1217E+02
wheel_601	902103	723605	2170814	0	>3584	0.00	>600.00	19	-

Table 3.4: Complete LSMR(1000) results for subset CUTEst problems with no preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
BAS1LP	9825	5411	587775	0	953	0.00	5.06	0	5.5448E+01
BAXTER	30733	27441	111576	0	9064	0.00	323.68	0	9.7609E+01
BCDOUT	7078	5412	67344	0	29576	0.00	214.33	0	3.5431E+01
CO9	22924	10789	109651	0	8356	0.00	116.14	0	8.9188E+01
CONT11_L	1961394	1468599	5382999	0	206	0.00	91.72	0	8.0916E+02
DBIR1	45775	18804	1077025	0	616	0.00	0.64	0	3.4935E+01
DBIR2	45877	18906	1158159	0	364	0.00	3.12	0	1.6711E+02
D2Q06C	5831	2171	33081	0	563	0.00	6.41	0	1.6746E+02
DELF000	5543	3128	13741	0	1498	0.00	4.20	0	5.3817E+01
GE	16369	10099	44825	0	1498	0.00	13.63	0	7.2589E+01
LARGE001	7176	4162	18887	0	1246	0.00	4.20	0	6.0689E+01
LPL1	129959	39951	386218	0	1740	0.00	71.26	0	7.0878E+01
MOD2	66409	34774	199810	0	650	0.00	10.69	0	1.3872E+02
MODEL10	16819	4400	150372	0	758	0.00	2.09	0	5.3558E+01
MPSBCD03	7078	5412	66210	0	35179	0.00	255.89	0	3.5371E+01
NSCT2	37563	23003	697738	0	317	0.00	2.40	0	1.8394E+02
NSIR2	10057	4453	154939	0	362	0.00	0.59	0	8.0556E+01
PDE1	271792	270595	990587	0	1515	0.00	407.99	0	3.0302E+02
PDS-100	514577	156016	1096002	0	566	0.00	40.13	0	2.8489E+02
PDS-90	475448	142596	1014136	0	543	0.00	33.94	0	2.6847E+02
PILOT-JA	2267	940	14977	0	258	0.00	0.05	0	3.3251E+01
PILOTNOV	2446	975	13331	0	264	0.00	0.06	0	3.5035E+01
RAIL2586	923269	2586	8011362	0	441	0.00	20.27	0	1.4113E+02
RAIL4284	1096894	4284	11284032	0	489	0.00	40.40	0	1.6948E+02
SPAL_004	321696	10203	46168124	0	>2631	0.00	>600.00	19	-
STAT96V2	957432	29089	2852184	0	820	0.00	22.71	0	9.7273E+02
STAT96V3	1113780	33841	3317736	0	865	0.00	29.16	0	1.0492E+03
STAT96V4	63076	3173	491336	0	1929	0.00	9.34	0	1.2052E+02
STORMG21K	1377306	526185	3459881	0	142	0.00	12.66	0	8.9636E+02
WATSON_1	386992	201155	1055093	0	1724	0.00	363.20	0	2.5495E+02
WATSON_2	677224	352013	1846391	0	1462	0.00	534.22	0	3.3569E+02
WORLD	67147	34506	198883	0	594	0.00	8.88	0	1.4068E+02

Table 3.4: Complete LSMR(1000) results for subset UF problems with no preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
12month1	872622	12471	22624727	0	>5535	0.00	>600.00	19	-
162bit	3606	3476	37118	0	8719	0.00	37.10	0	1.1788E+01
176bit	7441	7150	82270	0	38860	0.00	361.46	0	1.8430E+01
192bit	13691	13093	154303	0	>35534	0.00	>600.00	19	-
208bit	24430	23191	299756	0	>19983	0.00	>600.00	19	-
beaflw	500	492	53403	0	373	0.00	0.09	0	5.0539E+00
c8_mat11	5761	4562	2462970	0	8129	0.00	78.65	0	2.2179E+01
connectus	394707	458	1127525	0	342	0.00	1.49	0	6.2791E+02
ESOC	327062	37349	6019939	0	356	0.00	10.86	0	4.0438E+02
EternityII_Etilde	204304	10054	1170516	0	843	0.00	8.91	0	4.3764E-06
f855_mat9	2511	2456	171214	0	3349	0.00	9.92	0	1.7981E+01
GL7d16	955127	460260	14488881	0	59	0.00	8.70	0	7.4875E+02
GL7d17	1548649	955127	25978098	0	51	0.00	18.07	0	8.9897E+02
GL7d18	1955309	1548645	35590540	0	68	0.00	40.66	0	9.3184E+02
GL7d19	1955296	1911130	37322725	0	110	0.00	83.12	0	1.0426E+03
GL7d20	1911124	1437546	29893084	0	83	0.00	44.57	0	1.0916E+03
GL7d21	1437546	822922	18174775	0	91	0.00	23.91	0	1.0029E+03
GL7d22	822906	349443	8251000	0	125	0.00	13.06	0	7.8940E+02
GL7d23	349443	105054	2695430	0	143	0.00	4.41	0	5.3569E+02
graphics	29493	11822	117954	0	>39699	0.00	>600.00	19	-
HFE18_96_in	2372	2371	933343	0	24116	0.00	109.11	0	4.9100E-01
IG5-15	11369	6146	323509	0	1613	0.00	9.66	0	5.4856E+01
IG5-16	18846	9519	588326	0	2559	0.00	27.87	0	7.1510E+01
IG5-17	30162	14060	1035008	0	2825	0.00	48.67	0	9.1039E+01
IG5-18	47894	20818	1790490	0	2776	0.00	77.62	0	1.1518E+02
IMDB	896302	303617	3782463	0	>1731	0.00	>600.00	19	-
kneser_10_4_1	349651	330751	992252	0	>1719	0.00	>600.00	19	-
landmark	71952	2673	1146848	0	18053	0.00	98.26	0	1.3198E-05
LargeRegFile	2111154	801374	4944201	0	112	0.00	13.30	0	4.4422E+02
Maragal_6	21251	10144	537694	0	2609	0.00	30.21	0	1.0695E+01
Maragal_7	46845	26525	1200537	0	1477	0.00	38.45	0	1.3690E+01
Maragal_8	60845	33093	1308415	0	>13184	0.00	>600.00	19	-
mri1	114637	65536	589824	0	3356	0.00	256.14	0	2.6742E+01
mri2	104597	63240	569160	0	3439	0.00	257.16	0	1.4126E+02
NotreDame_actors	383640	127823	1470404	0	>3708	0.00	>600.00	19	-
psse0	26722	11028	102432	0	20991	0.00	298.67	0	6.6360E+01
psse1	14318	11028	57376	0	17058	0.00	240.53	0	3.5979E+01
psse2	28634	11028	115262	0	24225	0.00	351.03	0	7.8597E+01
rel9	5921786	274667	23667183	0	104	0.00	37.89	0	1.5416E+03
relat9	9746232	274667	38955420	0	86	0.00	48.68	0	3.0561E+03
Rucci1	1977885	109900	7791168	0	>3721	0.00	>600.00	19	-
sls	1748122	62729	6804304	0	188	0.00	9.43	0	1.2376E-05
TF14	3159	2644	29862	0	25235	0.00	85.86	0	5.5730E-07
TF15	7741	6334	80057	0	>73085	0.00	>600.00	19	-
TF16	19320	15437	216173	0	>29515	0.00	>600.00	19	-
TF17	48629	38132	586218	0	>11952	0.00	>600.00	19	-
TF18	123867	95368	1597545	0	>4978	0.00	>600.00	19	-
TF19	317955	241029	4370721	0	>2171	0.00	>600.00	19	-
tomographic1	59360	45908	647495	0	>10101	0.00	>600.00	19	-
Trec14	15904	3159	2872265	0	518	0.00	3.62	0	1.1217E+02
wheel_601	902103	723605	2170814	0	>946	0.00	>600.00	19	-

Table 3.5: Complete LSMR(0) results for subset CUTEst problems with diagonal preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
BAS1LP	9825	5411	587775	5411	7610	0.00	14.10	0	5.5447E+01
BAXTER	30733	27441	111576	27441	>100000	0.00	>86.64	18	-
BCDOUT	7078	5412	67344	5412	>100000	0.00	>32.47	18	-
CO9	22924	10789	109651	10789	5063	0.00	2.98	0	8.9188E+01
CONT11_L	1961394	1468599	5382999	1468599	206	0.01	10.76	0	8.0916E+02
DBIR1	45775	18804	1077025	2171	1597	0.00	0.27	0	3.4934E+01
DBIR2	45877	18906	1158159	18804	2229	0.00	8.79	0	1.6669E+02
D2Q06C	5831	2171	33081	18906	2208	0.00	9.45	0	1.6651E+02
DELF000	5543	3128	13741	3128	26469	0.00	2.65	0	5.3817E+01
GE	16369	10099	44825	10099	6249	0.00	2.29	0	7.2447E+01
LARGE001	7176	4162	18887	4162	26782	0.00	3.69	0	6.0680E+01
LPL1	129959	39951	386218	39951	3175	0.00	7.88	0	7.0878E+01
MOD2	66409	34774	199810	34774	1370	0.00	1.83	0	1.3872E+02
MODEL10	16819	4400	150372	4400	2229	0.00	1.28	0	5.3554E+01
MPSBCD03	7078	5412	66210	5412	>100000	0.00	>32.57	18	-
NSCT2	37563	23003	697738	23003	1395	0.00	3.80	0	1.8379E+02
NSIR2	10057	4453	154939	4453	1037	0.00	0.59	0	8.0492E+01
PDE1	271792	270595	990587	270595	965	0.00	8.38	0	3.0302E+02
PDS-100	514577	156016	1096002	156016	342	0.00	5.24	0	2.8489E+02
PDS-90	475448	142596	1014136	142596	331	0.00	4.60	0	2.6847E+02
PILOT-JA	2267	940	14977	940	2344	0.00	0.18	0	3.1987E+01
PILOTNOV	2446	975	13331	975	1927	0.00	0.12	0	3.2873E+01
RAIL2586	923269	2586	8011362	2586	401	0.01	17.64	0	1.4113E+02
RAIL4284	1096894	4284	11284032	4284	733	0.01	55.71	0	1.6948E+02
SPAL_004	321696	10203	46168124	10203	>2507	0.04	>600.00	19	-
STAT96V2	957432	29089	2852184	29089	726	0.00	8.21	0	9.7273E+02
STAT96V3	1113780	33841	3317736	33841	765	0.00	10.46	0	1.0492E+03
STAT96V4	63076	3173	491336	3173	810	0.00	1.35	0	1.2052E+02
STORMG21K	1377306	526185	3459881	526185	183	0.01	5.14	0	8.9636E+02
WATSON_1	386992	201155	1055093	201155	422	0.00	3.39	0	2.5495E+02
WATSON_2	677224	352013	1846391	352013	349	0.00	5.25	0	3.3569E+02
WORLD	67147	34506	198883	34506	1369	0.00	1.82	0	1.4068E+02

Table 3.5: Complete LSMR(0) results for subset UF problems with diagonal preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
12month1	872622	12471	22624727	12471	268	0.06	26.26	0	9.2740E+02
162bit	3606	3476	37118	3476	2540	0.00	0.39	0	1.1771E+01
176bit	7441	7150	82270	7150	6537	0.00	2.14	0	1.8417E+01
192bit	13691	13093	154303	13093	12203	0.00	7.66	0	2.4855E+01
208bit	24430	23191	299756	23191	17073	0.00	21.08	0	3.8506E+01
beaflw	500	492	53403	492	40985	0.00	4.04	0	4.5721E+00
c8_mat11	5761	4562	2462970	4562	38344	0.00	171.65	0	2.1947E+01
connectus	394707	458	1127525	458	7	0.00	0.03	0	6.2791E+02
ESOC	327062	37349	6019939	37349	15004	0.01	332.98	0	2.2335E+01
EternityII_Etilde	204304	10054	1170516	10054	1122	0.00	5.69	0	4.5124E-06
f855_mat9	2511	2456	171214	2456	20354	0.00	6.81	0	1.7978E+01
GL7d16	955127	460260	14488881	460260	48	0.01	13.44	0	7.4875E+02
GL7d17	1548649	955127	25978098	955127	48	0.03	24.26	0	8.9897E+02
GL7d18	1955309	1548645	35590540	1548645	64	0.04	39.84	0	9.3184E+02
GL7d19	1955296	1911130	37322725	1911130	53	0.04	28.33	0	1.0426E+03
GL7d20	1911124	1437546	29893084	1437546	31	0.03	16.13	0	1.0916E+03
GL7d21	1437546	822922	18174775	822922	26	0.02	7.33	0	1.0029E+03
GL7d22	822906	349443	8251000	349443	24	0.01	2.35	0	7.8940E+02
GL7d23	349443	105054	2695430	105054	24	0.00	0.53	0	5.3569E+02
graphics	29493	11822	117954	11822	>100000	0.00	>47.86	18	-
HFE18_96_in	2372	2371	933343	2371	15102	0.00	24.58	0	4.9063E-01
IG5-15	11369	6146	323509	6146	608	0.00	0.43	0	5.4856E+01
IG5-16	18846	9519	588326	9519	863	0.00	1.22	0	7.1510E+01
IG5-17	30162	14060	1035008	14060	828	0.00	2.39	0	9.1039E+01
IG5-18	47894	20818	1790490	20818	738	0.00	4.55	0	1.1518E+02
IMDB	896302	303617	3782463	303617	>10670	0.01	>600.00	19	-
kneser_10_4_1	349651	330751	992252	330751	10781	0.00	142.54	0	1.6241E+02
landmark	71952	2673	1146848	2673	894	0.00	1.96	0	1.1276E-05
LargeRegFile	2111154	801374	4944201	801374	54	0.01	2.44	0	4.4422E+02
Maragal_6	21251	10144	537694	10144	1942	0.00	2.32	0	1.0695E+01
Maragal_7	46845	26525	1200537	26525	1071	0.00	3.47	0	1.3690E+01
Maragal_8	60845	33093	1308415	33093	>100000	0.00	>422.80	18	-
mri1	114637	65536	589824	65536	6116	0.00	18.17	0	2.6742E+01
mri2	104597	63240	569160	63240	11822	0.00	30.06	0	1.4126E+02
NotreDame_actors	383640	127823	1470404	127823	>49880	0.00	>600.00	19	-
psse0	26722	11028	102432	11028	43122	0.00	20.05	0	6.6359E+01
psse1	14318	11028	57376	11028	50610	0.00	18.91	0	3.5920E+01
psse2	28634	11028	115262	11028	58572	0.00	29.48	0	7.8596E+01
rel9	5921786	274667	23667183	274667	81	0.02	26.57	0	1.5416E+03
relat9	9746232	274667	38955420	274667	76	0.03	44.81	0	3.0561E+03
Rucci1	1977885	109900	7791168	109900	8330	0.01	321.85	0	7.2798E+02
sls	1748122	62729	6804304	62729	189	0.01	9.84	0	1.2361E-05
TF14	3159	2644	29862	2644	25709	0.00	3.03	0	5.5837E-07
TF15	7741	6334	80057	6334	81922	0.00	24.25	0	8.7862E-07
TF16	19320	15437	216173	15437	>100000	0.00	>75.68	18	-
TF17	48629	38132	586218	38132	>100000	0.00	>212.92	18	-
TF18	123867	95368	1597545	95368	>93527	0.00	>600.00	19	-
TF19	317955	241029	4370721	241029	>30368	0.00	>600.00	19	-
tomographic1	59360	45908	647495	45908	18905	0.00	48.55	0	4.1954E+01
Trec14	15904	3159	2872265	3159	1593	0.00	9.78	0	1.1217E+02
wheel_601	902103	723605	2170814	723605	>18285	0.01	>600.00	19	-

Table 3.6: Complete LSMR(10) results for subset CUTEst problems with diagonal preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
BAS1LP	9825	5411	587775	5411	7251	0.00	15.24	0	5.5447E+01
BAXTER	30733	27441	111576	27441	>100000	0.00	>125.56	18	-
BCDOUT	7078	5412	67344	5412	>100000	0.00	>39.31	18	-
CO9	22924	10789	109651	10789	5052	0.00	3.70	0	8.9188E+01
CONT11_L	1961394	1468599	5382999	1468599	206	0.01	18.10	0	8.0916E+02
DBIR1	45775	18804	1077025	2171	1590	0.00	0.31	0	3.4934E+01
DBIR2	45877	18906	1158159	18804	2178	0.00	9.33	0	1.6669E+02
D2Q06C	5831	2171	33081	18906	2153	0.00	9.94	0	1.6651E+02
DELF000	5543	3128	13741	3128	26430	0.00	3.72	0	5.3817E+01
GE	16369	10099	44825	10099	6165	0.00	3.09	0	7.2447E+01
LARGE001	7176	4162	18887	4162	26742	0.00	5.05	0	6.0680E+01
LPL1	129959	39951	386218	39951	3161	0.00	10.13	0	7.0878E+01
MOD2	66409	34774	199810	34774	1368	0.00	2.56	0	1.3872E+02
MODEL10	16819	4400	150372	4400	2222	0.00	1.42	0	5.3554E+01
MPSBCD03	7078	5412	66210	5412	>100000	0.00	>39.13	18	-
NSCT2	37563	23003	697738	23003	1354	0.00	4.13	0	1.8379E+02
NSIR2	10057	4453	154939	4453	999	0.00	0.63	0	8.0492E+01
PDE1	271792	270595	990587	270595	869	0.00	11.23	0	3.0302E+02
PDS-100	514577	156016	1096002	156016	342	0.00	4.21	0	2.8489E+02
PDS-90	475448	142596	1014136	142596	331	0.00	3.67	0	2.6847E+02
PILOT-JA	2267	940	14977	940	2291	0.00	0.19	0	3.1987E+01
PILOTNOV	2446	975	13331	975	1894	0.00	0.14	0	3.2873E+01
RAIL2586	923269	2586	8011362	2586	393	0.01	18.49	0	1.4113E+02
RAIL4284	1096894	4284	11284032	4284	720	0.01	57.02	0	1.6948E+02
SPAL_004	321696	10203	46168124	10203	>2645	0.04	>600.00	19	-
STAT96V2	957432	29089	2852184	29089	724	0.00	8.93	0	9.7273E+02
STAT96V3	1113780	33841	3317736	33841	763	0.00	10.86	0	1.0492E+03
STAT96V4	63076	3173	491336	3173	809	0.00	1.40	0	1.2052E+02
STORMG21K	1377306	526185	3459881	526185	178	0.01	6.76	0	8.9636E+02
WATSON_1	386992	201155	1055093	201155	422	0.00	4.88	0	2.5495E+02
WATSON_2	677224	352013	1846391	352013	349	0.00	7.25	0	3.3569E+02
WORLD	67147	34506	198883	34506	1368	0.00	2.55	0	1.4068E+02

Table 3.6: Complete LSMR(10) results for subset UF problems with diagonal preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
12month1	872622	12471	22624727	12471	254	0.02	26.60	0	9.2740E+02
162bit	3606	3476	37118	3476	2538	0.00	0.48	0	1.1771E+01
176bit	7441	7150	82270	7150	6531	0.00	2.70	0	1.8417E+01
192bit	13691	13093	154303	13093	12188	0.00	9.60	0	2.4855E+01
208bit	24430	23191	299756	23191	17052	0.00	26.17	0	3.8506E+01
beaflw	500	492	53403	492	36582	0.00	3.68	0	4.5729E+00
c8_mat11	5761	4562	2462970	4562	33886	0.00	151.63	0	2.1947E+01
connectus	394707	458	1127525	458	7	0.00	0.04	0	6.2791E+02
ESOC	327062	37349	6019939	37349	14911	0.01	533.18	0	2.2335E+01
EternityII_Etilde	204304	10054	1170516	10054	1125	0.00	5.62	0	4.3441E-06
f855_mat9	2511	2456	171214	2456	18906	0.00	6.73	0	1.7978E+01
GL7d16	955127	460260	14488881	460260	48	0.02	9.37	0	7.4875E+02
GL7d17	1548649	955127	25978098	955127	47	0.03	16.27	0	8.9897E+02
GL7d18	1955309	1548645	35590540	1548645	63	0.05	45.49	0	9.3184E+02
GL7d19	1955296	1911130	37322725	1911130	53	0.04	32.87	0	1.0426E+03
GL7d20	1911124	1437546	29893084	1437546	31	0.03	14.08	0	1.0916E+03
GL7d21	1437546	822922	18174775	822922	26	0.02	6.62	0	1.0029E+03
GL7d22	822906	349443	8251000	349443	24	0.01	2.50	0	7.8940E+02
GL7d23	349443	105054	2695430	105054	24	0.00	0.63	0	5.3569E+02
graphics	29493	11822	117954	11822	>100000	0.00	>61.43	18	-
HFE18_96_in	2372	2371	933343	2371	15067	0.00	24.98	0	4.9063E-01
IG5-15	11369	6146	323509	6146	589	0.00	0.46	0	5.4856E+01
IG5-16	18846	9519	588326	9519	832	0.00	1.38	0	7.1510E+01
IG5-17	30162	14060	1035008	14060	799	0.00	2.69	0	9.1039E+01
IG5-18	47894	20818	1790490	20818	715	0.00	5.04	0	1.1518E+02
IMDB	896302	303617	3782463	303617	>9821	0.01	>600.00	19	-
kneser_10_4_1	349651	330751	992252	330751	10778	0.00	208.56	0	1.6241E+02
landmark	71952	2673	1146848	2673	895	0.00	2.03	0	1.1276E-05
LargeRegFile	2111154	801374	4944201	801374	54	0.01	3.26	0	4.4422E+02
Maragal_6	21251	10144	537694	10144	1912	0.00	2.52	0	1.0695E+01
Maragal_7	46845	26525	1200537	26525	1053	0.00	3.77	0	1.3690E+01
Maragal_8	60845	33093	1308415	33093	>100000	0.00	>471.61	18	-
mri1	114637	65536	589824	65536	5709	0.00	26.51	0	2.6742E+01
mri2	104597	63240	569160	63240	10651	0.00	37.30	0	1.4126E+02
NotreDame_actors	383640	127823	1470404	127823	>39243	0.00	>600.00	19	-
psse0	26722	11028	102432	11028	43175	0.00	25.78	0	6.6359E+01
psse1	14318	11028	57376	11028	50349	0.00	25.66	0	3.5920E+01
psse2	28634	11028	115262	11028	58388	0.00	37.66	0	7.8596E+01
rel9	5921786	274667	23667183	274667	81	0.03	25.26	0	1.5416E+03
relat9	9746232	274667	38955420	274667	76	0.03	43.40	0	3.0561E+03
Rucci1	1977885	109900	7791168	109900	8326	0.01	301.52	0	7.2798E+02
sls	1748122	62729	6804304	62729	187	0.01	9.43	0	1.2327E-05
TF14	3159	2644	29862	2644	25531	0.00	3.78	0	5.5874E-07
TF15	7741	6334	80057	6334	81671	0.00	29.85	0	8.7982E-07
TF16	19320	15437	216173	15437	>100000	0.00	>100.44	18	-
TF17	48629	38132	586218	38132	>100000	0.00	>276.54	18	-
TF18	123867	95368	1597545	95368	>73908	0.00	>600.00	19	-
TF19	317955	241029	4370721	241029	>24189	0.01	>600.00	19	-
tomographic1	59360	45908	647495	45908	18822	0.00	67.73	0	4.1954E+01
Trec14	15904	3159	2872265	3159	1389	0.00	9.19	0	1.1217E+02
wheel_601	902103	723605	2170814	723605	>11457	0.01	>600.00	19	-

Table 3.7: Complete LSMR(100) results for subset CUTEst problems with diagonal preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
BAS1LP	9825	5411	587775	5411	4809	0.00	12.39	0	5.5447E+01
BAXTER	30733	27441	111576	27441	>100000	0.00	>441.74	18	-
BCDOUT	7078	5412	67344	5412	80452	0.00	81.41	0	3.5383E+01
CO9	22924	10789	109651	10789	4787	0.00	9.38	0	8.9188E+01
CONT11_L	1961394	1468599	5382999	1468599	206	0.01	59.36	0	8.0916E+02
DBIR1	45775	18804	1077025	2171	1520	0.00	0.65	0	3.4934E+01
DBIR2	45877	18906	1158159	18804	1803	0.00	11.37	0	1.6669E+02
D2Q06C	5831	2171	33081	18906	1774	0.00	11.67	0	1.6651E+02
DELF000	5543	3128	13741	3128	26145	0.00	12.80	0	5.3817E+01
GE	16369	10099	44825	10099	5733	0.00	9.38	0	7.2447E+01
LARGE001	7176	4162	18887	4162	26308	0.00	17.03	0	6.0680E+01
LPL1	129959	39951	386218	39951	3027	0.00	23.07	0	7.0878E+01
MOD2	66409	34774	199810	34774	1359	0.00	7.97	0	1.3872E+02
MODEL10	16819	4400	150372	4400	2170	0.00	2.43	0	5.3554E+01
MPSBCD03	7078	5412	66210	5412	98539	0.00	97.83	0	3.5307E+01
NSCT2	37563	23003	697738	23003	1011	0.00	5.60	0	1.8379E+02
NSIR2	10057	4453	154939	4453	732	0.00	0.79	0	8.0492E+01
PDE1	271792	270595	990587	270595	806	0.00	34.71	0	3.0302E+02
PDS-100	514577	156016	1096002	156016	342	0.00	9.36	0	2.8489E+02
PDS-90	475448	142596	1014136	142596	331	0.00	8.27	0	2.6847E+02
PILOT-JA	2267	940	14977	940	2078	0.00	0.37	0	3.1987E+01
PILOTNOV	2446	975	13331	975	1784	0.00	0.33	0	3.2873E+01
RAIL2586	923269	2586	8011362	2586	348	0.01	15.94	0	1.4113E+02
RAIL4284	1096894	4284	11284032	4284	662	0.01	50.93	0	1.6948E+02
SPAL_004	321696	10203	46168124	10203	2524	0.04	535.99	0	5.6546E-06
STAT96V2	957432	29089	2852184	29089	722	0.00	10.69	0	9.7273E+02
STAT96V3	1113780	33841	3317736	33841	761	0.00	13.06	0	1.0492E+03
STAT96V4	63076	3173	491336	3173	803	0.00	1.64	0	1.2052E+02
STORMG21K	1377306	526185	3459881	526185	162	0.01	13.12	0	8.9636E+02
WATSON_1	386992	201155	1055093	201155	419	0.00	13.10	0	2.5495E+02
WATSON_2	677224	352013	1846391	352013	338	0.00	18.79	0	3.3569E+02
WORLD	67147	34506	198883	34506	1358	0.00	7.92	0	1.4068E+02

Table 3.7: Complete LSMR(100) results for subset UF problems with diagonal preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
12month1	872622	12471	22624727	12471	217	0.02	20.43	0	9.2740E+02
162bit	3606	3476	37118	3476	2519	0.00	1.43	0	1.1771E+01
176bit	7441	7150	82270	7150	6458	0.00	7.79	0	1.8417E+01
192bit	13691	13093	154303	13093	12117	0.00	27.85	0	2.4855E+01
208bit	24430	23191	299756	23191	16874	0.00	70.75	0	3.8506E+01
beaflw	500	492	53403	492	20410	0.00	3.17	0	4.5727E+00
c8_mat11	5761	4562	2462970	4562	18762	0.00	91.66	0	2.1947E+01
connectus	394707	458	1127525	458	7	0.00	0.03	0	6.2791E+02
ESOC	327062	37349	6019939	37349	13674	0.00	364.28	0	2.2335E+01
EternityII_Etilde	204304	10054	1170516	10054	1116	0.00	6.99	0	4.3655E-06
f855_mat9	2511	2456	171214	2456	11257	0.00	7.10	0	1.7978E+01
GL7d16	955127	460260	14488881	460260	46	0.01	6.46	0	7.4875E+02
GL7d17	1548649	955127	25978098	955127	47	0.02	14.56	0	8.9897E+02
GL7d18	1955309	1548645	35590540	1548645	60	0.04	29.94	0	9.3184E+02
GL7d19	1955296	1911130	37322725	1911130	53	0.04	28.75	0	1.0426E+03
GL7d20	1911124	1437546	29893084	1437546	31	0.03	12.33	0	1.0916E+03
GL7d21	1437546	822922	18174775	822922	26	0.02	5.55	0	1.0029E+03
GL7d22	822906	349443	8251000	349443	24	0.01	1.94	0	7.8940E+02
GL7d23	349443	105054	2695430	105054	24	0.00	0.55	0	5.3569E+02
graphics	29493	11822	117954	11822	>100000	0.00	>600.00	19	-
HFE18_96_in	2372	2371	933343	2371	14624	0.00	28.55	0	4.9063E-01
IG5-15	11369	6146	323509	6146	510	0.00	0.71	0	5.4855E+01
IG5-16	18846	9519	588326	9519	719	0.00	1.76	0	7.1510E+01
IG5-17	30162	14060	1035008	14060	691	0.00	2.94	0	9.1039E+01
IG5-18	47894	20818	1790490	20818	619	0.00	5.01	0	1.1518E+02
IMDB	896302	303617	3782463	303617	>7082	0.00	>600.00	19	-
kneser_10_4_1	349651	330751	992252	330751	>9882	0.00	>600.00	19	-
landmark	71952	2673	1146848	2673	892	0.00	2.91	0	1.1276E-05
LargeRegFile	2111154	801374	4944201	801374	53	0.01	4.78	0	4.4422E+02
Maragal_6	21251	10144	537694	10144	1577	0.00	3.98	0	1.0695E+01
Maragal_7	46845	26525	1200537	26525	864	0.00	5.85	0	1.3690E+01
Maragal_8	60845	33093	1308415	33093	>66213	0.00	>600.00	19	-
mri1	114637	65536	589824	65536	4563	0.00	55.32	0	2.6742E+01
mri2	104597	63240	569160	63240	7038	0.00	78.47	0	1.4126E+02
NotreDame_actors	383640	127823	1470404	127823	>19025	0.00	>600.00	19	-
psse0	26722	11028	102432	11028	43140	0.00	83.72	0	6.6359E+01
psse1	14318	11028	57376	11028	49162	0.00	91.68	0	3.5920E+01
psse2	28634	11028	115262	11028	57967	0.00	113.85	0	7.8596E+01
rel9	5921786	274667	23667183	274667	80	0.02	27.56	0	1.5416E+03
relat9	9746232	274667	38955420	274667	75	0.03	49.35	0	3.0561E+03
Rucci1	1977885	109900	7791168	109900	8291	0.01	505.45	0	7.2798E+02
sls	1748122	62729	6804304	62729	180	0.01	10.81	0	1.2558E-05
TF14	3159	2644	29862	2644	23574	0.00	10.47	0	5.6149E-07
TF15	7741	6334	80057	6334	76063	0.00	83.09	0	8.7740E-07
TF16	19320	15437	216173	15437	>100000	0.00	596.63	0	1.3893E-06
TF17	48629	38132	586218	38132	>79717	0.00	>600.00	19	-
TF18	123867	95368	1597545	95368	>30086	0.00	>600.00	19	-
TF19	317955	241029	4370721	241029	>10284	0.01	>600.00	19	-
tomographic1	59360	45908	647495	45908	18456	0.00	164.78	0	4.1954E+01
Trec14	15904	3159	2872265	3159	812	0.00	5.51	0	1.1217E+02
wheel_601	902103	723605	2170814	723605	>3521	0.01	>600.00	19	-

Table 3.8: Complete LSMR(1000) results for subset CUTEst problems with diagonal preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
BAS1LP	9825	5411	587775	5411	958	0.00	5.14	0	5.5447E+01
BAXTER	30733	27441	111576	27441	>16396	0.00	>600.00	19	-
BCDOUT	7078	5412	67344	5412	32278	0.00	237.20	0	3.5383E+01
CO9	22924	10789	109651	10789	3948	0.00	51.05	0	8.9188E+01
CONT11_L	1961394	1468599	5382999	1468599	206	0.01	85.17	0	8.0916E+02
DBIR1	45775	18804	1077025	2171	955	0.00	1.45	0	3.4934E+01
DBIR2	45877	18906	1158159	18804	906	0.00	13.95	0	1.6669E+02
D2Q06C	5831	2171	33081	18906	892	0.00	14.09	0	1.6651E+02
DELF000	5543	3128	13741	3128	17110	0.00	69.85	0	5.3817E+01
GE	16369	10099	44825	10099	4598	0.00	55.90	0	7.2447E+01
LARGE001	7176	4162	18887	4162	17739	0.00	96.83	0	6.0680E+01
LPL1	129959	39951	386218	39951	1686	0.00	68.41	0	7.0878E+01
MOD2	66409	34774	199810	34774	1130	0.00	31.28	0	1.3872E+02
MODEL10	16819	4400	150372	4400	1463	0.00	6.50	0	5.3554E+01
MPSBCD03	7078	5412	66210	5412	39770	0.00	309.56	0	3.5307E+01
NSCT2	37563	23003	697738	23003	446	0.00	4.62	0	1.8379E+02
NSIR2	10057	4453	154939	4453	422	0.00	0.80	0	8.0492E+01
PDE1	271792	270595	990587	270595	799	0.00	133.12	0	3.0302E+02
PDS-100	514577	156016	1096002	156016	342	0.00	17.95	0	2.8489E+02
PDS-90	475448	142596	1014136	142596	330	0.00	15.12	0	2.6847E+02
PILOT-JA	2267	940	14977	940	904	0.00	0.55	0	3.1987E+01
PILOTNOV	2446	975	13331	975	927	0.00	0.59	0	3.2873E+01
RAIL2586	923269	2586	8011362	2586	309	0.01	15.28	0	1.4113E+02
RAIL4284	1096894	4284	11284032	4284	582	0.01	50.50	0	1.6948E+02
SPAL_004	321696	10203	46168124	10203	1590	0.04	398.24	0	5.6703E-06
STAT96V2	957432	29089	2852184	29089	713	0.00	18.61	0	9.7273E+02
STAT96V3	1113780	33841	3317736	33841	753	0.00	23.64	0	1.0492E+03
STAT96V4	63076	3173	491336	3173	765	0.00	2.64	0	1.2052E+02
STORMG21K	1377306	526185	3459881	526185	147	0.01	13.75	0	8.9636E+02
WATSON_1	386992	201155	1055093	201155	417	0.00	29.34	0	2.5495E+02
WATSON_2	677224	352013	1846391	352013	333	0.00	35.05	0	3.3569E+02
WORLD	67147	34506	198883	34506	1127	0.00	31.39	0	1.4068E+02

Table 3.8: Complete LSMR(1000) results for subset UF problems with diagonal preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
12month1	872622	12471	22624727	12471	204	0.02	19.25	0	9.2740E+02
162bit	3606	3476	37118	3476	2403	0.00	8.68	0	1.1771E+01
176bit	7441	7150	82270	7150	6155	0.00	52.56	0	1.8417E+01
192bit	13691	13093	154303	13093	11656	0.00	192.26	0	2.4855E+01
208bit	24430	23191	299756	23191	16190	0.00	492.51	0	3.8506E+01
beaflw	500	492	53403	492	440	0.00	0.11	0	4.5580E+00
c8_mat11	5761	4562	2462970	4562	10041	0.00	97.55	0	2.1947E+01
connectus	394707	458	1127525	458	7	0.00	0.03	0	6.2791E+02
ESOC	327062	37349	6019939	37349	>8846	0.01	>600.00	19	-
EternityII_Etilde	204304	10054	1170516	10054	840	0.00	8.86	0	4.3449E-06
f855_mat9	2511	2456	171214	2456	3735	0.00	11.26	0	1.7978E+01
GL7d16	955127	460260	14488881	460260	46	0.01	11.88	0	7.4875E+02
GL7d17	1548649	955127	25978098	955127	47	0.03	21.69	0	8.9897E+02
GL7d18	1955309	1548645	35590540	1548645	60	0.04	44.96	0	9.3184E+02
GL7d19	1955296	1911130	37322725	1911130	53	0.04	40.26	0	1.0426E+03
GL7d20	1911124	1437546	29893084	1437546	31	0.03	15.76	0	1.0916E+03
GL7d21	1437546	822922	18174775	822922	26	0.02	7.47	0	1.0029E+03
GL7d22	822906	349443	8251000	349443	24	0.01	2.26	0	7.8940E+02
GL7d23	349443	105054	2695430	105054	24	0.00	0.59	0	5.3569E+02
graphics	29493	11822	117954	11822	>38920	0.00	>600.00	19	-
HFE18_96_in	2372	2371	933343	2371	10305	0.00	46.06	0	4.9063E-01
IG5-15	11369	6146	323509	6146	410	0.00	0.97	0	5.4856E+01
IG5-16	18846	9519	588326	9519	565	0.00	2.71	0	7.1510E+01
IG5-17	30162	14060	1035008	14060	547	0.00	4.18	0	9.1039E+01
IG5-18	47894	20818	1790490	20818	504	0.00	6.33	0	1.1518E+02
IMDB	896302	303617	3782463	303617	>1728	0.01	>600.00	19	-
kneser_10_4_1	349651	330751	992252	330751	>1753	0.00	>600.00	19	-
landmark	71952	2673	1146848	2673	813	0.00	2.87	0	1.1276E-05
LargeRegFile	2111154	801374	4944201	801374	53	0.01	4.26	0	4.4422E+02
Maragal_6	21251	10144	537694	10144	1125	0.00	9.27	0	1.0695E+01
Maragal_7	46845	26525	1200537	26525	590	0.00	7.83	0	1.3690E+01
Maragal_8	60845	33093	1308415	33093	>13331	0.00	>600.00	19	-
mri1	114637	65536	589824	65536	3356	0.00	251.05	0	2.6742E+01
mri2	104597	63240	569160	63240	3438	0.00	250.76	0	1.4126E+02
NotreDame_actors	383640	127823	1470404	127823	>3843	0.00	>600.00	19	-
psse0	26722	11028	102432	11028	>42328	0.00	>600.00	19	-
psse1	14318	11028	57376	11028	>42576	0.00	>600.00	19	-
psse2	28634	11028	115262	11028	>42067	0.00	>600.00	19	-
rel9	5921786	274667	23667183	274667	80	0.02	22.93	0	1.5416E+03
relat9	9746232	274667	38955420	274667	75	0.03	38.18	0	3.0561E+03
Rucci1	1977885	109900	7791168	109900	>3839	0.01	>600.00	19	-
sls	1748122	62729	6804304	62729	176	0.01	8.51	0	1.2197E-05
TF14	3159	2644	29862	2644	17823	0.00	59.48	0	5.5979E-07
TF15	7741	6334	80057	6334	61448	0.00	502.72	0	8.6921E-07
TF16	19320	15437	216173	15437	>30258	0.00	>600.00	19	-
TF17	48629	38132	586218	38132	>12271	0.00	>600.00	19	-
TF18	123867	95368	1597545	95368	>5098	0.00	>600.00	19	-
TF19	317955	241029	4370721	241029	>2238	0.00	>600.00	19	-
tomographic1	59360	45908	647495	45908	>10208	0.00	>600.00	19	-
Trec14	15904	3159	2872265	3159	431	0.00	2.97	0	1.1217E+02
wheel_601	902103	723605	2170814	723605	>976	0.00	>600.00	19	-

Table 3.9: Complete LSMR(0) results for subset CUTEst problems with MIQR preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
BAS1LP	9825	5411	587775	154335	55243	0.57	147.35	0	5.5447E+01
BAXTER	30733	27441	111576	166672	>100000	0.30	>169.73	18	-
BCDOUT	7078	5412	67344	227118	>100000	0.39	>130.64	18	-
CO9	22924	10789	109651	139168	4354	0.15	5.66	0	8.9188E+01
CONT11_L	1961394	1468599	5382999	6823917	>2	15.51	>15.79	16	-
DBIR1	45775	18804	1077025	22404	489	0.03	0.18	0	3.4934E+01
DBIR2	45877	18906	1158159	306833	33884	0.80	181.59	0	1.6669E+02
D2Q06C	5831	2171	33081	311225	36935	0.96	214.66	0	1.6651E+02
DELF000	5543	3128	13741	9959	715	0.01	0.13	0	5.3817E+01
GE	16369	10099	44825	98350	581	0.07	0.59	0	7.2447E+01
LARGE001	7176	4162	18887	14243	64293	0.02	14.35	0	6.0680E+01
LPL1	129959	39951	386218	184639	570	0.28	2.30	0	7.0878E+01
MOD2	66409	34774	199810	559518	1577	0.42	6.99	0	1.3872E+02
MODEL10	16819	4400	150372	34670	6330	0.19	5.11	0	5.3554E+01
MPSBCD03	7078	5412	66210	228815	>100000	0.38	>132.85	18	-
NSCT2	37563	23003	697738	561767	15344	1.51	84.43	0	1.8379E+02
NSIR2	10057	4453	154939	98551	22062	0.21	22.27	0	8.0492E+01
PDE1	271792	270595	990587	>0	-	>600.00	-	19	-
PDS-100	514577	156016	1096002	1027112	228	1.18	6.80	0	2.8489E+02
PDS-90	475448	142596	1014136	950792	216	1.06	5.80	0	2.6847E+02
PILOT-JA	2267	940	14977	9650	64	0.02	0.03	0	3.1987E+01
PILOTNOV	2446	975	13331	9320	43	0.02	0.02	0	3.2873E+01
RAIL2586	923269	2586	8011362	6235	851	2.41	39.03	0	1.4113E+02
RAIL4284	1096894	4284	11284032	6345	949	4.81	75.89	0	1.6948E+02
SPAL_004	321696	10203	46168124	18683	>2656	9.56	>600.00	19	-
STAT96V2	957432	29089	2852184	38807	521	0.14	6.16	0	9.7273E+02
STAT96V3	1113780	33841	3317736	45145	542	0.17	7.56	0	1.0492E+03
STAT96V4	63076	3173	491336	11493	1935	0.04	3.37	0	1.2052E+02
STORMG21K	1377306	526185	3459881	6933837	>8260	62.81	>600.00	19	-
WATSON_1	386992	201155	1055093	1005650	165	1.71	3.87	0	2.5495E+02
WATSON_2	677224	352013	1846391	2808070	119	5.02	8.70	0	3.3569E+02
WORLD	67147	34506	198883	535778	1109	0.40	4.89	0	1.4068E+02

Table 3.9: Complete LSMR(0) results for subset UF problems with MIQR preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
12month1	872622	12471	22624727	73375	981	25.14	127.29	0	9.2739E+02
162bit	3606	3476	37118	193542	734	0.43	1.14	0	1.1771E+01
176bit	7441	7150	82270	388870	2762	1.17	6.72	0	1.8417E+01
192bit	13691	13093	154303	685467	4952	2.43	21.83	0	2.4854E+01
208bit	24430	23191	299756	1202798	10238	4.86	82.88	0	3.8499E+01
beaflw	500	492	53403	28073	42326	0.07	9.30	0	4.6097E+00
c8_mat11	5761	4562	2462970	78255	>100000	5.09	>485.86	18	-
connectus	394707	458	1127525	478	119	0.11	0.74	0	6.2791E+02
ESOC	327062	37349	6019939	698366	>20693	6.73	>600.00	19	-
EternityII_Etilde	204304	10054	1170516	24368	2101	0.61	11.22	0	4.4546E-06
f855_mat9	2511	2456	171214	136743	>100000	0.61	>92.46	18	-
GL7d16	955127	460260	14488881	9346036	272	379.46	443.09	0	7.4875E+02
GL7d17	1548649	955127	25978098	>0	-	>600.00	-	19	-
GL7d18	1955309	1548645	35590540	0	>1	600.00	>600.00	19	-
GL7d19	1955296	1911130	37322725	>0	-	>600.00	-	19	-
GL7d20	1911124	1437546	29893084	0	>1	600.00	>600.00	19	-
GL7d21	1437546	822922	18174775	0	>1	600.00	>600.00	19	-
GL7d22	822906	349443	8251000	12616485	127	204.16	228.56	0	7.8940E+02
GL7d23	349443	105054	2695430	1721600	97	24.86	28.36	0	5.3569E+02
graphics	29493	11822	117954	31960	>100000	0.08	>70.17	18	-
HFE18_96_in	2372	2371	933343	10978	30605	1.18	53.19	0	4.9063E-01
IG5-15	11369	6146	323509	189538	133	0.98	1.19	0	5.4855E+01
IG5-16	18846	9519	588326	279931	158	1.88	2.31	0	7.1509E+01
IG5-17	30162	14060	1035008	409603	177	3.29	4.09	0	9.1038E+01
IG5-18	47894	20818	1790490	587680	217	5.79	7.68	0	1.1518E+02
IMDB	896302	303617	3782463	15909318	>3584	74.57	>600.00	19	-
kneser_10_4_1	349651	330751	992252	6394519	>7847	9.78	>600.00	19	-
landmark	71952	2673	1146848	11307	36	0.27	0.35	0	1.1271E-05
LargeRegFile	2111154	801374	4944201	3615761	202	10.53	23.36	0	4.4422E+02
Maragal_6	21251	10144	537694	246737	9225	2.31	25.11	0	1.0690E+01
Maragal_7	46845	26525	1200537	662167	1525	8.30	18.79	0	1.3690E+01
Maragal_8	60845	33093	1308415	1702715	>46298	16.32	>600.00	19	-
mri1	114637	65536	589824	519051	14129	1.21	90.07	0	2.6742E+01
mri2	104597	63240	569160	1486341	6553	3.99	69.82	0	1.4126E+02
NotreDame_actors	383640	127823	1470404	6768455	>10284	11.66	>600.00	19	-
psse0	26722	11028	102432	31603	1242	0.08	0.96	0	6.6358E+01
psse1	14318	11028	57376	40288	4908	0.10	3.40	0	3.5919E+01
psse2	28634	11028	115262	38437	8016	0.08	6.45	0	7.8596E+01
rel9	5921786	274667	23667183	498966	111	21.89	57.91	0	1.5416E+03
relat9	9746232	274667	38955420	337475	84	18.66	69.89	0	3.0561E+03
Rucci1	1977885	109900	7791168	638743	>10191	2.41	>600.00	19	-
sls	1748122	62729	6804304	71400	717	2.21	42.33	0	1.2945E-05
TF14	3159	2644	29862	150764	50256	0.22	38.12	0	5.5888E-07
TF15	7741	6334	80057	379663	>100000	0.73	>189.98	18	-
TF16	19320	15437	216173	933646	>100000	2.31	>529.65	18	-
TF17	48629	38132	586218	2304372	>44797	7.46	>600.00	19	-
TF18	123867	95368	1597545	5699962	>17089	24.53	>600.00	19	-
TF19	317955	241029	4370721	14260905	>5957	90.18	>600.00	19	-
tomographic1	59360	45908	647495	988212	>78108	2.82	>600.00	19	-
Trec14	15904	3159	2872265	11942	9641	2.41	60.87	0	1.1217E+02
wheel_601	902103	723605	2170814	7796970	>5287	21.52	>600.00	19	-

Table 3.10: Complete LSMR(10) results for subset CUTEst problems with MIQR preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
BAS1LP	9825	5411	587775	154335	48420	0.57	133.70	0	5.5447E+01
BAXTER	30733	27441	111576	166672	103	0.30	0.52	0	8.6168E+01
BCDOUT	7078	5412	67344	227118	>100000	0.40	>137.51	18	-
CO9	22924	10789	109651	139168	3611	0.16	5.20	0	8.9188E+01
CONT11_L	1961394	1468599	5382999	6823917	>2	16.14	>16.44	16	-
DBIR1	45775	18804	1077025	22404	471	0.04	0.18	0	3.4934E+01
DBIR2	45877	18906	1158159	306833	30673	1.32	185.29	0	1.6669E+02
D2Q06C	5831	2171	33081	311225	33838	0.83	213.36	0	1.6651E+02
DELF000	5543	3128	13741	9959	693	0.01	0.15	0	5.3817E+01
GE	16369	10099	44825	98350	572	0.07	0.64	0	7.2447E+01
LARGE001	7176	4162	18887	14243	53686	0.02	14.39	0	6.0680E+01
LPL1	129959	39951	386218	184639	563	0.28	2.62	0	7.0878E+01
MOD2	66409	34774	199810	559518	1515	0.44	7.56	0	1.3872E+02
MODEL10	16819	4400	150372	34670	5870	0.20	5.02	0	5.3554E+01
MPSBCD03	7078	5412	66210	228815	>100000	0.39	>137.96	18	-
NSCT2	37563	23003	697738	561767	13525	1.46	81.95	0	1.8379E+02
NSIR2	10057	4453	154939	98551	20205	0.21	21.23	0	8.0492E+01
PDE1	271792	270595	990587	>0	-	>600.00	-	19	-
PDS-100	514577	156016	1096002	1027112	228	1.21	5.18	0	2.8489E+02
PDS-90	475448	142596	1014136	950792	216	1.09	4.57	0	2.6847E+02
PILOT-JA	2267	940	14977	9650	61	0.02	0.03	0	3.1987E+01
PILOTNOV	2446	975	13331	9320	43	0.02	0.03	0	3.2873E+01
RAIL2586	923269	2586	8011362	6235	816	2.37	39.62	0	1.4113E+02
RAIL4284	1096894	4284	11284032	6345	923	4.82	77.84	0	1.6948E+02
SPAL_004	321696	10203	46168124	18683	>2740	9.67	>600.00	19	-
STAT96V2	957432	29089	2852184	38807	462	0.15	5.56	0	9.7273E+02
STAT96V3	1113780	33841	3317736	45145	485	0.17	6.84	0	1.0492E+03
STAT96V4	63076	3173	491336	11493	1767	0.04	3.15	0	1.2052E+02
STORMG21K	1377306	526185	3459881	6933837	>6446	66.80	>600.00	19	-
WATSON_1	386992	201155	1055093	1005650	165	1.69	4.27	0	2.5495E+02
WATSON_2	677224	352013	1846391	2808070	119	5.04	9.26	0	3.3569E+02
WORLD	67147	34506	198883	535778	1084	0.41	5.24	0	1.4068E+02

Table 3.10: Complete LSMR(10) results for subset UF problems with MIQR preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
12month1	872622	12471	22624727	73375	972	23.18	122.52	0	9.2739E+02
162bit	3606	3476	37118	193542	728	0.47	1.21	0	1.1771E+01
176bit	7441	7150	82270	388870	2710	1.23	7.60	0	1.8417E+01
192bit	13691	13093	154303	685467	4790	2.55	23.69	0	2.4854E+01
208bit	24430	23191	299756	1202798	9764	5.52	84.25	0	3.8499E+01
beaflw	500	492	53403	28073	38436	0.08	8.67	0	4.6096E+00
c8_mat11	5761	4562	2462970	78255	>100000	7.82	>527.77	18	-
connectus	394707	458	1127525	478	114	0.12	0.62	0	6.2791E+02
ESOC	327062	37349	6019939	698366	>20935	6.75	>600.00	19	-
EternityII_Etilde	204304	10054	1170516	24368	2098	0.67	12.34	0	4.4757E-06
f855_mat9	2511	2456	171214	136743	>100000	0.62	>95.00	18	-
GL7d16	955127	460260	14488881	9346036	264	397.42	478.30	0	7.4875E+02
GL7d17	1548649	955127	25978098	31102238	422	1148.65	>600.00	0	8.9897E+02
GL7d18	1955309	1548645	35590540	>82048471	-	>600.00	-	19	-
GL7d19	1955296	1911130	37322725	>178396100	-	>600.00	-	19	-
GL7d20	1911124	1437546	29893084	>118385247	-	>600.00	-	19	-
GL7d21	1437546	822922	18174775	49569906	196	657.94	>600.00	0	1.0029E+03
GL7d22	822906	349443	8251000	12616485	124	165.69	190.26	0	7.8940E+02
GL7d23	349443	105054	2695430	1721600	91	24.26	27.75	0	5.3569E+02
graphics	29493	11822	117954	31960	>100000	0.08	>82.32	18	-
HFE18_96_in	2372	2371	933343	10978	30130	1.08	55.29	0	4.9063E-01
IG5-15	11369	6146	323509	189538	126	0.96	1.16	0	5.4855E+01
IG5-16	18846	9519	588326	279931	150	1.85	2.29	0	7.1509E+01
IG5-17	30162	14060	1035008	409603	169	3.28	4.12	0	9.1038E+01
IG5-18	47894	20818	1790490	587680	205	5.87	7.75	0	1.1518E+02
IMDB	896302	303617	3782463	15909318	>3303	51.71	>600.00	19	-
kneser_10_4_1	349651	330751	992252	6394519	>8403	9.50	>600.00	19	-
landmark	71952	2673	1146848	11307	36	0.27	0.36	0	1.1271E-05
LargeRegFile	2111154	801374	4944201	3615761	167	11.14	24.47	0	4.4422E+02
Maragal_6	21251	10144	537694	246737	8699	2.28	24.61	0	1.0690E+01
Maragal_7	46845	26525	1200537	662167	1444	8.42	18.94	0	1.3690E+01
Maragal_8	60845	33093	1308415	1702715	>43720	16.12	>600.00	19	-
mri1	114637	65536	589824	519051	8810	1.26	63.25	0	2.6742E+01
mri2	104597	63240	569160	1486341	4315	4.09	51.52	0	1.4126E+02
NotreDame_actors	383640	127823	1470404	6768455	>9971	11.41	>600.00	19	-
psse0	26722	11028	102432	31603	1210	0.07	1.09	0	6.6358E+01
psse1	14318	11028	57376	40288	4588	0.10	3.77	0	3.5919E+01
psse2	28634	11028	115262	38437	7677	0.08	7.10	0	7.8596E+01
rel9	5921786	274667	23667183	498966	107	16.10	47.50	0	1.5416E+03
relat9	9746232	274667	38955420	337475	82	14.26	55.63	0	3.0561E+03
Rucci1	1977885	109900	7791168	638743	>15623	2.37	>600.00	19	-
sls	1748122	62729	6804304	71400	620	1.56	27.46	0	1.2743E-05
TF14	3159	2644	29862	150764	44760	0.24	35.01	0	5.5070E-07
TF15	7741	6334	80057	379663	>100000	0.75	>198.99	18	-
TF16	19320	15437	216173	933646	>100000	2.38	>545.35	18	-
TF17	48629	38132	586218	2304372	>43947	7.59	>600.00	19	-
TF18	123867	95368	1597545	5699962	>16944	23.83	>600.00	19	-
TF19	317955	241029	4370721	14260905	>5798	82.22	>600.00	19	-
tomographic1	59360	45908	647495	988212	>72373	2.86	>600.00	19	-
Trec14	15904	3159	2872265	11942	8533	2.35	54.43	0	1.1217E+02
wheel_601	902103	723605	2170814	7796970	>5102	20.39	>600.00	19	-

Table 3.11: Complete LSMR(100) results for subset CUTEst problems with MIQR preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
BAS1LP	9825	5411	587775	154335	20697	0.56	72.22	0	5.5447E+01
BAXTER	30733	27441	111576	166672	116	0.31	0.76	0	7.0880E+01
BCDOUT	7078	5412	67344	227118	>100000	0.39	>201.69	18	-
CO9	22924	10789	109651	139168	2026	0.16	5.57	0	8.9188E+01
CONT11_L	1961394	1468599	5382999	6823917	>2	15.50	>15.80	16	-
DBIR1	45775	18804	1077025	22404	350	0.04	0.22	0	3.4934E+01
DBIR2	45877	18906	1158159	306833	14271	0.81	114.88	0	1.6669E+02
D2Q06C	5831	2171	33081	311225	16271	0.81	134.99	0	1.6651E+02
DELF000	5543	3128	13741	9959	538	0.01	0.29	0	5.3817E+01
GE	16369	10099	44825	98350	483	0.07	1.07	0	7.2447E+01
LARGE001	7176	4162	18887	14243	16080	0.02	11.81	0	6.0680E+01
LPL1	129959	39951	386218	184639	514	0.27	4.59	0	7.0878E+01
MOD2	66409	34774	199810	559518	1043	0.42	9.29	0	1.3872E+02
MODEL10	16819	4400	150372	34670	4333	0.20	5.93	0	5.3554E+01
MPSBCD03	7078	5412	66210	228815	>100000	0.38	>202.46	18	-
NSCT2	37563	23003	697738	561767	5553	1.53	48.18	0	1.8379E+02
NSIR2	10057	4453	154939	98551	9130	0.21	14.50	0	8.0492E+01
PDE1	271792	270595	990587	>0	-	>600.00	-	19	-
PDS-100	514577	156016	1096002	1027112	226	1.19	8.49	0	2.8489E+02
PDS-90	475448	142596	1014136	950792	216	1.07	7.39	0	2.6847E+02
PILOT-JA	2267	940	14977	9650	54	0.02	0.03	0	3.1987E+01
PILOTNOV	2446	975	13331	9320	41	0.02	0.03	0	3.2873E+01
RAIL2586	923269	2586	8011362	6235	643	2.29	33.26	0	1.4113E+02
RAIL4284	1096894	4284	11284032	6345	765	4.75	68.10	0	1.6948E+02
SPAL_004	321696	10203	46168124	18683	>2609	9.84	>600.00	19	-
STAT96V2	957432	29089	2852184	38807	438	0.15	6.81	0	9.7273E+02
STAT96V3	1113780	33841	3317736	45145	459	0.17	8.31	0	1.0492E+03
STAT96V4	63076	3173	491336	11493	1220	0.04	2.64	0	1.2052E+02
STORMG21K	1377306	526185	3459881	6933837	>3829	59.11	>600.00	19	-
WATSON_1	386992	201155	1055093	1005650	164	1.71	7.04	0	2.5495E+02
WATSON_2	677224	352013	1846391	2808070	119	5.04	12.44	0	3.3569E+02
WORLD	67147	34506	198883	535778	860	0.41	7.63	0	1.4068E+02

Table 3.11: Complete LSMR(100) results for subset UF problems with MIQR preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
12month1	872622	12471	22624727	73375	911	24.01	115.70	0	9.2739E+02
162bit	3606	3476	37118	193542	618	0.41	1.26	0	1.1771E+01
176bit	7441	7150	82270	388870	2202	1.16	7.92	0	1.8417E+01
192bit	13691	13093	154303	685467	3979	2.42	24.69	0	2.4854E+01
208bit	24430	23191	299756	1202798	7114	5.04	80.52	0	3.8499E+01
beaflw	500	492	53403	28073	27835	0.07	7.88	0	4.6095E+00
c8_mat11	5761	4562	2462970	78255	>100000	4.96	>548.45	18	-
connectus	394707	458	1127525	478	88	0.11	0.49	0	6.2791E+02
ESOC	327062	37349	6019939	698366	>12906	7.27	>600.00	19	-
EternityII_Etilde	204304	10054	1170516	24368	2046	0.65	13.52	0	4.4062E-06
f855_mat9	2511	2456	171214	136743	93693	0.61	115.54	0	1.7596E+01
GL7d16	955127	460260	14488881	9346036	217	375.13	435.86	0	7.4875E+02
GL7d17	1548649	955127	25978098	>0	-	>600.00	-	19	-
GL7d18	1955309	1548645	35590540	>0	-	>600.00	-	19	-
GL7d19	1955296	1911130	37322725	>0	-	>600.00	-	19	-
GL7d20	1911124	1437546	29893084	0	>1	600.00	>600.00	19	-
GL7d21	1437546	822922	18174775	0	>1	600.00	>600.00	19	-
GL7d22	822906	349443	8251000	12616485	112	224.33	251.80	0	7.8940E+02
GL7d23	349443	105054	2695430	1721600	82	34.13	37.81	0	5.3569E+02
graphics	29493	11822	117954	31960	>100000	0.08	>224.47	18	-
HFE18_96_in	2372	2371	933343	10978	27545	1.32	56.95	0	4.9063E-01
IG5-15	11369	6146	323509	189538	114	1.06	1.31	0	5.4855E+01
IG5-16	18846	9519	588326	279931	131	2.51	2.99	0	7.1509E+01
IG5-17	30162	14060	1035008	409603	145	5.05	5.96	0	9.1038E+01
IG5-18	47894	20818	1790490	587680	175	9.01	10.83	0	1.1518E+02
IMDB	896302	303617	3782463	15909318	>2587	82.74	>600.00	19	-
kneser_10_4_1	349651	330751	992252	6394519	>4682	10.66	>600.00	19	-
landmark	71952	2673	1146848	11307	36	0.27	0.36	0	1.1271E-05
LargeRegFile	2111154	801374	4944201	3615761	73	10.41	19.66	0	4.4422E+02
Maragal_6	21251	10144	537694	246737	4957	2.88	21.85	0	1.0690E+01
Maragal_7	46845	26525	1200537	662167	904	13.61	22.99	0	1.3690E+01
Maragal_8	60845	33093	1308415	1702715	>33204	25.84	>600.00	19	-
mri1	114637	65536	589824	519051	4085	1.24	62.05	0	2.6742E+01
mri2	104597	63240	569160	1486341	1554	6.36	36.15	0	1.4126E+02
NotreDame_actors	383640	127823	1470404	6768455	>7796	15.73	>600.00	19	-
psse0	26722	11028	102432	31603	800	0.07	1.76	0	6.6358E+01
psse1	14318	11028	57376	40288	2976	0.10	6.37	0	3.5919E+01
psse2	28634	11028	115262	38437	5146	0.08	11.62	0	7.8596E+01
rel9	5921786	274667	23667183	498966	97	27.33	62.03	0	1.5416E+03
relat9	9746232	274667	38955420	337475	78	20.60	67.88	0	3.0561E+03
Rucci1	1977885	109900	7791168	638743	>10914	2.42	>600.00	19	-
sls	1748122	62729	6804304	71400	401	2.26	24.57	0	1.3108E-05
TF14	3159	2644	29862	150764	20567	0.24	22.50	0	5.5797E-07
TF15	7741	6334	80057	379663	>100000	0.74	>287.18	18	-
TF16	19320	15437	216173	933646	>82986	2.47	>600.00	19	-
TF17	48629	38132	586218	2304372	>31632	8.28	>600.00	19	-
TF18	123867	95368	1597545	5699962	>11975	27.47	>600.00	19	-
TF19	317955	241029	4370721	14260905	>4283	92.60	>600.00	19	-
tomographic1	59360	45908	647495	988212	>142	3.09	>4.81	16	-
Trec14	15904	3159	2872265	11942	5659	2.51	39.89	0	1.1217E+02
wheel_601	902103	723605	2170814	7796970	>2368	21.92	>600.00	19	-

Table 3.12: Complete LSMR(1000) results for subset CUTEst problems with MIQR preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
BAS1LP	9825	5411	587775	154335	7583	0.57	69.14	0	5.5447E+01
BAXTER	30733	27441	111576	166672	1021	0.33	21.03	0	6.1183E+01
BCDOUT	7078	5412	67344	227118	>73227	0.39	>600.00	19	-
CO9	22924	10789	109651	139168	851	0.15	6.26	0	8.9188E+01
CONT11_L	1961394	1468599	5382999	6823917	>2	15.53	>15.83	16	-
DBIR1	45775	18804	1077025	22404	283	0.03	0.23	0	3.4934E+01
DBIR2	45877	18906	1158159	306833	3975	0.81	108.07	0	1.6669E+02
D2Q06C	5831	2171	33081	311225	4607	0.81	127.59	0	1.6651E+02
DELF000	5543	3128	13741	9959	426	0.01	0.49	0	5.3817E+01
GE	16369	10099	44825	98350	366	0.07	1.28	0	7.2447E+01
LARGE001	7176	4162	18887	14243	6730	0.02	34.90	0	6.0680E+01
LPL1	129959	39951	386218	184639	438	0.29	6.95	0	7.0878E+01
MOD2	66409	34774	199810	559518	616	0.42	11.67	0	1.3872E+02
MODEL10	16819	4400	150372	34670	2670	0.19	14.43	0	5.3554E+01
MPSBCD03	7078	5412	66210	228815	>71790	0.38	>600.00	19	-
NSCT2	37563	23003	697738	561767	2067	1.58	59.72	0	1.8379E+02
NSIR2	10057	4453	154939	98551	4493	0.21	27.64	0	8.0492E+01
PDE1	271792	270595	990587	>0	-	>600.00	-	19	-
PDS-100	514577	156016	1096002	1027112	225	1.19	10.39	0	2.8489E+02
PDS-90	475448	142596	1014136	950792	216	1.07	8.82	0	2.6847E+02
PILOT-JA	2267	940	14977	9650	54	0.02	0.03	0	3.1987E+01
PILOTNOV	2446	975	13331	9320	41	0.02	0.03	0	3.2873E+01
RAIL2586	923269	2586	8011362	6235	420	2.29	23.31	0	1.4113E+02
RAIL4284	1096894	4284	11284032	6345	515	4.74	50.76	0	1.6948E+02
SPAL_004	321696	10203	46168124	18683	>2397	9.51	>600.00	19	-
STAT96V2	957432	29089	2852184	38807	434	0.14	8.95	0	9.7273E+02
STAT96V3	1113780	33841	3317736	45145	455	0.17	11.07	0	1.0492E+03
STAT96V4	63076	3173	491336	11493	630	0.04	1.94	0	1.2052E+02
STORMG21K	1377306	526185	3459881	6933837	>1131	58.37	>600.00	19	-
WATSON_1	386992	201155	1055093	1005650	164	1.75	7.65	0	2.5495E+02
WATSON_2	677224	352013	1846391	2808070	119	5.08	12.46	0	3.3569E+02
WORLD	67147	34506	198883	535778	527	0.40	8.74	0	1.4068E+02

Table 3.12: Complete LSMR(1000) results for subset UF problems with MIQR preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
12month1	872622	12471	22624727	73375	660	22.64	91.41	0	9.2739E+02
162bit	3606	3476	37118	193542	451	0.42	1.30	0	1.1771E+01
176bit	7441	7150	82270	388870	1405	1.15	12.27	0	1.8417E+01
192bit	13691	13093	154303	685467	2543	2.44	47.04	0	2.4854E+01
208bit	24430	23191	299756	1202798	4724	4.82	167.76	0	3.8499E+01
beaflw	500	492	53403	28073	444	0.06	0.20	0	4.6095E+00
c8_mat11	5761	4562	2462970	78255	>56607	5.76	>600.00	19	-
connectus	394707	458	1127525	478	88	0.11	0.50	0	6.2791E+02
ESOC	327062	37349	6019939	698366	>8013	6.48	>600.00	19	-
EternityII_Etilde	204304	10054	1170516	24368	871	0.61	10.29	0	4.4789E-06
f855_mat9	2511	2456	171214	136743	20090	0.60	82.03	0	1.7595E+01
GL7d16	955127	460260	14488881	9346036	193	433.17	505.74	0	7.4875E+02
GL7d17	1548649	955127	25978098	0	>1	600.00	>600.00	19	-
GL7d18	1955309	1548645	35590540	>0	-	>600.00	-	19	-
GL7d19	1955296	1911130	37322725	0	>1	600.00	>600.00	19	-
GL7d20	1911124	1437546	29893084	0	>1	600.00	>600.00	19	-
GL7d21	1437546	822922	18174775	0	>1	600.00	>600.00	19	-
GL7d22	822906	349443	8251000	12616485	112	239.71	271.72	0	7.8940E+02
GL7d23	349443	105054	2695430	1721600	82	33.06	36.97	0	5.3569E+02
graphics	29493	11822	117954	31960	>37939	0.08	>600.00	19	-
HFE18_96_in	2372	2371	933343	10978	17753	1.50	85.20	0	4.9063E-01
IG5-15	11369	6146	323509	189538	113	1.04	1.29	0	5.4855E+01
IG5-16	18846	9519	588326	279931	127	2.74	3.21	0	7.1509E+01
IG5-17	30162	14060	1035008	409603	138	5.52	6.42	0	9.1038E+01
IG5-18	47894	20818	1790490	587680	162	10.27	12.16	0	1.1518E+02
IMDB	896302	303617	3782463	15909318	>1183	84.09	>600.00	19	-
kneser_10_4_1	349651	330751	992252	6394519	>1438	10.77	>600.00	19	-
landmark	71952	2673	1146848	11307	36	0.27	0.36	0	1.1271E-05
LargeRegFile	2111154	801374	4944201	3615761	73	10.46	19.07	0	4.4422E+02
Maragal_6	21251	10144	537694	246737	1141	3.79	15.19	0	1.0690E+01
Maragal_7	46845	26525	1200537	662167	443	16.72	23.18	0	1.3690E+01
Maragal_8	60845	33093	1308415	1702715	>10713	26.08	>600.00	19	-
mri1	114637	65536	589824	519051	1875	1.24	135.87	0	2.6742E+01
mri2	104597	63240	569160	1486341	586	6.68	27.54	0	1.4126E+02
NotreDame_actors	383640	127823	1470404	6768455	>2865	15.96	>600.00	19	-
psse0	26722	11028	102432	31603	449	0.07	1.85	0	6.6358E+01
psse1	14318	11028	57376	40288	1214	0.10	11.10	0	3.5919E+01
psse2	28634	11028	115262	38437	2054	0.08	23.93	0	7.8596E+01
rel9	5921786	274667	23667183	498966	97	26.06	59.67	0	1.5416E+03
relat9	9746232	274667	38955420	337475	78	18.68	68.05	0	3.0561E+03
Rucci1	1977885	109900	7791168	638743	>3600	2.51	>600.00	19	-
sls	1748122	62729	6804304	71400	282	2.09	18.76	0	1.2176E-05
TF14	3159	2644	29862	150764	9900	0.24	40.11	0	5.5818E-07
TF15	7741	6334	80057	379663	41805	0.75	419.04	0	8.7297E-07
TF16	19320	15437	216173	933646	>24145	2.44	>600.00	19	-
TF17	48629	38132	586218	2304372	>9764	7.83	>600.00	19	-
TF18	123867	95368	1597545	5699962	>4021	26.73	>600.00	19	-
TF19	317955	241029	4370721	14260905	>1737	92.45	>600.00	19	-
tomographic1	59360	45908	647495	988212	>120	2.94	>4.33	16	-
Trec14	15904	3159	2872265	11942	1912	2.38	20.09	0	1.1217E+02
wheel_601	902103	723605	2170814	7796970	>875	21.72	>600.00	19	-

Table 3.13: Complete LSMR(0) results for subset CUTEst problems with RIF preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
BAS1LP	9825	5411	587775	58422	>76907	7.22	>160.11	16	-
BAXTER	30733	27441	111576	254733	>100000	1.32	>77.63	18	-
BCDOUT	7078	5412	67344	38953	>100000	1.51	>42.84	18	-
CO9	22924	10789	109651	52621	7577	1.04	6.69	0	8.9188E+01
CONT11_L	1961394	1468599	5382999	4883216	60	44.80	48.63	0	8.0916E+02
DBIR1	45775	18804	1077025	13660	13696	0.07	2.87	0	3.4934E+01
DBIR2	45877	18906	1158159	92947	>100000	40.02	>452.74	18	-
D2Q06C	5831	2171	33081	94898	>100000	47.25	>279.91	18	-
DELF000	5543	3128	13741	11667	31348	0.01	3.89	0	5.3817E+01
GE	16369	10099	44825	49164	840	0.17	0.60	0	7.2453E+01
LARGE001	7176	4162	18887	16930	>100000	0.01	>17.01	18	-
LPL1	129959	39951	386218	143744	>100000	0.44	>282.22	18	-
MOD2	66409	34774	199810	229986	58857	2.14	115.54	0	1.3872E+02
MODEL10	16819	4400	150372	24083	>100000	0.40	>64.43	18	-
MPSBCD03	7078	5412	66210	38965	>100000	1.59	>43.10	18	-
NSCT2	37563	23003	697738	109287	>100000	37.35	>199.27	18	-
NSIR2	10057	4453	154939	27196	>78	2.41	>2.46	16	-
PDE1	271792	270595	990587	>988272	-	>600.00	-	19	-
PDS-100	514577	156016	1096002	618440	203	22.52	24.84	0	2.8489E+02
PDS-90	475448	142596	1014136	570713	195	21.22	23.24	0	2.6847E+02
PILOT-JA	2267	940	14977	5780	30907	0.04	2.54	0	3.1987E+01
PILOTNOV	2446	975	13331	5958	18016	0.03	1.41	0	3.2873E+01
RAIL2586	923269	2586	8011362	24447	234	107.93	118.36	0	1.4113E+02
RAIL4284	1096894	4284	11284032	45055	375	343.08	371.85	0	1.6948E+02
SPAL_004	321696	10203	46168124	>6779	-	>600.00	-	19	-
STAT96V2	957432	29089	2852184	81055	421	0.61	5.40	0	9.7273E+02
STAT96V3	1113780	33841	3317736	94273	440	0.76	6.65	0	1.0492E+03
STAT96V4	63076	3173	491336	10513	449	2.16	2.93	0	1.2052E+02
STORMG21K	1377306	526185	3459881	>1839348	-	>600.00	-	19	-
WATSON_1	386992	201155	1055093	519977	249	0.52	2.75	0	2.5495E+02
WATSON_2	677224	352013	1846391	1171936	185	4.07	7.53	0	3.3569E+02
WORLD	67147	34506	198883	224464	26128	2.16	52.16	0	1.4068E+02

Table 3.13: Complete LSMR(0) results for subset UF problems with RIF preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
12month1	872622	12471	22624727	>62995	-	>600.00	-	19	-
162bit	3606	3476	37118	28550	1495	1.79	2.13	0	1.1771E+01
176bit	7441	7150	82270	56269	3906	8.47	10.34	0	1.8417E+01
192bit	13691	13093	154303	96275	7247	30.68	37.27	0	2.4854E+01
208bit	24430	23191	299756	168273	14113	109.37	134.59	0	3.8501E+01
beaflw	500	492	53403	5307	>11	0.19	>0.19	16	-
c8_mat11	5761	4562	2462970	49640	>100000	66.70	>511.66	18	-
connectus	394707	458	1127525	1744	7	2.30	2.33	0	6.2791E+02
ESOC	327062	37349	6019939	>273593	-	>600.00	-	19	-
EternityII_Etilde	204304	10054	1170516	103380	883	37.48	42.38	0	4.4328E-06
f855_mat9	2511	2456	171214	26961	>100000	2.98	>43.34	18	-
GL7d16	955127	460260	14488881	>291338	-	>600.00	-	19	-
GL7d17	1548649	955127	25978098	>311165	-	>600.00	-	19	-
GL7d18	1955309	1548645	35590540	>340984	-	>600.00	-	19	-
GL7d19	1955296	1911130	37322725	>561090	-	>600.00	-	19	-
GL7d20	1911124	1437546	29893084	>526415	-	>600.00	-	19	-
GL7d21	1437546	822922	18174775	>515081	-	>600.00	-	19	-
GL7d22	822906	349443	8251000	>533409	-	>600.00	-	19	-
GL7d23	349443	105054	2695430	>581512	-	>600.00	-	19	-
graphics	29493	11822	117954	30470	>100000	0.17	>52.95	18	-
HFE18_96_in	2372	2371	933343	26016	12458	14.71	36.08	0	4.9063E-01
IG5-15	11369	6146	323509	62626	326	9.89	10.17	0	5.4855E+01
IG5-16	18846	9519	588326	97466	483	27.21	28.04	0	7.1509E+01
IG5-17	30162	14060	1035008	145262	415	71.02	72.37	0	9.1039E+01
IG5-18	47894	20818	1790490	216979	456	180.69	183.54	0	1.1518E+02
IMDB	896302	303617	3782463	>499103	-	>600.00	-	19	-
kneser_10_4_1	349651	330751	992252	-	-1	-	-	10	-
landmark	71952	2673	1146848	17778	276	1.11	1.73	0	1.1280E-05
LargeRegFile	2111154	801374	4944201	>468683	-	>600.00	-	19	-
Maragal_6	21251	10144	537694	71907	5993	41.21	49.64	0	1.0694E+01
Maragal_7	46845	26525	1200537	166881	4895	144.33	162.88	0	1.3690E+01
Maragal_8	60845	33093	1308415	229119	>100000	204.46	>600.00	18	-
mri1	114637	65536	589824	325965	2748	93.88	104.43	0	2.6742E+01
mri2	104597	63240	569160	392461	>1	67.34	>67.35	16	-
NotreDame_actors	383640	127823	1470404	>719625	-	>600.00	-	19	-
psse0	26722	11028	102432	23833	22635	0.04	12.58	0	6.6358E+01
psse1	14318	11028	57376	28925	>100000	0.06	>50.86	18	-
psse2	28634	11028	115262	34657	>100000	0.12	>66.23	18	-
rel9	5921786	274667	23667183	>303262	-	>600.00	-	19	-
relat9	9746232	274667	38955420	>262822	-	>600.00	-	19	-
Rucci1	1977885	109900	7791168	932200	1827	207.41	326.74	0	7.2798E+02
sls	1748122	62729	6804304	>108831	-	>600.00	-	19	-
TF14	3159	2644	29862	28727	12904	0.43	2.78	0	5.6057E-07
TF15	7741	6334	80057	69250	43657	2.64	22.08	0	8.7393E-07
TF16	19320	15437	216173	169320	>100000	17.44	>129.43	18	-
TF17	48629	38132	586218	418887	>100000	118.52	>442.03	18	-
TF18	123867	95368	1597545	>831233	-	>600.00	-	19	-
TF19	317955	241029	4370721	>811487	-	>600.00	-	19	-
tomographic1	59360	45908	647495	280726	>100000	3.05	>357.35	18	-
Trec14	15904	3159	2872265	34692	>2	58.56	>58.58	16	-
wheel_601	902103	723605	2170814	4253762	>8653	43.64	>600.00	19	-

Table 3.14: Complete LSMR(10) results for subset CUTEst problems with RIF preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
BAS1LP	9825	5411	587775	58422	28	7.25	7.31	0	8.0218E+01
BAXTER	30733	27441	111576	254733	>100000	1.32	>79.54	18	-
BCDOUT	7078	5412	67344	38953	>100000	1.51	>50.06	18	-
CO9	22924	10789	109651	52621	7006	1.04	7.03	0	8.9188E+01
CONT11_L	1961394	1468599	5382999	4883216	60	45.56	52.40	0	8.0916E+02
DBIR1	45775	18804	1077025	13660	12283	0.07	2.97	0	3.4934E+01
DBIR2	45877	18906	1158159	92947	>100000	40.98	>518.59	18	-
D2Q06C	5831	2171	33081	94898	>100000	47.59	>288.71	18	-
DELF000	5543	3128	13741	11667	30637	0.01	4.99	0	5.3817E+01
GE	16369	10099	44825	49164	830	0.17	0.71	0	7.2453E+01
LARGE001	7176	4162	18887	16930	>100000	0.01	>22.47	18	-
LPL1	129959	39951	386218	143744	>100000	0.44	>343.06	18	-
MOD2	66409	34774	199810	229986	46350	2.15	117.56	0	1.3872E+02
MODEL10	16819	4400	150372	24083	>100000	0.39	>70.89	18	-
MPSBCD03	7078	5412	66210	38965	>100000	1.57	>49.69	18	-
NSCT2	37563	23003	697738	109287	>100000	37.53	>200.45	18	-
NSIR2	10057	4453	154939	27196	9	2.41	2.41	0	9.9395E+01
PDE1	271792	270595	990587	>993046	-	>600.00	-	19	-
PDS-100	514577	156016	1096002	618440	203	22.34	25.07	0	2.8489E+02
PDS-90	475448	142596	1014136	570713	195	21.45	23.91	0	2.6847E+02
PILOT-JA	2267	940	14977	5780	28197	0.04	2.57	0	3.1987E+01
PILOTNOV	2446	975	13331	5958	17920	0.03	1.60	0	3.2873E+01
RAIL2586	923269	2586	8011362	24447	233	110.43	121.17	0	1.4113E+02
RAIL4284	1096894	4284	11284032	45055	375	338.76	368.38	0	1.6948E+02
SPAL_004	321696	10203	46168124	>7018	-	>600.00	-	19	-
STAT96V2	957432	29089	2852184	81055	414	0.60	5.79	0	9.7273E+02
STAT96V3	1113780	33841	3317736	94273	435	0.77	7.25	0	1.0492E+03
STAT96V4	63076	3173	491336	10513	449	2.16	2.94	0	1.2052E+02
STORMG21K	1377306	526185	3459881	>1957476	-	>600.00	-	19	-
WATSON_1	386992	201155	1055093	519977	249	0.49	3.48	0	2.5495E+02
WATSON_2	677224	352013	1846391	1171936	185	4.11	8.48	0	3.3569E+02
WORLD	67147	34506	198883	224464	24796	2.19	64.30	0	1.4068E+02

Table 3.14: Complete LSMR(10) results for subset UF problems with RIF preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
12month1	872622	12471	22624727	>65361	-	>600.00	-	19	-
162bit	3606	3476	37118	28550	1495	1.76	2.17	0	1.1771E+01
176bit	7441	7150	82270	56269	3894	8.31	10.50	0	1.8417E+01
192bit	13691	13093	154303	96275	7236	30.08	37.80	0	2.4854E+01
208bit	24430	23191	299756	168273	13993	109.21	139.45	0	3.8501E+01
beaflw	500	492	53403	5307	>5	0.19	>0.19	16	-
c8_mat11	5761	4562	2462970	49640	>100000	63.80	>535.49	18	-
connectus	394707	458	1127525	1744	7	2.23	2.27	0	6.2791E+02
ESOC	327062	37349	6019939	>271701	-	>600.00	-	19	-
EternityII_Etilde	204304	10054	1170516	103380	883	37.16	42.12	0	4.4344E-06
f855_mat9	2511	2456	171214	26961	>100000	2.89	>45.52	18	-
GL7d16	955127	460260	14488881	>342783	-	>600.00	-	19	-
GL7d17	1548649	955127	25978098	>342999	-	>600.00	-	19	-
GL7d18	1955309	1548645	35590540	>375925	-	>600.00	-	19	-
GL7d19	1955296	1911130	37322725	>572915	-	>600.00	-	19	-
GL7d20	1911124	1437546	29893084	>544782	-	>600.00	-	19	-
GL7d21	1437546	822922	18174775	>537760	-	>600.00	-	19	-
GL7d22	822906	349443	8251000	>552082	-	>600.00	-	19	-
GL7d23	349443	105054	2695430	>569276	-	>600.00	-	19	-
graphics	29493	11822	117954	30470	>100000	0.16	>68.95	18	-
HFE18_96_in	2372	2371	933343	26016	12433	14.28	36.58	0	4.9063E-01
IG5-15	11369	6146	323509	62626	321	9.73	10.03	0	5.4855E+01
IG5-16	18846	9519	588326	97466	478	26.86	27.69	0	7.1509E+01
IG5-17	30162	14060	1035008	145262	410	70.05	71.35	0	9.1039E+01
IG5-18	47894	20818	1790490	216979	447	179.05	182.09	0	1.1518E+02
IMDB	896302	303617	3782463	>521169	-	>600.00	-	19	-
kneser_10_4_1	349651	330751	992252	-	-	-	-	10	-
landmark	71952	2673	1146848	17778	274	1.67	2.73	0	1.1280E-05
LargeRegFile	2111154	801374	4944201	>462274	-	>600.00	-	19	-
Maragal_6	21251	10144	537694	71907	>100000	40.18	>199.43	18	-
Maragal_7	46845	26525	1200537	166881	5718	144.30	169.55	0	1.3696E+01
Maragal_8	60845	33093	1308415	229119	>100000	210.23	>600.00	18	-
mri1	114637	65536	589824	325965	1575	93.78	101.51	0	2.6742E+01
mri2	104597	63240	569160	392461	>1	67.78	>67.78	16	-
NotreDame_actors	383640	127823	1470404	>708013	-	>600.00	-	19	-
psse0	26722	11028	102432	23833	22445	0.04	16.34	0	6.6358E+01
psse1	14318	11028	57376	28925	>100000	0.05	>65.68	18	-
psse2	28634	11028	115262	34657	>100000	0.13	>81.34	18	-
rel9	5921786	274667	23667183	>320081	-	>600.00	-	19	-
relat9	9746232	274667	38955420	>272798	-	>600.00	-	19	-
Rucci1	1977885	109900	7791168	932200	1823	172.24	243.72	0	7.2798E+02
sls	1748122	62729	6804304	>108831	-	>600.00	-	19	-
TF14	3159	2644	29862	28727	12914	0.43	3.12	0	5.5510E-07
TF15	7741	6334	80057	69250	43460	2.61	24.76	0	8.7486E-07
TF16	19320	15437	216173	169320	>100000	17.44	>149.74	18	-
TF17	48629	38132	586218	418887	>100000	119.28	>493.09	18	-
TF18	123867	95368	1597545	>829968	-	>600.00	-	19	-
TF19	317955	241029	4370721	>817427	-	>600.00	-	19	-
tomographic1	59360	45908	647495	280726	12	3.00	3.05	0	6.8499E+01
Trec14	15904	3159	2872265	34692	>1	57.38	>57.39	16	-
wheel_601	902103	723605	2170814	4253762	>7367	36.75	>600.00	19	-

Table 3.15: Complete LSMR(100) results for subset CUTEst problems with RIF preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
BAS1LP	9825	5411	587775	58422	110	7.31	7.58	0	6.7237E+01
BAXTER	30733	27441	111576	254733	>100000	1.32	>77.96	18	-
BCDOUT	7078	5412	67344	38953	>100000	1.51	>110.72	18	-
CO9	22924	10789	109651	52621	4943	1.04	11.44	0	8.9188E+01
CONT11_L	1961394	1468599	5382999	4883216	60	44.76	55.01	0	8.0916E+02
DBIR1	45775	18804	1077025	13660	8327	0.06	3.93	0	3.4934E+01
DBIR2	45877	18906	1158159	92947	37	40.22	40.40	0	1.7694E+02
D2Q06C	5831	2171	33081	94898	>100000	47.54	>282.42	18	-
DELF000	5543	3128	13741	11667	21381	0.01	10.89	0	5.3817E+01
GE	16369	10099	44825	49164	752	0.17	1.47	0	7.2453E+01
LARGE001	7176	4162	18887	16930	>100000	0.01	>68.54	18	-
LPL1	129959	39951	386218	143744	>75029	0.44	>600.00	19	-
MOD2	66409	34774	199810	229986	19375	2.14	127.94	0	1.3872E+02
MODEL10	16819	4400	150372	24083	39331	0.40	47.33	0	5.3554E+01
MPSBCD03	7078	5412	66210	38965	>100000	1.57	>110.34	18	-
NSCT2	37563	23003	697738	109287	>100000	37.29	>195.15	18	-
NSIR2	10057	4453	154939	27196	9	2.40	2.40	0	9.9395E+01
PDE1	271792	270595	990587	>992155	-	>600.00	-	19	-
PDS-100	514577	156016	1096002	618440	202	22.40	27.79	0	2.8489E+02
PDS-90	475448	142596	1014136	570713	194	21.12	25.79	0	2.6847E+02
PILOT-JA	2267	940	14977	5780	17735	0.04	3.60	0	3.1987E+01
PILOTNOV	2446	975	13331	5958	13349	0.03	2.72	0	3.2873E+01
RAIL2586	923269	2586	8011362	24447	231	106.27	116.63	0	1.4113E+02
RAIL4284	1096894	4284	11284032	45055	370	345.40	372.97	0	1.6948E+02
SPAL_004	321696	10203	46168124	>7087	-	>600.00	-	19	-
STAT96V2	957432	29089	2852184	81055	404	0.60	6.71	0	9.7273E+02
STAT96V3	1113780	33841	3317736	94273	424	0.76	8.10	0	1.0492E+03
STAT96V4	63076	3173	491336	10513	448	2.16	3.07	0	1.2052E+02
STORMG21K	1377306	526185	3459881	>1853965	-	>600.00	-	19	-
WATSON_1	386992	201155	1055093	519977	249	0.51	8.07	0	2.5495E+02
WATSON_2	677224	352013	1846391	1171936	185	4.13	14.23	0	3.3569E+02
WORLD	67147	34506	198883	224464	14880	2.16	97.72	0	1.4068E+02

Table 3.15: Complete LSMR(100) results for subset UF problems with RIF preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
12month1	872622	12471	22624727	>64652	-	>600.00	-	19	-
162bit	3606	3476	37118	28550	1477	1.81	2.79	0	1.1771E+01
176bit	7441	7150	82270	56269	3810	8.50	13.77	0	1.8417E+01
192bit	13691	13093	154303	96275	7178	30.49	49.19	0	2.4854E+01
208bit	24430	23191	299756	168273	13472	107.89	171.55	0	3.8501E+01
beaflw	500	492	53403	5307	>5	0.18	>0.18	16	-
c8_mat11	5761	4562	2462970	49640	>100000	66.51	>568.46	18	-
connectus	394707	458	1127525	1744	7	2.29	2.32	0	6.2791E+02
ESOC	327062	37349	6019939	>276035	-	>600.00	-	19	-
EternityII_Etilde	204304	10054	1170516	103380	882	37.55	43.21	0	4.4671E-06
f855_mat9	2511	2456	171214	26961	99063	2.96	71.92	0	1.6709E+01
GL7d16	955127	460260	14488881	>329968	-	>600.00	-	19	-
GL7d17	1548649	955127	25978098	>336685	-	>600.00	-	19	-
GL7d18	1955309	1548645	35590540	>323241	-	>600.00	-	19	-
GL7d19	1955296	1911130	37322725	>556503	-	>600.00	-	19	-
GL7d20	1911124	1437546	29893084	>527966	-	>600.00	-	19	-
GL7d21	1437546	822922	18174775	>519459	-	>600.00	-	19	-
GL7d22	822906	349443	8251000	>533442	-	>600.00	-	19	-
GL7d23	349443	105054	2695430	>552765	-	>600.00	-	19	-
graphics	29493	11822	117954	30470	>100000	0.17	>206.18	18	-
HFE18_96_in	2372	2371	933343	26016	12262	14.77	39.95	0	4.9063E-01
IG5-15	11369	6146	323509	62626	305	9.88	10.36	0	5.4855E+01
IG5-16	18846	9519	588326	97466	459	27.24	28.50	0	7.1509E+01
IG5-17	30162	14060	1035008	145262	388	71.77	73.59	0	9.1039E+01
IG5-18	47894	20818	1790490	216979	416	188.70	192.25	0	1.1518E+02
IMDB	896302	303617	3782463	>470966	-	>600.00	-	19	-
kneser_10_4_1	349651	330751	992252	-	-	-	-	10	-
landmark	71952	2673	1146848	17778	243	1.11	1.72	0	1.1280E-05
LargeRegFile	2111154	801374	4944201	>463814	-	>600.00	-	19	-
Maragal_6	21251	10144	537694	71907	1306	41.37	45.05	0	1.0694E+01
Maragal_7	46845	26525	1200537	166881	1302	146.96	156.89	0	1.3690E+01
Maragal_8	60845	33093	1308415	229119	>176	211.47	>212.98	16	-
mri1	114637	65536	589824	325965	905	95.75	107.00	0	2.6742E+01
mri2	104597	63240	569160	392461	>1	69.88	>69.89	16	-
NotreDame_actors	383640	127823	1470404	>701376	-	>600.00	-	19	-
psse0	26722	11028	102432	23833	21917	0.04	44.22	0	6.6358E+01
psse1	14318	11028	57376	28925	>100000	0.06	>193.68	18	-
psse2	28634	11028	115262	34657	>100000	0.12	>211.82	18	-
rel9	5921786	274667	23667183	>302393	-	>600.00	-	19	-
relat9	9746232	274667	38955420	>259346	-	>600.00	-	19	-
Rucci1	1977885	109900	7791168	932200	1804	201.14	309.16	0	7.2798E+02
sls	1748122	62729	6804304	>108831	-	>600.00	-	19	-
TF14	3159	2644	29862	28727	12512	0.43	6.79	0	5.5076E-07
TF15	7741	6334	80057	69250	41740	2.63	54.65	0	8.7033E-07
TF16	19320	15437	216173	169320	>100000	17.47	>333.90	18	-
TF17	48629	38132	586218	418887	>72570	119.09	>600.00	19	-
TF18	123867	95368	1597545	>819223	-	>600.00	-	19	-
TF19	317955	241029	4370721	>810255	-	>600.00	-	19	-
tomographic1	59360	45908	647495	280726	11	3.03	3.09	0	6.8499E+01
Trec14	15904	3159	2872265	34692	>1	58.60	>58.62	16	-
wheel_601	902103	723605	2170814	4253762	>2975	45.30	>600.00	19	-

Table 3.16: Complete LSMR(1000) results for subset CUTEst problems with RIF preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
BAS1LP	9825	5411	587775	58422	1009	7.24	12.77	0	5.8970E+01
BAXTER	30733	27441	111576	254733	>100000	1.33	>78.82	18	-
BCDOUT	7078	5412	67344	38953	>83353	1.52	>600.00	19	-
CO9	22924	10789	109651	52621	3675	1.04	47.22	0	8.9188E+01
CONT11_L	1961394	1468599	5382999	4883216	60	45.09	55.94	0	8.0916E+02
DBIR1	45775	18804	1077025	13660	42892	0.07	125.39	0	3.4987E+01
DBIR2	45877	18906	1158159	92947	37	40.12	40.30	0	1.7694E+02
D2Q06C	5831	2171	33081	94898	>100000	47.45	>283.35	18	-
DELF000	5543	3128	13741	11667	11666	0.01	45.71	0	5.3817E+01
GE	16369	10099	44825	49164	631	0.17	3.05	0	7.2453E+01
LARGE001	7176	4162	18887	16930	>100000	0.01	>540.23	18	-
LPL1	129959	39951	386218	143744	>11462	0.44	>600.00	19	-
MOD2	66409	34774	199810	229986	9499	2.16	427.85	0	1.3872E+02
MODEL10	16819	4400	150372	24083	20533	0.40	125.36	0	5.3554E+01
MPSBCD03	7078	5412	66210	38965	>83382	1.58	>600.00	19	-
NSCT2	37563	23003	697738	109287	>100000	37.33	>195.59	18	-
NSIR2	10057	4453	154939	27196	9	2.41	2.41	0	9.9395E+01
PDE1	271792	270595	990587	>994080	-	>600.00	-	19	-
PDS-100	514577	156016	1096002	618440	202	22.20	28.79	0	2.8489E+02
PDS-90	475448	142596	1014136	570713	194	21.11	26.68	0	2.6847E+02
PILOT-JA	2267	940	14977	5780	736	0.04	0.41	0	3.1987E+01
PILOTNOV	2446	975	13331	5958	695	0.03	0.38	0	3.2873E+01
RAIL2586	923269	2586	8011362	24447	226	106.13	116.17	0	1.4113E+02
RAIL4284	1096894	4284	11284032	45055	359	353.43	380.23	0	1.6948E+02
SPAL_004	321696	10203	46168124	>7094	-	>600.00	-	19	-
STAT96V2	957432	29089	2852184	81055	401	0.61	8.30	0	9.7273E+02
STAT96V3	1113780	33841	3317736	94273	421	0.76	10.40	0	1.0492E+03
STAT96V4	63076	3173	491336	10513	442	2.16	3.29	0	1.2052E+02
STORMG21K	1377306	526185	3459881	>1839359	-	>600.00	-	19	-
WATSON_1	386992	201155	1055093	519977	249	0.51	11.17	0	2.5495E+02
WATSON_2	677224	352013	1846391	1171936	185	4.15	16.30	0	3.3569E+02
WORLD	67147	34506	198883	224464	7509	2.16	329.32	0	1.4068E+02

Table 3.16: Complete LSMR(1000) results for subset UF problems with RIF preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
12month1	872622	12471	22624727	>64564	-	>600.00	-	19	-
162bit	3606	3476	37118	28550	1362	1.78	5.95	0	1.1771E+01
176bit	7441	7150	82270	56269	3618	8.48	38.92	0	1.8417E+01
192bit	13691	13093	154303	96275	6932	30.60	144.37	0	2.4854E+01
208bit	24430	23191	299756	168273	12829	108.40	503.38	0	3.8501E+01
beaflw	500	492	53403	5307	>5	0.18	>0.18	16	-
c8_mat11	5761	4562	2462970	49640	52356	66.58	>600.00	0	2.1759E+01
connectus	394707	458	1127525	1744	7	2.30	2.34	0	6.2791E+02
ESOC	327062	37349	6019939	>274077	-	>600.00	-	19	-
EternityII_Etilde	204304	10054	1170516	103380	762	38.00	45.75	0	4.4074E-06
f855_mat9	2511	2456	171214	26961	17784	2.98	64.91	0	1.6670E+01
GL7d16	955127	460260	14488881	>327955	-	>600.00	-	19	-
GL7d17	1548649	955127	25978098	>331042	-	>600.00	-	19	-
GL7d18	1955309	1548645	35590540	>356411	-	>600.00	-	19	-
GL7d19	1955296	1911130	37322725	>559594	-	>600.00	-	19	-
GL7d20	1911124	1437546	29893084	>531805	-	>600.00	-	19	-
GL7d21	1437546	822922	18174775	>534675	-	>600.00	-	19	-
GL7d22	822906	349443	8251000	>548441	-	>600.00	-	19	-
GL7d23	349443	105054	2695430	>585054	-	>600.00	-	19	-
graphics	29493	11822	117954	30470	33504	0.17	512.30	0	3.0333E-04
HFE18_96_in	2372	2371	933343	26016	9512	14.66	57.60	0	4.9063E-01
IG5-15	11369	6146	323509	62626	289	9.83	10.41	0	5.4855E+01
IG5-16	18846	9519	588326	97466	425	26.90	28.67	0	7.1509E+01
IG5-17	30162	14060	1035008	145262	363	69.93	72.21	0	9.1039E+01
IG5-18	47894	20818	1790490	216979	386	180.96	185.43	0	1.1518E+02
IMDB	896302	303617	3782463	>504695	-	>600.00	-	19	-
kneser_10_4_1	349651	330751	992252	-	-	-	-	10	-
landmark	71952	2673	1146848	17778	218	1.11	1.67	0	1.1280E-05
LargeRegFile	2111154	801374	4944201	>467134	-	>600.00	-	19	-
Maragal_6	21251	10144	537694	71907	906	41.21	47.79	0	1.0694E+01
Maragal_7	46845	26525	1200537	166881	436	145.71	150.75	0	1.3690E+01
Maragal_8	60845	33093	1308415	229119	>372	201.33	>206.25	16	-
mri1	114637	65536	589824	325965	825	94.29	127.02	0	2.6742E+01
mri2	104597	63240	569160	392461	>1	67.32	>67.33	16	-
NotreDame_actors	383640	127823	1470404	>729579	-	>600.00	-	19	-
psse0	26722	11028	102432	23833	21551	0.04	309.59	0	6.6358E+01
psse1	14318	11028	57376	28925	>41455	0.06	>600.00	19	-
psse2	28634	11028	115262	34657	>41141	0.12	>600.00	19	-
rel9	5921786	274667	23667183	>287148	-	>600.00	-	19	-
relat9	9746232	274667	38955420	>264626	-	>600.00	-	19	-
Rucci1	1977885	109900	7791168	932200	1755	200.02	455.41	0	7.2798E+02
sls	1748122	62729	6804304	>108831	-	>600.00	-	19	-
TF14	3159	2644	29862	28727	10260	0.44	34.70	0	5.2986E-07
TF15	7741	6334	80057	69250	37003	2.64	310.75	0	8.7663E-07
TF16	19320	15437	216173	169320	>28765	17.46	>600.00	19	-
TF17	48629	38132	586218	418887	>11688	119.25	>600.00	19	-
TF18	123867	95368	1597545	>806267	-	>600.00	-	19	-
TF19	317955	241029	4370721	>779510	-	>600.00	-	19	-
tomographic1	59360	45908	647495	280726	11	3.03	3.08	0	6.8499E+01
Trec14	15904	3159	2872265	34692	>1	59.78	>59.79	16	-
wheel_601	902103	723605	2170814	4253762	>854	45.05	>600.00	19	-

Table 3.17: Complete LSMR(0) results for subset CUTEst problems with `HSL_MI35` preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
BAS1LP	9825	5411	587775	113414	8234	1.38	20.31	0	5.5447E+01
BAXTER	30733	27441	111576	218513	>100000	0.28	>227.18	18	-
BCDOUT	7078	5412	67344	97350	>100000	0.47	>88.97	18	-
CO9	22924	10789	109651	122520	380	0.21	0.72	0	8.9188E+01
CONT11_L	1961394	1468599	5382999	10208898	22	9.38	12.62	0	8.0916E+02
DBIR1	45775	18804	1077025	30258	209	0.05	0.11	0	3.4934E+01
DBIR2	45877	18906	1158159	264644	1889	2.19	11.63	0	1.6702E+02
D2Q06C	5831	2171	33081	172316	806	1.92	5.85	0	1.6704E+02
DELF000	5543	3128	13741	11314	60	0.01	0.02	0	5.3817E+01
GE	16369	10099	44825	134483	29	0.08	0.11	0	7.2447E+01
LARGE001	7176	4162	18887	16000	75	0.01	0.03	0	6.0680E+01
LPL1	129959	39951	386218	541699	422	0.93	3.31	0	7.0878E+01
MOD2	66409	34774	199810	527770	153	0.99	1.69	0	1.3872E+02
MODEL10	16819	4400	150372	78015	743	0.09	0.83	0	5.3554E+01
MPSBCD03	7078	5412	66210	98584	>100000	0.43	>89.58	18	-
NSCT2	37563	23003	697738	165302	717	2.55	5.09	0	1.8388E+02
NSIR2	10057	4453	154939	54142	397	0.21	0.55	0	8.0529E+01
PDE1	271792	270595	990587	-	-	-	-	10	-
PDS-100	514577	156016	1096002	2891511	90	1.58	3.95	0	2.8489E+02
PDS-90	475448	142596	1014136	2626289	88	1.45	3.55	0	2.6847E+02
PILOT-JA	2267	940	14977	10870	330	0.02	0.07	0	3.1987E+01
PILOTNOV	2446	975	13331	11317	217	0.02	0.05	0	3.2873E+01
RAIL2586	923269	2586	8011362	51833	153	2.32	8.83	0	1.4113E+02
RAIL4284	1096894	4284	11284032	89219	226	4.74	21.25	0	1.6948E+02
SPAL_004	321696	10203	46168124	213972	>2793	75.92	>600.00	19	-
STAT96V2	957432	29089	2852184	276290	19	0.28	0.57	0	9.7273E+02
STAT96V3	1113780	33841	3317736	319109	20	0.31	0.61	0	1.0492E+03
STAT96V4	63076	3173	491336	47295	19	0.08	0.12	0	1.2052E+02
STORMG21K	1377306	526185	3459881	7505682	2296	40.05	224.37	0	8.9636E+02
WATSON_1	386992	201155	1055093	2634818	73	1.45	3.15	0	2.5495E+02
WATSON_2	677224	352013	1846391	4648375	54	2.95	5.28	0	3.3569E+02
WORLD	67147	34506	198883	511951	155	0.75	1.41	0	1.4068E+02

Table 3.17: Complete LSMR(0) results for subset UF problems with `HSL_MI35` preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
12month1	872622	12471	22624727	260889	376	175.35	212.58	0	9.2740E+02
162bit	3606	3476	37118	70512	254	0.14	0.28	0	1.1771E+01
176bit	7441	7150	82270	145649	461	0.30	0.83	0	1.8417E+01
192bit	13691	13093	154303	267084	1284	0.48	3.19	0	2.4854E+01
208bit	24430	23191	299756	471420	2199	0.97	9.76	0	3.8499E+01
beaflw	500	492	53403	9814	35274	0.11	5.45	0	4.6942E+00
c8_mat11	5761	4562	2462970	95477	33141	30.98	196.55	0	2.1934E+01
connectus	394707	458	1127525	5185	6	0.22	0.25	0	6.2791E+02
ESOC	327062	37349	6019939	776570	>20644	3.69	>600.00	19	-
EternityII_Etilde	204304	10054	1170516	205375	586	1.15	4.98	0	4.3435E-06
f855_mat9	2511	2456	171214	51366	12937	0.87	9.38	0	1.7979E+01
GL7d16	955127	460260	14488881	9665201	32	94.75	103.33	0	7.4875E+02
GL7d17	1548649	955127	25978098	20057165	28	327.05	343.72	0	8.9897E+02
GL7d18	1955309	1548645	35590540	32520973	-	>600.00	-	19	-
GL7d19	1955296	1911130	37322725	40133312	-	>600.00	-	19	-
GL7d20	1911124	1437546	29893084	30188087	28	523.25	551.58	0	1.0916E+03
GL7d21	1437546	822922	18174775	17281075	25	180.75	194.44	0	1.0029E+03
GL7d22	822906	349443	8251000	7337962	22	38.64	42.15	0	7.8940E+02
GL7d23	349443	105054	2695430	2205827	21	5.50	6.37	0	5.3569E+02
graphics	29493	11822	117954	24901	1892	0.04	1.35	0	3.0333E-04
HFE18_96_in	2372	2371	933343	49576	15197	5.73	35.27	0	4.9063E-01
IG5-15	11369	6146	323509	128833	244	0.70	1.03	0	5.4855E+01
IG5-16	18846	9519	588326	199678	354	1.65	2.52	0	7.1509E+01
IG5-17	30162	14060	1035008	295028	338	2.73	4.20	0	9.1039E+01
IG5-18	47894	20818	1790490	436954	322	6.82	9.57	0	1.1518E+02
IMDB	896302	303617	3782463	5858164	>5867	47.90	>600.00	19	-
kneser_10_4_1	349651	330751	992252	6759341	3279	5.77	192.55	0	1.6241E+02
landmark	71952	2673	1146848	26909	12	0.28	0.31	0	1.1270E-05
LargeRegFile	2111154	801374	4944201	4106048	12	2.57	3.80	0	4.4422E+02
Maragal_6	21251	10144	537694	212144	689	13.12	14.79	0	1.0695E+01
Maragal_7	46845	26525	1200537	553856	268	45.09	46.89	0	1.3690E+01
Maragal_8	60845	33093	1308415	597971	>75347	5.18	>600.00	19	-
mri1	114637	65536	589824	636290	2223	2.21	19.80	0	2.6742E+01
mri2	104597	63240	569160	781491	3107	4.86	27.96	0	1.4126E+02
NotreDame_actors	383640	127823	1470404	2506265	>19439	9.45	>600.00	19	-
psse0	26722	11028	102432	35197	71	0.02	0.07	0	6.6358E+01
psse1	14318	11028	57376	35771	575	0.03	0.43	0	3.5920E+01
psse2	28634	11028	115262	40814	722	0.04	0.64	0	7.8596E+01
rel9	5921786	274667	23667183	5764774	37	62.77	77.58	0	1.5416E+03
relat9	9746232	274667	38955420	5763434	36	71.48	96.51	0	3.0561E+03
Rucci1	1977885	109900	7791168	2306811	>9157	2.59	>600.00	19	-
sls	1748122	62729	6804304	1226997	70	7.89	12.39	0	9.7553E-06
TF14	3159	2644	29862	55249	12469	0.06	5.62	0	5.4276E-07
TF15	7741	6334	80057	132747	43527	0.20	47.48	0	8.7657E-07
TF16	19320	15437	216173	323886	>100000	0.44	>249.55	18	-
TF17	48629	38132	586218	800458	>90424	1.19	>600.00	19	-
TF18	123867	95368	1597545	2002386	>30385	3.82	>600.00	19	-
TF19	317955	241029	4370721	5061262	>10316	12.51	>600.00	19	-
tomographic1	59360	45908	647495	906437	1873	1.44	16.12	0	4.1931E+01
Trec14	15904	3159	2872265	66099	1778	26.49	38.05	0	1.1217E+02
wheel_601	902103	723605	2170814	14201674	>4291	63.25	>600.00	19	-

Table 3.18: Complete LSMR(10) results for subset CUTEst problems with `HSL_MI35` preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
BAS1LP	9825	5411	587775	113414	7983	1.33	21.71	0	5.5447E+01
BAXTER	30733	27441	111576	218513	>100000	0.29	>293.46	18	-
BCDOUT	7078	5412	67344	97350	>100000	0.46	>92.58	18	-
CO9	22924	10789	109651	122520	381	0.22	0.79	0	8.9188E+01
CONT11_L	1961394	1468599	5382999	10208898	22	9.38	13.68	0	8.0916E+02
DBIR1	45775	18804	1077025	30258	209	0.04	0.11	0	3.4934E+01
DBIR2	45877	18906	1158159	264644	1863	2.24	13.04	0	1.6702E+02
D2Q06C	5831	2171	33081	172316	833	2.14	6.80	0	1.6702E+02
DELF000	5543	3128	13741	11314	60	0.01	0.03	0	5.3817E+01
GE	16369	10099	44825	134483	28	0.08	0.12	0	7.2447E+01
LARGE001	7176	4162	18887	16000	75	0.01	0.04	0	6.0680E+01
LPL1	129959	39951	386218	541699	420	0.94	3.99	0	7.0878E+01
MOD2	66409	34774	199810	527770	151	1.07	1.93	0	1.3872E+02
MODEL10	16819	4400	150372	78015	743	0.09	0.88	0	5.3554E+01
MPSBCD03	7078	5412	66210	98584	>100000	0.42	>92.08	18	-
NSCT2	37563	23003	697738	165302	615	2.51	5.19	0	1.8388E+02
NSIR2	10057	4453	154939	54142	386	0.21	0.58	0	8.0529E+01
PDE1	271792	270595	990587	-	-	-	-	10	-
PDS-100	514577	156016	1096002	2891511	90	1.74	5.19	0	2.8489E+02
PDS-90	475448	142596	1014136	2626289	88	1.44	3.93	0	2.6847E+02
PILOT-JA	2267	940	14977	10870	323	0.03	0.08	0	3.1987E+01
PILOTNOV	2446	975	13331	11317	214	0.02	0.03	0	3.2873E+01
RAIL2586	923269	2586	8011362	51833	151	2.43	10.55	0	1.4113E+02
RAIL4284	1096894	4284	11284032	89219	224	4.65	25.03	0	1.6948E+02
SPAL_004	321696	10203	46168124	213972	>1047	74.72	>600.00	19	-
STAT96V2	957432	29089	2852184	276290	19	0.27	0.54	0	9.7273E+02
STAT96V3	1113780	33841	3317736	319109	20	0.31	0.64	0	1.0492E+03
STAT96V4	63076	3173	491336	47295	17	0.08	0.11	0	1.2052E+02
STORMG21K	1377306	526185	3459881	7505682	2285	30.83	258.65	0	8.9636E+02
WATSON_1	386992	201155	1055093	2634818	73	1.50	3.58	0	2.5495E+02
WATSON_2	677224	352013	1846391	4648375	54	2.85	5.73	0	3.3569E+02
WORLD	67147	34506	198883	511951	154	0.76	1.58	0	1.4068E+02

Table 3.18: Complete LSMR(10) results for subset UF problems with `HSL_MI35` preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
12month1	872622	12471	22624727	260889	371	171.69	207.50	0	9.2740E+02
162bit	3606	3476	37118	70512	247	0.15	0.31	0	1.1771E+01
176bit	7441	7150	82270	145649	454	0.28	0.85	0	1.8417E+01
192bit	13691	13093	154303	267084	1282	0.47	3.34	0	2.4854E+01
208bit	24430	23191	299756	471420	2198	0.97	10.38	0	3.8499E+01
beaflw	500	492	53403	9814	33967	0.11	5.44	0	4.6912E+00
c8_mat11	5761	4562	2462970	95477	29944	31.86	183.17	0	2.1934E+01
connectus	394707	458	1127525	5185	6	0.24	0.28	0	6.2791E+02
ESOC	327062	37349	6019939	776570	>21629	3.32	>600.00	19	-
EternityII_Etilde	204304	10054	1170516	205375	585	1.14	5.02	0	4.4236E-06
f855_mat9	2511	2456	171214	51366	12372	0.89	9.55	0	1.7979E+01
GL7d16	955127	460260	14488881	9665201	32	50.70	58.59	0	7.4875E+02
GL7d17	1548649	955127	25978098	20057165	28	301.96	318.66	0	8.9897E+02
GL7d18	1955309	1548645	35590540	>32520973	-	>600.00	-	19	-
GL7d19	1955296	1911130	37322725	40133312	46	438.21	486.49	0	1.0426E+03
GL7d20	1911124	1437546	29893084	30188087	28	219.99	242.04	0	1.0916E+03
GL7d21	1437546	822922	18174775	17281075	25	73.73	84.13	0	1.0029E+03
GL7d22	822906	349443	8251000	7337962	22	21.64	25.17	0	7.8940E+02
GL7d23	349443	105054	2695430	2205827	21	5.03	5.91	0	5.3569E+02
graphics	29493	11822	117954	24901	1891	0.04	1.68	0	3.0333E-04
HFE18_96_in	2372	2371	933343	49576	14659	6.11	35.13	0	4.9063E-01
IG5-15	11369	6146	323509	128833	239	0.71	1.06	0	5.4855E+01
IG5-16	18846	9519	588326	199678	348	1.68	2.58	0	7.1509E+01
IG5-17	30162	14060	1035008	295028	326	2.76	4.24	0	9.1039E+01
IG5-18	47894	20818	1790490	436954	309	6.76	9.48	0	1.1518E+02
IMDB	896302	303617	3782463	5858164	>5974	40.04	>600.00	19	-
kneser_10_4_1	349651	330751	992252	6759341	3257	5.69	203.24	0	1.6241E+02
landmark	71952	2673	1146848	26909	12	0.29	0.32	0	1.1270E-05
LargeRegFile	2111154	801374	4944201	4106048	12	2.21	3.51	0	4.4422E+02
Maragal_6	21251	10144	537694	212144	679	13.56	15.27	0	1.0695E+01
Maragal_7	46845	26525	1200537	553856	264	47.14	48.97	0	1.3690E+01
Maragal_8	60845	33093	1308415	597971	>71973	5.27	>600.00	19	-
mri1	114637	65536	589824	636290	2217	2.24	23.14	0	2.6742E+01
mri2	104597	63240	569160	781491	2935	4.95	29.66	0	1.4126E+02
NotreDame_actors	383640	127823	1470404	2506265	>18396	9.20	>600.00	19	-
psse0	26722	11028	102432	35197	71	0.02	0.08	0	6.6358E+01
psse1	14318	11028	57376	35771	575	0.03	0.51	0	3.5920E+01
psse2	28634	11028	115262	40814	722	0.04	0.76	0	7.8596E+01
rel9	5921786	274667	23667183	5764774	37	44.03	56.86	0	1.5416E+03
relat9	9746232	274667	38955420	5763434	36	53.35	73.79	0	3.0561E+03
Rucci1	1977885	109900	7791168	2306811	>12455	2.49	>600.00	19	-
sls	1748122	62729	6804304	1226997	68	6.44	9.92	0	1.0594E-05
TF14	3159	2644	29862	55249	11418	0.06	5.55	0	5.6152E-07
TF15	7741	6334	80057	132747	41034	0.21	47.82	0	8.7747E-07
TF16	19320	15437	216173	323886	>100000	0.45	392.60	0	1.3888E-06
TF17	48629	38132	586218	800458	>84020	1.22	>600.00	19	-
TF18	123867	95368	1597545	2002386	>28500	3.58	>600.00	19	-
TF19	317955	241029	4370721	5061262	>8670	12.75	>600.00	19	-
tomographic1	59360	45908	647495	906437	1867	1.48	17.23	0	4.1931E+01
Trec14	15904	3159	2872265	66099	1603	27.41	39.68	0	1.1217E+02
wheel_601	902103	723605	2170814	14201674	>4024	51.45	>600.00	19	-

Table 3.19: Complete LSMR(100) results for subset CUTEst problems with `HSL_MI35` preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
BAS1LP	9825	5411	587775	113414	5870	1.33	19.66	0	5.5447E+01
BAXTER	30733	27441	111576	218513	>91449	0.30	>600.00	19	-
BCDOUT	7078	5412	67344	97350	>100000	0.47	>164.35	18	-
CO9	22924	10789	109651	122520	363	0.21	1.15	0	8.9188E+01
CONT11_L	1961394	1468599	5382999	10208898	22	8.98	12.78	0	8.0916E+02
DBIR1	45775	18804	1077025	30258	204	0.04	0.14	0	3.4934E+01
DBIR2	45877	18906	1158159	264644	1643	2.11	14.38	0	1.6702E+02
D2Q06C	5831	2171	33081	172316	745	1.89	7.24	0	1.6703E+02
DELF000	5543	3128	13741	11314	60	0.01	0.03	0	5.3817E+01
GE	16369	10099	44825	134483	28	0.08	0.12	0	7.2447E+01
LARGE001	7176	4162	18887	16000	76	0.01	0.04	0	6.0680E+01
LPL1	129959	39951	386218	541699	398	0.89	5.01	0	7.0878E+01
MOD2	66409	34774	199810	527770	151	0.97	2.11	0	1.3872E+02
MODEL10	16819	4400	150372	78015	730	0.09	1.21	0	5.3554E+01
MPSBCD03	7078	5412	66210	98584	>100000	0.42	>160.74	18	-
NSCT2	37563	23003	697738	165302	436	2.47	5.17	0	1.8388E+02
NSIR2	10057	4453	154939	54142	341	0.21	0.65	0	8.0529E+01
PDE1	271792	270595	990587	-	-	-	-	10	-
PDS-100	514577	156016	1096002	2891511	86	1.55	4.59	0	2.8489E+02
PDS-90	475448	142596	1014136	2626289	85	1.40	4.11	0	2.6847E+02
PILOT-JA	2267	940	14977	10870	296	0.02	0.09	0	3.1987E+01
PILOTNOV	2446	975	13331	11317	200	0.02	0.06	0	3.2873E+01
RAIL2586	923269	2586	8011362	51833	142	2.51	8.59	0	1.4113E+02
RAIL4284	1096894	4284	11284032	89219	217	4.11	19.78	0	1.6948E+02
SPAL_004	321696	10203	46168124	213972	>2947	71.40	>600.00	19	-
STAT96V2	957432	29089	2852184	276290	19	0.28	0.55	0	9.7273E+02
STAT96V3	1113780	33841	3317736	319109	20	0.32	0.65	0	1.0492E+03
STAT96V4	63076	3173	491336	47295	17	0.08	0.11	0	1.2052E+02
STORMG21K	1377306	526185	3459881	7505682	1871	29.82	323.34	0	8.9636E+02
WATSON_1	386992	201155	1055093	2634818	70	1.47	3.78	0	2.5495E+02
WATSON_2	677224	352013	1846391	4648375	54	2.85	5.86	0	3.3569E+02
WORLD	67147	34506	198883	511951	152	0.74	1.99	0	1.4068E+02

Table 3.19: Complete LSMR(100) results for subset UF problems with `HSL_MI35` preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
12month1	872622	12471	22624727	260889	349	181.99	218.15	0	9.2740E+02
162bit	3606	3476	37118	70512	234	0.15	0.37	0	1.1771E+01
176bit	7441	7150	82270	145649	431	0.31	1.16	0	1.8417E+01
192bit	13691	13093	154303	267084	1273	0.47	5.21	0	2.4854E+01
208bit	24430	23191	299756	471420	2188	1.01	16.20	0	3.8499E+01
beaflw	500	492	53403	9814	21187	0.10	4.52	0	4.6912E+00
c8_mat11	5761	4562	2462970	95477	19906	31.90	144.56	0	2.1934E+01
connectus	394707	458	1127525	5185	6	0.23	0.26	0	6.2791E+02
ESOC	327062	37349	6019939	776570	>10934	3.90	>600.00	19	-
EternityII_Etilde	204304	10054	1170516	205375	570	1.17	5.54	0	4.5088E-06
f855_mat9	2511	2456	171214	51366	8730	0.89	8.98	0	1.7979E+01
GL7d16	955127	460260	14488881	9665201	32	96.09	104.73	0	7.4875E+02
GL7d17	1548649	955127	25978098	20057165	28	329.38	347.31	0	8.9897E+02
GL7d18	1955309	1548645	35590540	>32520973	-	>600.00	-	19	9.3184E+02
GL7d19	1955296	1911130	37322725	>40133312	-	>600.00	-	19	1.0426E+03
GL7d20	1911124	1437546	29893084	30188087	28	527.27	553.67	0	1.0916E+03
GL7d21	1437546	822922	18174775	17281075	25	163.76	175.43	0	1.0029E+03
GL7d22	822906	349443	8251000	7337962	22	30.36	34.07	0	7.8940E+02
GL7d23	349443	105054	2695430	2205827	21	5.63	6.52	0	5.3569E+02
graphics	29493	11822	117954	24901	1924	0.04	4.29	0	3.0333E-04
HFE18_96_in	2372	2371	933343	49576	13148	6.06	35.56	0	4.9063E-01
IG5-15	11369	6146	323509	128833	226	0.72	1.19	0	5.4855E+01
IG5-16	18846	9519	588326	199678	331	1.72	2.89	0	7.1509E+01
IG5-17	30162	14060	1035008	295028	302	2.87	4.66	0	9.1039E+01
IG5-18	47894	20818	1790490	436954	289	6.98	10.12	0	1.1518E+02
IMDB	896302	303617	3782463	5858164	>4059	46.74	>600.00	19	-
kneser_10_4_1	349651	330751	992252	6759341	3172	5.73	331.96	0	1.6241E+02
landmark	71952	2673	1146848	26909	12	0.29	0.32	0	1.1270E-05
LargeRegFile	2111154	801374	4944201	4106048	12	2.47	3.79	0	4.4422E+02
Maragal_6	21251	10144	537694	212144	626	13.68	15.95	0	1.0695E+01
Maragal_7	46845	26525	1200537	553856	236	47.35	49.69	0	1.3690E+01
Maragal_8	60845	33093	1308415	597971	>48409	5.31	>600.00	19	-
mri1	114637	65536	589824	636290	2177	2.23	37.63	0	2.6742E+01
mri2	104597	63240	569160	781491	2337	4.96	41.13	0	1.4126E+02
NotreDame_actors	383640	127823	1470404	2506265	>12256	9.72	>600.00	19	-
psse0	26722	11028	102432	35197	71	0.02	0.12	0	6.6358E+01
psse1	14318	11028	57376	35771	572	0.03	1.17	0	3.5920E+01
psse2	28634	11028	115262	40814	721	0.04	1.61	0	7.8596E+01
rel9	5921786	274667	23667183	5764774	37	57.69	72.76	0	1.5416E+03
relat9	9746232	274667	38955420	5763434	36	73.85	97.11	0	3.0561E+03
Rucci1	1977885	109900	7791168	2306811	3633	2.73	232.98	0	7.2798E+02
sls	1748122	62729	6804304	1226997	66	8.36	12.25	0	8.6581E-06
TF14	3159	2644	29862	55249	9648	0.07	7.51	0	5.5738E-07
TF15	7741	6334	80057	132747	33891	0.20	62.63	0	8.7655E-07
TF16	19320	15437	216173	323886	>100000	0.45	525.09	0	1.3896E-06
TF17	48629	38132	586218	800458	>51649	1.26	>600.00	19	-
TF18	123867	95368	1597545	2002386	>19450	3.57	>600.00	19	-
TF19	317955	241029	4370721	5061262	>6540	11.26	>600.00	19	-
tomographic1	59360	45908	647495	906437	1845	1.46	26.43	0	4.1931E+01
Trec14	15904	3159	2872265	66099	1142	27.38	35.22	0	1.1217E+02
wheel_601	902103	723605	2170814	14201674	>2341	61.10	>600.00	19	-

Table 3.20: Complete LSMR(1000) results for subset CUTEst problems with `HSL_MI35` preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
BAS1LP	9825	5411	587775	113414	1885	1.32	15.89	0	5.5447E+01
BAXTER	30733	27441	111576	218513	>15000	0.28	>600.00	19	-
BCDOUT	7078	5412	67344	97350	>72374	0.46	>600.00	19	-
CO9	22924	10789	109651	122520	337	0.22	1.54	0	8.9188E+01
CONT11_L	1961394	1468599	5382999	10208898	22	14.38	21.93	0	8.0916E+02
DBIR1	45775	18804	1077025	30258	197	0.04	0.17	0	3.4934E+01
DBIR2	45877	18906	1158159	264644	1230	3.46	36.04	0	1.6702E+02
D2Q06C	5831	2171	33081	172316	571	1.96	9.31	0	1.6705E+02
DELF000	5543	3128	13741	11314	60	0.01	0.03	0	5.3817E+01
GE	16369	10099	44825	134483	28	0.08	0.12	0	7.2447E+01
LARGE001	7176	4162	18887	16000	76	0.01	0.04	0	6.0680E+01
LPL1	129959	39951	386218	541699	397	0.92	7.84	0	7.0878E+01
MOD2	66409	34774	199810	527770	148	1.02	2.31	0	1.3872E+02
MODEL10	16819	4400	150372	78015	711	0.09	2.39	0	5.3554E+01
MPSBCD03	7078	5412	66210	98584	>68770	0.42	>600.00	19	-
NSCT2	37563	23003	697738	165302	283	2.43	4.88	0	1.8388E+02
NSIR2	10057	4453	154939	54142	276	0.21	0.67	0	8.0530E+01
PDE1	271792	270595	990587	-	-	-	-	10	-
PDS-100	514577	156016	1096002	2891511	86	1.64	4.99	0	2.8489E+02
PDS-90	475448	142596	1014136	2626289	85	1.48	4.54	0	2.6847E+02
PILOT-JA	2267	940	14977	10870	264	0.02	0.10	0	3.1987E+01
PILOTNOV	2446	975	13331	11317	188	0.02	0.06	0	3.2873E+01
RAIL2586	923269	2586	8011362	51833	139	2.40	9.08	0	1.4113E+02
RAIL4284	1096894	4284	11284032	89219	211	4.53	23.02	0	1.6948E+02
SPAL_004	321696	10203	46168124	213972	>1372	74.57	>600.00	19	-
STAT96V2	957432	29089	2852184	276290	19	0.28	0.59	0	9.7273E+02
STAT96V3	1113780	33841	3317736	319109	20	0.32	0.72	0	1.0492E+03
STAT96V4	63076	3173	491336	47295	17	0.09	0.12	0	1.2052E+02
STORMG21K	1377306	526185	3459881	7505682	912	32.80	594.67	0	8.9636E+02
WATSON_1	386992	201155	1055093	2634818	70	1.50	4.08	0	2.5495E+02
WATSON_2	677224	352013	1846391	4648375	54	2.93	6.41	0	3.3569E+02
WORLD	67147	34506	198883	511951	152	0.76	2.04	0	1.4068E+02

Table 3.20: Complete LSMR(1000) results for subset UF problems with `HSL_MI35` preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
12month1	872622	12471	22624727	260889	330	178.82	219.07	0	9.2740E+02
162bit	3606	3476	37118	70512	224	0.15	0.40	0	1.1771E+01
176bit	7441	7150	82270	145649	406	0.33	1.62	0	1.8417E+01
192bit	13691	13093	154303	267084	1205	0.57	15.87	0	2.4854E+01
208bit	24430	23191	299756	471420	2104	1.22	62.69	0	3.8499E+01
beaflw	500	492	53403	9814	424	0.10	0.23	0	4.6846E+00
c8_mat11	5761	4562	2462970	95477	12648	33.45	183.77	0	2.1934E+01
connectus	394707	458	1127525	5185	6	0.29	0.32	0	6.2791E+02
ESOC	327062	37349	6019939	776570	>7366	4.30	>600.00	19	-
EternityII_Etilde	204304	10054	1170516	205375	498	1.16	6.15	0	4.3254E-06
f855_mat9	2511	2456	171214	51366	3960	0.89	14.67	0	1.7979E+01
GL7d16	955127	460260	14488881	9665201	32	67.30	81.72	0	7.4875E+02
GL7d17	1548649	955127	25978098	20057165	28	526.55	554.00	0	8.9897E+02
GL7d18	1955309	1548645	35590540	>32520973	-	>600.00	-	19	9.3184E+02
GL7d19	1955296	1911130	37322725	>40133312	-	>600.00	-	19	-
GL7d20	1911124	1437546	29893084	30188087	28	465.20	490.39	0	1.0916E+03
GL7d21	1437546	822922	18174775	17281075	25	165.67	177.30	0	1.0029E+03
GL7d22	822906	349443	8251000	7337962	22	33.77	39.21	0	7.8940E+02
GL7d23	349443	105054	2695430	2205827	21	7.89	9.31	0	5.3569E+02
graphics	29493	11822	117954	24901	1071	0.07	10.74	0	3.0333E-04
HFE18_96_in	2372	2371	933343	49576	9417	6.07	54.77	0	4.9063E-01
IG5-15	11369	6146	323509	128833	218	0.72	1.24	0	5.4855E+01
IG5-16	18846	9519	588326	199678	316	1.71	3.19	0	7.1509E+01
IG5-17	30162	14060	1035008	295028	286	2.82	4.90	0	9.1039E+01
IG5-18	47894	20818	1790490	436954	271	7.15	10.80	0	1.1518E+02
IMDB	896302	303617	3782463	5858164	>1342	48.99	>600.00	19	-
kneser_10_4_1	349651	330751	992252	6759341	>1464	6.12	>600.00	19	-
landmark	71952	2673	1146848	26909	12	0.31	0.36	0	1.1270E-05
LargeRegFile	2111154	801374	4944201	4106048	12	2.91	4.72	0	4.4422E+02
Maragal_6	21251	10144	537694	212144	566	13.52	17.61	0	1.0695E+01
Maragal_7	46845	26525	1200537	553856	219	82.04	86.61	0	1.3690E+01
Maragal_8	60845	33093	1308415	597971	>10331	5.54	>600.00	19	-
mri1	114637	65536	589824	636290	2074	2.24	161.52	0	2.6742E+01
mri2	104597	63240	569160	781491	1672	4.92	122.22	0	1.4126E+02
NotreDame_actors	383640	127823	1470404	2506265	>3250	9.32	>600.00	19	-
psse0	26722	11028	102432	35197	71	0.02	0.12	0	6.6358E+01
psse1	14318	11028	57376	35771	571	0.03	2.82	0	3.5920E+01
psse2	28634	11028	115262	40814	721	0.04	4.52	0	7.8596E+01
rel9	5921786	274667	23667183	5764774	37	47.82	63.01	0	1.5416E+03
relat9	9746232	274667	38955420	5763434	36	59.44	83.83	0	3.0561E+03
Rucci1	1977885	109900	7791168	2306811	1449	2.66	239.28	0	7.2798E+02
sls	1748122	62729	6804304	1226997	66	7.22	11.09	0	8.6581E-06
TF14	3159	2644	29862	55249	7795	0.08	29.55	0	5.6044E-07
TF15	7741	6334	80057	132747	27816	0.23	266.18	0	8.7980E-07
TF16	19320	15437	216173	323886	>24783	0.47	>600.00	19	-
TF17	48629	38132	586218	800458	>8399	1.85	>600.00	19	-
TF18	123867	95368	1597545	2002386	>4475	3.77	>600.00	19	-
TF19	317955	241029	4370721	5061262	>1975	10.50	>600.00	19	-
tomographic1	59360	45908	647495	906437	1795	1.56	95.85	0	4.1931E+01
Trec14	15904	3159	2872265	66099	585	28.31	33.05	0	1.1217E+02
wheel_601	902103	723605	2170814	14201674	>757	36.08	>600.00	19	-

Table 3.21: Complete LSMR(10) results for subset CUTEst problems with `HSL_MI35` (`lsize=rsize=`10) preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
BAS1LP	9825	5411	587775	59460	8741	1.31	20.09	0	5.5447E+01
BAXTER	30733	27441	111576	248516	>100000	0.22	>287.79	18	-
BCDOUT	7078	5412	67344	56194	>100000	0.33	>75.67	18	-
CO9	22924	10789	109651	91588	1225	0.16	1.82	0	8.9188E+01
CONT11_L	1961394	1468599	5382999	8018634	15	6.69	9.21	0	8.0916E+02
DBIR1	45775	18804	1077025	21230	411	0.02	0.16	0	3.4934E+01
DBIR2	45877	18906	1158159	160207	2214	1.41	12.27	0	1.6702E+02
D2Q06C	5831	2171	33081	107376	1012	1.74	6.74	0	1.6706E+02
DELF000	5543	3128	13741	11314	60	0.01	0.03	0	5.3817E+01
GE	16369	10099	44825	76862	1786	0.20	1.98	0	7.2516E+01
LARGE001	7176	4162	18887	16000	75	0.01	0.04	0	6.0680E+01
LPL1	129959	39951	386218	389043	453	0.32	3.06	0	7.0878E+01
MOD2	66409	34774	199810	351891	204	0.31	1.22	0	1.3872E+02
MODEL10	16819	4400	150372	43968	766	0.06	0.72	0	5.3554E+01
MPSBCD03	7078	5412	66210	56094	>100000	0.33	>76.03	18	-
NSCT2	37563	23003	697738	96039	703	2.71	5.18	0	1.8388E+02
NSIR2	10057	4453	154939	29825	558	0.24	0.68	0	8.0531E+01
PDE1	271792	270595	990587	-	-	-	-	10	-
PDS-100	514577	156016	1096002	1679965	149	0.86	4.32	0	2.8489E+02
PDS-90	475448	142596	1014136	1535845	139	0.78	3.73	0	2.6847E+02
PILOT-JA	2267	940	14977	7346	1151	0.01	0.16	0	3.1988E+01
PILOTNOV	2446	975	13331	7824	1261	0.02	0.16	0	3.2873E+01
RAIL2586	923269	2586	8011362	27976	201	1.96	10.45	0	1.4113E+02
RAIL4284	1096894	4284	11284032	46967	288	3.90	23.95	0	1.6948E+02
SPAL_004	321696	10203	46168124	112156	>2978	74.69	>600.00	19	-
STAT96V2	957432	29089	2852184	257489	28	0.29	0.73	0	9.7273E+02
STAT96V3	1113780	33841	3317736	296992	30	0.33	0.78	0	1.0492E+03
STAT96V4	63076	3173	491336	27248	44	0.07	0.15	0	1.2052E+02
STORMG21K	1377306	526185	3459881	4420995	1860	24.85	162.70	0	8.9636E+02
WATSON_1	386992	201155	1055093	1762220	84	0.85	2.72	0	2.5495E+02
WATSON_2	677224	352013	1846391	3079918	73	1.60	4.65	0	3.3569E+02
WORLD	67147	34506	198883	344341	210	0.33	1.19	0	1.4068E+02

Table 3.21: Complete LSMR(10) results for subset UF problems with `HSL_MI35` (`lsize=rsize=`10) preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$
12month1	872622	12471	22624727	136725	582	188.80	246.22	0	9.2740E+02
162bit	3606	3476	37118	37830	249	0.10	0.21	0	1.1771E+01
176bit	7441	7150	82270	78458	1258	0.14	1.36	0	1.8417E+01
192bit	13691	13093	154303	143676	1896	0.29	3.67	0	2.4854E+01
208bit	24430	23191	299756	254405	2806	0.46	9.86	0	3.8499E+01
beaflw	500	492	53403	5249	32447	0.11	4.66	0	4.7608E+00
c8_mat11	5761	4562	2462970	50088	32760	31.00	192.57	0	2.1934E+01
connectus	394707	458	1127525	2683	6	0.23	0.26	0	6.2791E+02
ESOC	327062	37349	6019939	409718	>21687	3.18	>600.00	19	-
EternityII_Etilde	204304	10054	1170516	108479	736	0.85	5.44	0	4.3810E-06
f855_mat9	2511	2456	171214	26961	13568	0.75	8.00	0	1.7979E+01
GL7d16	955127	460260	14488881	5062800	34	93.30	101.19	0	7.4875E+02
GL7d17	1548649	955127	25978098	10506043	28	304.82	319.44	0	8.9897E+02
GL7d18	1955309	1548645	35590540	17034972	-	>600.00	-	19	-
GL7d19	1955296	1911130	37322725	21022344	-	>600.00	-	19	-
GL7d20	1911124	1437546	29893084	15812924	28	462.95	487.35	0	1.0916E+03
GL7d21	1437546	822922	18174775	9052076	25	163.44	173.42	0	1.0029E+03
GL7d22	822906	349443	8251000	3843806	22	30.18	33.33	0	7.8940E+02
GL7d23	349443	105054	2695430	1155527	23	4.18	5.03	0	5.3569E+02
graphics	29493	11822	117954	24901	1891	0.04	1.64	0	3.0333E-04
HFE18_96_in	2372	2371	933343	26025	13963	5.80	32.14	0	4.9063E-01
IG5-15	11369	6146	323509	67549	286	0.65	1.01	0	5.4855E+01
IG5-16	18846	9519	588326	104653	477	1.32	2.38	0	7.1510E+01
IG5-17	30162	14060	1035008	154603	564	2.61	4.90	0	9.1039E+01
IG5-18	47894	20818	1790490	228941	447	6.21	9.71	0	1.1518E+02
IMDB	896302	303617	3782463	3175197	>6445	39.31	>600.00	19	-
kneser_10_4_1	349651	330751	992252	3625386	5405	3.20	272.56	0	1.6241E+02
landmark	71952	2673	1146848	25379	15	0.29	0.33	0	1.1270E-05
LargeRegFile	2111154	801374	4944201	4100211	12	2.49	3.82	0	4.4422E+02
Maragal_6	21251	10144	537694	111451	840	12.84	14.59	0	1.0695E+01
Maragal_7	46845	26525	1200537	290994	352	46.45	48.52	0	1.3690E+01
Maragal_8	60845	33093	1308415	338926	>81164	4.85	>600.00	19	-
mri1	114637	65536	589824	587874	2086	1.13	21.01	0	2.6742E+01
mri2	104597	63240	569160	517099	2832	2.90	23.16	0	1.4126E+02
NotreDame_actors	383640	127823	1470404	1351987	>22515	6.66	>600.00	19	-
psse0	26722	11028	102432	35197	71	0.02	0.08	0	6.6358E+01
psse1	14318	11028	57376	35771	575	0.03	0.51	0	3.5920E+01
psse2	28634	11028	115262	40814	722	0.03	0.74	0	7.8596E+01
rel9	5921786	274667	23667183	3020149	46	34.74	52.43	0	1.5416E+03
relat9	9746232	274667	38955420	3019616	43	50.15	77.92	0	3.0561E+03
Rucci1	1977885	109900	7791168	1208504	1427	2.12	65.96	0	7.2798E+02
sls	1748122	62729	6804304	670244	73	5.36	9.20	0	1.0457E-05
TF14	3159	2644	29862	29023	13099	0.06	4.33	0	5.5800E-07
TF15	7741	6334	80057	69617	44601	0.11	35.84	0	8.7962E-07
TF16	19320	15437	216173	169745	>100000	0.29	>204.60	18	-
TF17	48629	38132	586218	419386	>100000	0.75	>559.44	18	-
TF18	123867	95368	1597545	1048981	>39457	2.38	>600.00	19	-
TF19	317955	241029	4370721	2651254	>12221	7.71	>600.00	19	-
tomographic1	59360	45908	647495	496800	5739	0.46	39.68	0	4.1927E+01
Trec14	15904	3159	2872265	34684	1721	22.88	33.97	0	1.1217E+02
wheel_601	902103	723605	2170814	7244270	>4914	60.12	>600.00	19	-

Table 3.22: Complete results for subset CUTEst problems with BA-GMRES(100).

name	m	n	$nz(A)$	storage	iterations	factor time	total time	status	$\|r\|$
BAS1LP	9825	5411	587775	5411	-	0.00	>600.00	19	-
BAXTER	30733	27441	111576	27441	-	0.00	>600.00	19	-
BCDOUT	7078	5412	67344	556912	>100000	0.00	>408.07	18	-
CO9	22924	10789	109651	1099989	26080	0.00	125.25	0	8.9188E+01
CONT11_L	1961394	1468599	5382999	148338799	151	0.00	51.60	0	8.0916E+02
DBIR1	45775	18804	1077025	229571	360	0.00	0.51	0	3.4934E+01
DBIR2	45877	18906	1158159	1909504	361	0.00	13.14	0	1.6669E+02
D2Q06C	5831	2171	33081	1919806	691	0.00	40.52	0	1.6651E+02
DELF000	5543	3128	13741	326228	98834	0.00	94.73	0	5.3817E+01
GE	16369	10099	44825	1030299	5178	0.00	21.49	0	7.2447E+01
LARGE001	7176	4162	18887	430662	99853	0.00	139.37	0	6.0680E+01
LPL1	129959	39951	386218	4045351	1327	0.00	30.55	0	7.0878E+01
MOD2	66409	34774	199810	3522474	1028	0.00	10.20	0	1.3872E+02
MODEL10	16819	4400	150372	454700	837	0.00	5.70	0	5.3554E+01
MPSBCD03	7078	5412	66210	556912	>100000	0.00	>334.04	18	-
NSCT2	37563	23003	697738	2333603	385	0.00	10.77	0	1.8379E+02
NSIR2	10057	4453	154939	460053	221	0.00	1.00	0	8.0492E+01
PDE1	271792	270595	990587	270595	-	0.00	>600.00	19	-
PDS-100	514577	156016	1096002	12019236	76	0.00	3.31	0	2.8489E+02
PDS-90	475448	142596	1014136	10557652	73	0.00	2.89	0	2.6847E+02
PILOT-JA	2267	940	14977	105240	875	0.00	0.44	0	3.1987E+01
PILOTNOV	2446	975	13331	108775	645	0.00	0.33	0	3.2873E+01
RAIL2586	923269	2586	8011362	271486	153	0.00	44.12	0	1.4113E+02
RAIL4284	1096894	4284	11284032	442984	312	0.00	154.55	0	1.6948E+02
SPAL_004	321696	10203	46168124	20410	1	0.00	4.92	0	3.2793E-11
STAT96V2	957432	29089	2852184	2948289	194	0.00	9.95	0	9.7273E+02
STAT96V3	1113780	33841	3317736	3428241	193	0.00	12.45	0	1.0492E+03
STAT96V4	63076	3173	491336	330773	168	0.00	2.16	0	1.2052E+02
STORMG21K	1377306	526185	3459881	526185	-	0.00	>600.00	19	-
WATSON_1	386992	201155	1055093	11469139	56	0.00	3.76	0	2.5495E+02
WATSON_2	677224	352013	1846391	17251085	48	0.00	5.20	0	3.3569E+02
WORLD	67147	34506	198883	3495406	1021	0.00	9.80	0	1.4068E+02

Table 3.22: Complete results for subset UF problems with BA-GMRES(100).

name	m	n	$nz(A)$	storage	iterations	factor time	total time	status	$\|r\|$
12month1	872622	12471	22624727	764511	60	0.00	28.23	0	9.2739E+02
162bit	3606	3476	37118	361376	597	0.00	1.99	0	1.1771E+01
176bit	7441	7150	82270	732450	>100000	0.00	>447.84	18	-
192bit	13691	13093	154303	13093	-	0.00	>600.00	19	-
208bit	24430	23191	299756	23191	-	0.00	>600.00	19	-
beaflw	500	492	53403	59992	>100000	0.00	>125.54	18	-
c8_mat11	5761	4562	2462970	4562	-	0.00	>600.00	19	-
connectus	394707	458	1127525	1850	3	0.00	0.14	0	6.2791E+02
ESOC	327062	37349	6019939	37349	-	0.00	>600.00	19	-
EternityII_Etilde	204304	10054	1170516	1025754	151	0.00	4.46	0	4.6066E-06
f855_mat9	2511	2456	171214	2456	-	0.00	>600.00	19	-
GL7d16	955127	460260	14488881	4602708	9	0.00	7.33	0	7.4875E+02
GL7d17	1548649	955127	25978098	8596231	8	0.00	17.05	0	8.9897E+02
GL7d18	1955309	1548645	35590540	17035225	10	0.00	30.80	0	9.3184E+02
GL7d19	1955296	1911130	37322725	19111408	9	0.00	38.02	0	1.0426E+03
GL7d20	1911124	1437546	29893084	8625316	5	0.00	23.56	0	1.0916E+03
GL7d21	1437546	822922	18174775	5760508	6	0.00	11.85	0	1.0029E+03
GL7d22	822906	349443	8251000	2446155	6	0.00	4.44	0	7.8940E+02
GL7d23	349443	105054	2695430	735432	6	0.00	0.97	0	5.3569E+02
graphics	29493	11822	117954	1204322	>100000	0.00	>518.96	18	-
HFE18_96_in	2372	2371	933343	2371	-	0.00	>600.00	19	-
IG5-15	11369	6146	323509	580318	92	0.00	1.00	0	5.4855E+01
IG5-16	18846	9519	588326	971719	225	0.00	5.47	0	7.1509E+01
IG5-17	30162	14060	1035008	1430360	142	0.00	5.09	0	9.1038E+01
IG5-18	47894	20818	1790490	2112918	129	0.00	12.51	0	1.1518E+02
IMDB	896302	303617	3782463	303617	-	0.00	>600.00	19	-
kneser_10_4_1	349651	330751	992252	330751	-	0.00	>600.00	19	-
landmark	71952	2673	1146848	75654	27	0.00	1.89	0	1.1533E-05
LargeRegFile	2111154	801374	4944201	6411062	7	0.00	2.97	0	4.4422E+02
Maragal_6	21251	10144	537694	10144	-	0.00	>600.00	19	-
Maragal_7	46845	26525	1200537	1835053	68	0.00	2.86	0	1.3690E+01
Maragal_8	60845	33093	1308415	33093	-	0.00	>600.00	19	-
mri1	114637	65536	589824	6629436	6440	0.00	310.86	0	2.6742E+01
mri2	104597	63240	569160	6397540	2703	0.00	87.42	0	1.4126E+02
NotreDame_actors	383640	127823	1470404	127823	-	0.00	>600.00	19	-
psse0	26722	11028	102432	1124128	>100000	0.00	>407.55	18	-
psse1	14318	11028	57376	1124128	>100000	0.00	>228.82	18	-
psse2	28634	11028	115262	1124128	>100000	0.00	>520.15	18	-
rel9	5921786	274667	23667183	3570851	12	0.00	24.72	0	1.5416E+03
relat9	9746232	274667	38955420	3845546	13	0.00	41.53	0	3.0561E+03
Rucci1	1977885	109900	7791168	109900	-	0.00	>600.00	19	-
sls	1748122	62729	6804304	3013342	47	0.00	9.69	0	2.0942E-04
TF14	3159	2644	29862	277344	>100000	0.00	>224.16	18	-
TF15	7741	6334	80057	650034	>100000	0.00	>515.71	18	-
TF16	19320	15437	216173	15437	-	0.00	>600.00	19	-
TF17	48629	38132	586218	38132	-	0.00	>600.00	19	-
TF18	123867	95368	1597545	95368	-	0.00	>600.00	19	-
TF19	317955	241029	4370721	241029	-	0.00	>600.00	19	-
tomographic1	59360	45908	647495	45908	-	0.00	>600.00	19	-
Trec14	15904	3159	2872265	329359	2101	0.00	205.64	0	1.1217E+02
wheel_601	902103	723605	2170814	723605	-	0.00	>600.00	19	-

Table 3.23: Complete results for subset CUTEst problems with BA-GMRES(500).

name	m	n	$nz(A)$	storage	iterations	factor time	total time	status	$\|r\|$
BAS1LP	9825	5411	587775	2962411	7782	0.00	152.80	0	5.5447E+01
BAXTER	30733	27441	111576	27441	-	0.00	>600.00	19	-
BCDOUT	7078	5412	67344	2962912	>100000	0.00	>542.73	18	-
CO9	22924	10789	109651	5656789	6330	0.00	48.40	0	8.9188E+01
CONT11_L	1961394	1468599	5382999	149807602	101	0.00	33.40	0	8.0916E+02
DBIR1	45775	18804	1077025	700243	284	0.00	0.44	0	3.4934E+01
DBIR2	45877	18906	1158159	7055662	367	0.00	7.36	0	1.6669E+02
D2Q06C	5831	2171	33081	9723406	1001	0.00	45.20	0	1.6651E+02
DELF000	5543	3128	13741	1818628	4754	0.00	8.94	0	5.3817E+01
GE	16369	10099	44825	5311099	1909	0.00	11.77	0	7.2447E+01
LARGE001	7176	4162	18887	2336662	11803	0.00	31.65	0	6.0680E+01
LPL1	129959	39951	386218	20266951	755	0.00	21.60	0	7.0878E+01
MOD2	66409	34774	199810	17673274	643	0.00	11.75	0	1.3872E+02
MODEL10	16819	4400	150372	1863308	388	0.00	1.48	0	5.3554E+01
MPSBCD03	7078	5412	66210	2962912	>100000	0.00	>571.16	18	-
NSCT2	37563	23003	697738	4781258	205	0.00	2.74	0	1.8379E+02
NSIR2	10057	4453	154939	984313	210	0.00	0.55	0	8.0492E+01
PDE1	271792	270595	990587	270595	-	0.00	>600.00	19	-
PDS-100	514577	156016	1096002	12019236	76	0.00	3.25	0	2.8489E+02
PDS-90	475448	142596	1014136	10557652	73	0.00	2.80	0	2.6847E+02
PILOT-JA	2267	940	14977	427458	334	0.00	0.15	0	3.1987E+01
PILOTNOV	2446	975	13331	449095	340	0.00	0.14	0	3.2873E+01
RAIL2586	923269	2586	8011362	495112	178	0.00	42.21	0	1.4113E+02
RAIL4284	1096894	4284	11284032	958072	212	0.00	79.53	0	1.6948E+02
SPAL_004	321696	10203	46168124	20410	1	0.00	4.91	0	3.2793E-11
STAT96V2	957432	29089	2852184	12573814	425	0.00	13.57	0	9.7273E+02
STAT96V3	1113780	33841	3317736	14216653	414	0.00	15.07	0	1.0492E+03
STAT96V4	63076	3173	491336	415798	125	0.00	1.39	0	1.2052E+02
STORMG21K	1377306	526185	3459881	526185	-	0.00	>600.00	19	-
WATSON_1	386992	201155	1055093	11469139	56	0.00	3.63	0	2.5495E+02
WATSON_2	677224	352013	1846391	17251085	48	0.00	6.16	0	3.3569E+02
WORLD	67147	34506	198883	17539006	634	0.00	11.65	0	1.4068E+02

Table 3.23: Complete results for subset UF problems with BA-GMRES(500).

name	m	n	$nz(A)$	storage	iterations	factor time	total time	status	$\|r\|$
12month1	872622	12471	22624727	764511	60	0.00	27.89	0	9.2739E+02
162bit	3606	3476	37118	1215038	319	0.00	0.61	0	1.1771E+01
176bit	7441	7150	82270	3833650	1401	0.00	8.52	0	1.8417E+01
192bit	13691	13093	154303	6811093	12001	0.00	156.21	0	2.4854E+01
208bit	24430	23191	299756	11870191	8506	0.00	183.82	0	3.8499E+01
beaflw	500	492	53403	475792	485	0.00	0.78	0	4.3538E+00
c8_mat11	5761	4562	2462970	4562	-	0.00	>600.00	19	-
connectus	394707	458	1127525	1850	3	0.00	0.13	0	6.2791E+02
ESOC	327062	37349	6019939	37349	-	0.00	>600.00	19	-
EternityII_Etilde	204304	10054	1170516	4019398	384	0.00	7.43	0	5.3392E-06
f855_mat9	2511	2456	171214	2456	-	0.00	>600.00	19	-
GL7d16	955127	460260	14488881	4602708	9	0.00	7.20	0	7.4875E+02
GL7d17	1548649	955127	25978098	8596231	8	0.00	16.81	0	8.9897E+02
GL7d18	1955309	1548645	35590540	17035225	10	0.00	29.17	0	9.3184E+02
GL7d19	1955296	1911130	37322725	19111408	9	0.00	38.59	0	1.0426E+03
GL7d20	1911124	1437546	29893084	8625316	5	0.00	23.59	0	1.0916E+03
GL7d21	1437546	822922	18174775	5760508	6	0.00	9.94	0	1.0029E+03
GL7d22	822906	349443	8251000	2446155	6	0.00	3.42	0	7.8940E+02
GL7d23	349443	105054	2695430	735432	6	0.00	0.89	0	5.3569E+02
graphics	29493	11822	117954	11822	-	0.00	>600.00	19	-
HFE18_96_in	2372	2371	933343	2371	-	0.00	>600.00	19	-
IG5-15	11369	6146	323509	580318	92	0.00	1.40	0	5.4855E+01
IG5-16	18846	9519	588326	1470142	151	0.00	2.69	0	7.1509E+01
IG5-17	30162	14060	1035008	1758938	123	0.00	4.15	0	9.1038E+01
IG5-18	47894	20818	1790490	2260114	107	0.00	8.69	0	1.1518E+02
IMDB	896302	303617	3782463	303617	-	0.00	>600.00	19	-
kneser_10_4_1	349651	330751	992252	330751	-	0.00	>600.00	19	-
landmark	71952	2673	1146848	75654	27	0.00	2.61	0	1.1533E-05
LargeRegFile	2111154	801374	4944201	6411062	7	0.00	3.01	0	4.4422E+02
Maragal_6	21251	10144	537694	3727498	354	0.00	6.07	0	1.0687E+01
Maragal_7	46845	26525	1200537	1835053	68	0.00	2.89	0	1.3690E+01
Maragal_8	60845	33093	1308415	33093	-	0.00	>600.00	19	-
mri1	114637	65536	589824	33085036	2481	0.00	129.14	0	2.6742E+01
mri2	104597	63240	569160	31934740	1438	0.00	93.05	0	1.4126E+02
NotreDame_actors	383640	127823	1470404	127823	-	0.00	>600.00	19	-
psse0	26722	11028	102432	11028	-	0.00	>600.00	19	-
psse1	14318	11028	57376	11028	-	0.00	>600.00	19	-
psse2	28634	11028	115262	11028	-	0.00	>600.00	19	-
rel9	5921786	274667	23667183	3570851	12	0.00	25.47	0	1.5416E+03
relat9	9746232	274667	38955420	3845546	13	0.00	45.07	0	3.0561E+03
Rucci1	1977885	109900	7791168	109900	-	0.00	>600.00	19	-
sls	1748122	62729	6804304	3013342	47	0.00	10.01	0	2.0942E-04
TF14	3159	2644	29862	1576144	>100000	0.00	>297.93	18	-
TF15	7741	6334	80057	6334	-	0.00	>600.00	19	-
TF16	19320	15437	216173	15437	-	0.00	>600.00	19	-
TF17	48629	38132	586218	38132	-	0.00	>600.00	19	-
TF18	123867	95368	1597545	95368	-	0.00	>600.00	19	-
TF19	317955	241029	4370721	241029	-	0.00	>600.00	19	-
tomographic1	59360	45908	647495	45908	-	0.00	>600.00	19	-
Trec14	15904	3159	2872265	1834159	1187	0.00	109.10	0	1.1217E+02
wheel_601	902103	723605	2170814	723605	-	0.00	>600.00	19	-

Table 3.24: Complete results for subset CUTEst problems with BA-GMRES(1000).

name	m	n	$nz(A)$	storage	iterations	factor time	total time	status	$\|r\|$
BAS1LP	9825	5411	587775	6419411	4406	0.00	119.59	0	5.5447E+01
BAXTER	30733	27441	111576	27441	-	0.00	>600.00	19	-
BCDOUT	7078	5412	67344	5412	-	0.00	>600.00	19	-
CO9	22924	10789	109651	11802789	2619	0.00	37.17	0	8.9188E+01
CONT11_L	1961394	1468599	5382999	149807602	101	0.00	32.92	0	8.0916E+02
DBIR1	45775	18804	1077025	700243	284	0.00	0.42	0	3.4934E+01
DBIR2	45877	18906	1158159	7055662	367	0.00	7.21	0	1.6669E+02
D2Q06C	5831	2171	33081	17102778	864	0.00	24.89	0	1.6651E+02
DELF000	5543	3128	13741	4134128	3616	0.00	12.78	0	5.3817E+01
GE	16369	10099	44825	8719998	799	0.00	7.22	0	7.2447E+01
LARGE001	7176	4162	18887	5169162	6589	0.00	33.58	0	6.0680E+01
LPL1	129959	39951	386218	28745911	706	0.00	26.24	0	7.0878E+01
MOD2	66409	34774	199810	20505898	579	0.00	13.36	0	1.3872E+02
MODEL10	16819	4400	150372	1863308	388	0.00	1.43	0	5.3554E+01
MPSBCD03	7078	5412	66210	5412	-	0.00	>600.00	19	-
NSCT2	37563	23003	697738	4781258	205	0.00	2.74	0	1.8379E+02
NSIR2	10057	4453	154939	984313	210	0.00	0.56	0	8.0492E+01
PDE1	271792	270595	990587	270595	-	0.00	>600.00	19	-
PDS-100	514577	156016	1096002	12019236	76	0.00	3.18	0	2.8489E+02
PDS-90	475448	142596	1014136	10557652	73	0.00	2.78	0	2.6847E+02
PILOT-JA	2267	940	14977	427458	334	0.00	0.16	0	3.1987E+01
PILOTNOV	2446	975	13331	449095	340	0.00	0.14	0	3.2873E+01
RAIL2586	923269	2586	8011362	495112	178	0.00	41.97	0	1.4113E+02
RAIL4284	1096894	4284	11284032	958072	212	0.00	77.62	0	1.6948E+02
SPAL_004	321696	10203	46168124	20410	1	0.00	3.87	0	3.2793E-11
STAT96V2	957432	29089	2852184	12573814	425	0.00	13.11	0	9.7273E+02
STAT96V3	1113780	33841	3317736	14216653	414	0.00	15.55	0	1.0492E+03
STAT96V4	63076	3173	491336	415798	125	0.00	1.41	0	1.2052E+02
STORMG21K	1377306	526185	3459881	526185	-	0.00	>600.00	19	-
WATSON_1	386992	201155	1055093	11469139	56	0.00	4.89	0	2.5495E+02
WATSON_2	677224	352013	1846391	17251085	48	0.00	5.18	0	3.3569E+02
WORLD	67147	34506	198883	20065186	571	0.00	12.43	0	1.4068E+02

Table 3.24: Complete results for subset UF problems with BA-GMRES(1000).

name	m	n	$nz(A)$	storage	iterations	factor time	total time	status	$\|r\|$
12month1	872622	12471	22624727	764511	60	0.00	27.96	0	9.2739E+02
162bit	3606	3476	37118	1215038	319	0.00	0.81	0	1.1771E+01
176bit	7441	7150	82270	5121390	655	0.00	6.30	0	1.8417E+01
192bit	13691	13093	154303	14109093	6005	0.00	132.01	0	2.4854E+01
208bit	24430	23191	299756	24217191	6219	0.00	213.97	0	3.8499E+01
beaflw	500	492	53403	475792	485	0.00	0.51	0	4.3538E+00
c8_mat11	5761	4562	2462970	4562	-	0.00	>600.00	19	-
connectus	394707	458	1127525	1850	3	0.00	0.13	0	6.2791E+02
ESOC	327062	37349	6019939	37349	-	0.00	>600.00	19	-
EternityII_Etilde	204304	10054	1170516	4019398	384	0.00	9.30	0	5.3392E-06
f855_mat9	2511	2456	171214	2456	-	0.00	>600.00	19	-
GL7d16	955127	460260	14488881	4602708	9	0.00	6.75	0	7.4875E+02
GL7d17	1548649	955127	25978098	8596231	8	0.00	14.72	0	8.9897E+02
GL7d18	1955309	1548645	35590540	17035225	10	0.00	25.33	0	9.3184E+02
GL7d19	1955296	1911130	37322725	19111408	9	0.00	34.12	0	1.0426E+03
GL7d20	1911124	1437546	29893084	8625316	5	0.00	20.63	0	1.0916E+03
GL7d21	1437546	822922	18174775	5760508	6	0.00	9.27	0	1.0029E+03
GL7d22	822906	349443	8251000	2446155	6	0.00	3.33	0	7.8940E+02
GL7d23	349443	105054	2695430	735432	6	0.00	0.92	0	5.3569E+02
graphics	29493	11822	117954	11822	-	0.00	>600.00	19	-
HFE18_96_in	2372	2371	933343	3376371	1632	0.00	61.33	0	4.9063E-01
IG5-15	11369	6146	323509	580318	92	0.00	1.39	0	5.4855E+01
IG5-16	18846	9519	588326	1470142	151	0.00	2.75	0	7.1509E+01
IG5-17	30162	14060	1035008	1758938	123	0.00	4.09	0	9.1038E+01
IG5-18	47894	20818	1790490	2260114	107	0.00	10.44	0	1.1518E+02
IMDB	896302	303617	3782463	303617	-	0.00	>600.00	19	-
kneser_10_4_1	349651	330751	992252	330751	-	0.00	>600.00	19	-
landmark	71952	2673	1146848	75654	27	0.00	1.94	0	1.1533E-05
LargeRegFile	2111154	801374	4944201	6411062	7	0.00	3.03	0	4.4422E+02
Maragal_6	21251	10144	537694	3727498	354	0.00	4.19	0	1.0687E+01
Maragal_7	46845	26525	1200537	1835053	68	0.00	2.87	0	1.3690E+01
Maragal_8	60845	33093	1308415	33093	-	0.00	>600.00	19	-
mri1	114637	65536	589824	62016508	932	0.00	83.92	0	2.6742E+01
mri2	104597	63240	569160	47669568	744	0.00	41.31	0	1.4126E+02
NotreDame_actors	383640	127823	1470404	127823	-	0.00	>600.00	19	-
psse0	26722	11028	102432	12042028	28003	0.00	428.84	0	6.6358E+01
psse1	14318	11028	57376	12042028	37887	0.00	479.57	0	3.5919E+01
psse2	28634	11028	115262	12042028	43868	0.00	554.11	0	7.8596E+01
rel9	5921786	274667	23667183	3570851	12	0.00	24.30	0	1.5416E+03
relat9	9746232	274667	38955420	3845546	13	0.00	39.89	0	3.0561E+03
Rucci1	1977885	109900	7791168	109900	-	0.00	>600.00	19	-
sls	1748122	62729	6804304	3013342	47	0.00	9.42	0	2.0942E-04
TF14	3159	2644	29862	3649644	1758	0.00	6.81	0	5.3777E-09
TF15	7741	6334	80057	6334	-	0.00	>600.00	19	-
TF16	19320	15437	216173	15437	-	0.00	>600.00	19	-
TF17	48629	38132	586218	38132	-	0.00	>600.00	19	-
TF18	123867	95368	1597545	95368	-	0.00	>600.00	19	-
TF19	317955	241029	4370721	241029	-	0.00	>600.00	19	-
tomographic1	59360	45908	647495	45908	-	0.00	>600.00	19	-
Trec14	15904	3159	2872265	2661039	690	0.00	53.76	0	1.1217E+02
wheel_601	902103	723605	2170814	723605	-	0.00	>600.00	19	-

Table 3.25: Complete GMRES(1000) results for subset CUTEst problems with HSL_MI30 preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$	$\frac{\|r\|}{\|r_0\|}$	$\frac{\|A^T r\| \|r_0\|}{\|A^T r_0\| \ \|r\|}$
BAS1LP	9825	5411	587775	16094406	2963	1.04	30.26	0	5.54E+01	5.59E-01	1.84E-08
BAXTER	30733	27441	111576	58883648	>19591	0.79	>600.00	19	1.75E+02	-	-
BCDOUT	7078	5412	67344	12704193	>88545	0.27	>600.00	19	8.41E+01	-	-
CO9	22924	10789	109651	5301866	147	0.76	1.29	0	8.92E+01	5.89E-01	3.63E-09
CONT11_L	1961394	1468599	5382999	22208667	-	18.50	>18.53	15	-	-	-
DBIR1	45775	18804	1077025	204752	13	0.14	0.15	0	3.49E+01	4.57E-01	6.25E-09
DBIR2	45877	18906	1158159	66556702	>16262	4.38	>600.00	19	2.14E+02	-	-
D2Q06C	5831	2171	33081	66659024	>16510	4.40	>600.00	19	2.14E+02	-	-
DELF000	5543	3128	13741	406113	43	0.01	0.02	0	5.38E+01	7.23E-01	3.69E-08
GE	16369	10099	44825	1465738	46	0.36	0.43	0	7.24E+01	5.66E-01	3.76E-09
LARGE001	7176	4162	18887	772007	64	0.02	0.05	0	6.07E+01	7.16E-01	6.43E-09
LPL1	129959	39951	386218	10100746	50	3.28	3.82	0	7.09E+01	1.97E-01	2.18E-07
MOD2	66409	34774	199810	7068004	57	1.21	1.64	0	1.39E+02	5.38E-01	8.93E-10
MODEL10	16819	4400	150372	3412364	143	0.48	0.86	0	5.36E+01	4.13E-01	1.78E-09
MPSBCD03	7078	5412	66210	12710678	>85965	0.33	>600.00	19	8.41E+01	-	-
NSCT2	37563	23003	697738	61973946	>17929	3.94	>600.00	19	1.94E+02	-	-
NSIR2	10057	4453	154939	14815406	16757	0.18	131.57	0	8.05E+01	8.03E-01	1.88E-13
PDE1	271792	270595	990587	-	-	>600.00	-	19	-	-	-
PDS-100	514577	156016	1096002	38544110	46	13.75	16.89	0	2.85E+02	3.97E-01	4.66E-07
PDS-90	475448	142596	1014136	36281464	47	12.69	15.34	0	2.68E+02	3.89E-01	4.55E-07
PILOT-JA	2267	940	14977	159318	35	0.02	0.03	0	3.20E+01	6.72E-01	9.17E-12
PILOTNOV	2446	975	13331	85870	12	0.02	0.02	0	3.29E+01	6.65E-01	5.95E-11
RAIL2586	923269	2586	8011362	17020112	8	4.21	4.80	0	1.41E+02	1.47E-01	4.00E-09
RAIL4284	1096894	4284	11284032	30195352	13	13.93	15.27	0	1.69E+02	1.62E-01	5.69E-09
SPAL_004	321696	10203	46168124	115431345	225	43.31	88.26	0	3.26E+00	5.75E-03	9.27E-04
STAT96V2	957432	29089	2852184	21968275	18	1.10	1.95	0	9.73E+02	9.94E-01	2.64E-07
STAT96V3	1113780	33841	3317736	30148761	22	1.30	2.58	0	1.05E+03	9.94E-01	2.30E-07
STAT96V4	63076	3173	491336	1704750	18	0.20	0.26	0	1.21E+02	4.80E-01	5.47E-06
STORMG21K	1377306	526185	3459881	1058511913	>538	57.99	>600.00	19	1.17E+03	-	-
WATSON_1	386992	201155	1055093	10223817	7	1.00	1.24	0	2.55E+02	4.10E-01	6.44E-08
WATSON_2	677224	352013	1846391	15734420	5	1.99	2.31	0	3.36E+02	4.08E-01	2.61E-07
WORLD	67147	34506	198883	6167439	48	3.44	3.79	0	1.41E+02	5.43E-01	6.31E-10

Table 3.25: Complete GMRES(1000) results for subset UF problems with HSL_MI30 preconditioning.

name	m	n	$nz(A)$	factors	iterations	factor time	total time	status	$\|r\|$	$\frac{\|r\|}{\|r_0\|}$	$\frac{\|A^T r\| \|r_0\|}{\|A^T r_0\| \ \|r\|}$
12month1	872622	12471	22624727	236783260	229	372.84	443.10	0	9.27E+02	9.93E-01	3.36E-07
162bit	3606	3476	37118	1490417	187	0.17	0.38	0	1.18E+01	1.96E-01	2.67E-06
176bit	7441	7150	82270	11671874	776	0.45	5.42	0	1.84E+01	2.14E-01	2.26E-06
192bit	13691	13093	154303	26394378	961	0.70	15.05	0	2.49E+01	2.13E-01	2.44E-06
208bit	24430	23191	299756	48798025	2608	1.81	70.43	0	3.85E+01	2.46E-01	2.09E-06
beaflw	500	492	53403	1063656	>100000	0.11	>38.91	18	4.37E+00	1.95E-01	4.82E-07
c8_mat11	5761	4562	2462970	12944770	>41612	7.40	>600.00	19	7.59E+01	-	-
connectus	394707	458	1127525	2318148	2	0.59	0.64	0	6.28E+02	9.99E-01	8.06E-07
ESOC	327062	37349	6019939	377404333	>2870	316.47	>600.00	19	5.72E+02	-	-
EternityII_Etilde	204304	10054	1170516	19636280	72	2.17	3.75	0	2.50E-04	5.52E-07	3.01E-02
f855_mat9	2511	2456	171214	5231054	>100000	0.51	>254.20	18	4.98E+01	9.93E-01	9.99E-01
GL7d16	955127	460260	14488881	81800532	32	220.49	234.44	0	7.49E+02	7.66E-01	2.07E-07
GL7d17	1548649	955127	25978098	-	-	>600.00	-	19	-	-	-
GL7d18	1955309	1548645	35590540	-	-	>600.00	-	19	-	-	-
GL7d19	1955296	1911130	37322725	-	-	>600.00	-	19	-	-	-
GL7d20	1911124	1437546	29893084	-	-	>600.00	-	19	-	-	-
GL7d21	1437546	822922	18174775	-	-	>600.00	-	19	-	-	-
GL7d22	822906	349443	8251000	59424141	25	191.90	199.72	0	7.89E+02	8.70E-01	2.91E-07
GL7d23	349443	105054	2695430	19514016	20	93.45	95.21	0	5.36E+02	9.06E-01	2.21E-07
graphics	29493	11822	117954	12629942	301	0.08	1.38	0	3.03E-04	1.77E-06	6.21E-05
HFE18_96_in	2372	2371	933343	5771976	>100000	0.71	>535.65	18	5.21E-01	1.07E-02	1.96E-05
IG5-15	11369	6146	323509	8051948	423	1.79	4.17	0	5.49E+01	5.14E-01	2.42E-08
IG5-16	18846	9519	588326	18105996	599	1.47	9.16	0	7.15E+01	5.21E-01	2.04E-08
IG5-17	30162	14060	1035008	27005475	569	6.99	17.61	0	9.10E+01	5.24E-01	1.79E-08
IG5-18	47894	20818	1790490	51571438	707	10.79	38.58	0	1.15E+02	5.26E-01	1.56E-08
IMDB	896302	303617	3782463	837783100	>687	124.58	>600.00	19	9.47E+02	-	-
kneser_10_4_1	349651	330751	992252	691807272	>1277	14.60	>600.00	19	5.91E+02	-	-
landmark	71952	2673	1146848	1917793	14	0.49	0.56	0	2.36E-02	8.78E-05	7.87E-04
LargeRegFile	2111154	801374	4944201	24923112	-	79.53	>79.55	15	1.45E+03	-	-
Maragal_6	21251	10144	537694	19453979	598	2.12	8.93	0	1.07E+01	7.72E-01	7.74E-07
Maragal_7	46845	26525	1200537	24312381	309	8.11	14.00	0	1.37E+01	7.35E-01	8.45E-07
Maragal_8	60845	33093	1308415	95330093	>11544	2.96	>600.00	19	2.47E+02	-	-
mri1	114637	65536	589824	10965652	51	1.95	2.59	0	2.67E+01	7.90E-02	5.21E-06
mri2	104597	63240	569160	170412072	4321	6.26	367.52	0	1.41E+02	4.37E-01	9.17E-07
NotreDame_actors	383640	127823	1470404	517614175	>1885	29.06	>600.00	19	6.19E+02	-	-
psse0	26722	11028	102432	1048664	23	0.07	0.10	0	6.64E+01	7.62E-01	9.68E-11
psse1	14318	11028	57376	2718730	102	0.03	0.22	0	3.59E+01	5.14E-01	9.55E-11
psse2	28634	11028	115262	5292756	128	0.06	0.51	0	7.86E+01	7.75E-01	2.60E-10
rel9	5921786	274667	23667183	-	-	>600.00	-	19	-	-	-
relat9	9746232	274667	38955420	-	-	>600.00	-	19	-	-	-
Rucci1	1977885	109900	7791168	19056222	-	30.04	>30.09	15	-	-	-
sls	1748122	62729	6804304	31745053	10	14.66	16.38	0	1.34E-04	1.02E-07	3.80E-03
TF14	3159	2644	29862	4001498	664	0.20	1.36	0	8.05E-03	1.43E-04	4.67E-04
TF15	7741	6334	80057	11839190	815	0.41	5.71	0	1.32E-02	1.50E-04	4.11E-04
TF16	19320	15437	216173	28977642	807	1.05	13.35	0	1.61E-02	1.16E-04	4.87E-04
TF17	48629	38132	586218	74631817	833	3.75	39.78	0	2.26E-02	1.02E-04	5.12E-04
TF18	123867	95368	1597545	220273500	977	12.27	137.94	0	3.31E-02	9.39E-05	5.19E-04
TF19	317955	241029	4370721	501475643	869	37.88	393.05	0	4.26E-02	7.55E-05	6.02E-04
tomographic1	59360	45908	647495	107515216	1372	1.50	64.44	0	4.19E+01	1.72E-01	1.21E-06
Trec14	15904	3159	2872265	22314107	3628	10.76	78.42	0	1.12E+02	8.89E-01	6.45E-10
wheel_601	902103	723605	2170814	939479126	>562	46.89	>600.00	19	9.50E+02	-	-

Table 3.26: Complete MINRES results for subset CUTEst problems HSL_MI30 preconditioning.

name	m	n	$nz(A)$	storage	iterations	factor time	total time	status	$\|r\|$	$\frac{\|r\|}{\|r_0\|}$	$\frac{\|A^T r\| \|r_0\|}{\|A^T r_0\| \ \|r\|}$
BAS1LP	9825	5411	587775	858406	11477	1.03	32.51	0	5.54E+01	5.59E-01	5.82E-09
BAXTER	30733	27441	111576	709648	>100000	0.80	>305.83	18	6.61E+01	3.77E-01	1.50E-04
BCDOUT	7078	5412	67344	214193	>100000	0.27	>66.19	18	3.54E+01	4.21E-01	9.16E-06
C09	22924	10789	109651	346055	194	0.77	1.06	0	8.92E+01	5.89E-01	1.92E-09
CONT11_L	1961394	1468599	5382999	22208667	19	18.36	22.88	0	8.09E+02	5.78E-01	1.15E-06
DBIR1	45775	18804	1077025	100726	18	0.14	0.15	0	3.49E+01	4.57E-01	7.86E-09
DBIR2	45877	18906	1158159	1977702	62307	4.57	455.44	0	1.67E+02	7.79E-01	1.23E-10
D2Q06C	5831	2171	33081	1876024	>84581	4.18	>600.00	19	1.67E+02	7.77E-01	7.11E-11
DELF000	5543	3128	13741	33260	58	0.01	0.02	0	5.38E+01	7.23E-01	2.03E-08
GE	16369	10099	44825	248210	81	0.37	0.46	0	7.24E+01	5.66E-01	4.34E-09
LARGE001	7176	4162	18887	46375	90	0.02	0.05	0	6.07E+01	7.16E-01	3.45E-09
LPL1	129959	39951	386218	1605246	66	3.25	3.83	0	7.09E+01	1.97E-01	2.09E-07
MOD2	66409	34774	199810	1300573	88	1.21	1.72	0	1.39E+02	5.38E-01	7.79E-10
MODEL10	16819	4400	150372	378047	202	0.48	0.73	0	5.36E+01	4.13E-01	1.64E-09
MPSBCD03	7078	5412	66210	220678	>100000	0.33	>66.27	18	3.54E+01	4.20E-01	2.84E-06
NSCT2	37563	23003	697738	1407946	>100000	3.88	>526.77	18	1.84E+02	9.48E-01	1.83E-11
NSIR2	10057	4453	154939	305406	72961	0.17	65.32	0	8.05E+01	8.03E-01	2.91E-07
PDE1	271792	270595	990587	-	-	>600.00	-	19	-	-	-
PDS-100	514577	156016	1096002	7696832	64	14.03	17.16	0	2.85E+02	3.97E-01	3.83E-07
PDS-90	475448	142596	1014136	7233396	76	12.86	16.12	0	2.68E+02	3.89E-01	4.98E-07
PILOT-JA	2267	940	14977	47073	54	0.02	0.03	0	3.20E+01	6.72E-01	9.24E-12
PILOTNOV	2446	975	13331	44818	20	0.02	0.02	0	3.29E+01	6.65E-01	2.27E-12
RAIL2586	923269	2586	8011362	9613272	9	4.31	4.98	0	1.41E+02	1.47E-01	1.38E-08
RAIL4284	1096894	4284	11284032	15880038	19	13.08	14.91	0	1.69E+02	1.62E-01	1.17E-09
SPAL_004	321696	10203	46168124	40754070	535	42.00	125.69	0	1.47E+00	2.58E-03	1.23E-03
STAT96V2	957432	29089	2852184	4210897	22	1.29	2.19	0	9.73E+02	9.94E-01	2.49E-07
STAT96V3	1113780	33841	3317736	4901099	27	1.28	2.54	0	1.05E+03	9.94E-01	1.41E-07
STAT96V4	63076	3173	491336	512268	24	0.21	0.28	0	1.21E+02	4.80E-01	4.91E-06
STORMG21K	1377306	526185	3459881	34433755	>4234	56.90	>600.00	19	8.96E+02	7.64E-01	2.04E-07
WATSON_1	386992	201155	1055093	6106788	8	0.99	1.25	0	2.55E+02	4.10E-01	1.37E-07
WATSON_2	677224	352013	1846391	10588235	7	2.15	2.60	0	3.36E+02	4.08E-01	4.69E-08
WORLD	67147	34506	198883	1288095	70	3.42	3.83	0	1.41E+02	5.43E-01	7.07E-10

Table 3.26: Complete MINRES results for subset UF problems with HSL_MI30 preconditioning.

name	m	n	$nz(A)$	storage	iterations	factor time	total time	status	$\|r\|$	$\frac{\|r\|}{\|r_0\|}$	$\frac{\|A^T r\| \|r_0\|}{\|A^T r_0\| \ \|r\|}$
12month1	872622	12471	22624727	34096963	294	373.85	417.74	0	9.27E+02	9.93E-01	2.71E-07
162bit	3606	3476	37118	166083	252	0.15	0.27	0	1.18E+01	1.96E-01	2.75E-06
176bit	7441	7150	82270	349258	981	0.45	1.43	0	1.84E+01	2.14E-01	2.28E-06
192bit	13691	13093	154303	654954	1521	0.69	4.15	0	2.49E+01	2.13E-01	2.34E-06
208bit	24430	23191	299756	1177025	3131	1.79	18.28	0	3.85E+01	2.46E-01	2.02E-06
beaflw	500	492	53403	71656	>100000	0.12	>17.42	18	4.56E+00	2.04E-01	1.17E-05
c8_mat11	5761	4562	2462970	2621770	>76276	7.41	>600.00	19	2.18E+01	2.88E-01	3.39E-07
connectus	394707	458	1127525	1527818	3	0.58	0.65	0	6.28E+02	9.99E-01	3.41E-07
ESOC	327062	37349	6019939	12993333	>14678	316.35	>600.00	19	4.36E-03	7.62E-06	1.09E-01
EternityII_Etilde	204304	10054	1170516	4202504	81	2.17	3.49	0	1.21E-04	2.67E-07	5.66E-02
f855_mat9	2511	2456	171214	264054	>100000	0.51	>66.90	18	1.65E+01	3.30E-01	5.06E-04
GL7d16	955127	460260	14488881	36508148	35	220.47	235.09	0	7.49E+02	7.66E-01	2.84E-07
GL7d17	1548649	955127	25978098	-	-	>600.00	-	19	-	-	-
GL7d18	1955309	1548645	35590540	-	-	>600.00	-	19	-	-	-
GL7d19	1955296	1911130	37322725	-	-	>600.00	-	19	-	-	-
GL7d20	1911124	1437546	29893084	-	-	>600.00	-	19	-	-	-
GL7d21	1437546	822922	18174775	-	-	>600.00	-	19	-	-	-
GL7d22	822906	349443	8251000	30115416	30	192.74	202.06	0	7.89E+02	8.70E-01	3.07E-07
GL7d23	349443	105054	2695430	10424076	22	94.06	95.99	0	5.36E+02	9.06E-01	3.05E-07
graphics	29493	11822	117954	194127	224	0.08	0.35	0	3.03E-04	1.77E-06	1.67E-02
HFE18_96_in	2372	2371	933343	1028976	16095	0.70	47.90	0	4.91E-01	1.01E-02	9.75E-06
IG5-15	11369	6146	323509	643103	535	1.81	2.90	0	5.49E+01	5.14E-01	2.41E-08
IG5-16	18846	9519	588326	1115361	772	1.48	4.48	0	7.15E+01	5.21E-01	2.04E-08
IG5-17	30162	14060	1035008	1843157	706	7.00	11.96	0	9.10E+01	5.24E-01	1.78E-08
IG5-18	47894	20818	1790490	2992054	886	10.04	21.55	0	1.15E+02	5.26E-01	1.54E-08
IMDB	896302	303617	3782463	13438747	>4263	124.49	>600.00	19	8.04E+02	8.50E-01	7.08E-05
kneser_10_4_1	349651	330751	992252	11405272	1867	14.40	120.88	0	1.62E+02	2.75E-01	3.74E-06
landmark	71952	2673	1146848	873043	25	0.48	0.60	0	8.36E-05	3.12E-07	7.09E-02
LargeRegFile	2111154	801374	4944201	24923112	21	78.63	86.25	0	4.44E+02	3.06E-01	1.25E-09
Maragal_6	21251	10144	537694	679769	1291	2.10	5.44	0	1.07E+01	7.72E-01	7.74E-07
Maragal_7	46845	26525	1200537	1641051	477	8.13	11.43	0	1.37E+01	7.35E-01	8.55E-07
Maragal_8	60845	33093	1308415	1392093	65802	2.96	504.85	0	2.39E+02	9.68E-01	3.83E-06
mri1	114637	65536	589824	1776829	65	1.95	2.62	0	2.67E+01	7.90E-02	5.21E-06
mri2	104597	63240	569160	2575072	10271	6.26	118.90	0	1.41E+02	4.37E-01	9.17E-07
NotreDame_actors	383640	127823	1470404	6151175	>12190	28.88	>600.00	19	5.19E+02	8.37E-01	9.90E-06
psse0	26722	11028	102432	180414	30	0.07	0.10	0	6.64E+01	7.62E-01	3.72E-11
psse1	14318	11028	57376	133438	136	0.04	0.14	0	3.59E+01	5.14E-01	7.28E-11
psse2	28634	11028	115262	216020	174	0.06	0.28	0	7.86E+01	7.75E-01	1.66E-10
rel9	5921786	274667	23667183	-	-	>600.00	-	19	-	-	-
relat9	9746232	274667	38955420	-	-	>600.00	-	19	-	-	-
Rucci1	1977885	109900	7791168	19056222	553	40.80	109.48	0	7.28E+02	5.18E-01	9.22E-06
sls	1748122	62729	6804304	13636543	13	15.05	17.18	0	1.74E-05	1.32E-08	2.91E-02
TF14	3159	2644	29862	148306	1087	0.21	0.61	0	6.24E-03	1.11E-04	5.97E-04
TF15	7741	6334	80057	368065	1744	0.43	2.06	0	1.13E-02	1.28E-04	4.86E-04
TF16	19320	15437	216173	928743	1107	1.05	4.33	0	1.52E-02	1.09E-04	5.17E-04
TF17	48629	38132	586218	2359904	1199	3.77	14.09	0	2.17E-02	9.83E-05	5.46E-04
TF18	123867	95368	1597545	6080905	1463	12.20	57.35	0	3.21E-02	9.11E-05	5.40E-04
TF19	317955	241029	4370721	15718547	1087	37.71	144.15	0	4.26E-02	7.55E-05	6.07E-04
tomographic1	59360	45908	647495	2247216	1840	1.49	17.52	0	4.19E+01	1.72E-01	1.20E-06
Trec14	15904	3159	2872265	3251107	16005	10.68	170.66	0	1.12E+02	8.89E-01	6.16E-10
wheel_601	902103	723605	2170814	25831230	>4585	46.90	>600.00	19	4.23E+02	4.45E-01	5.08E-05

Table 3.27: Complete results for subset CUTEst problems solving the normal equations via HSL_MA97 factors.

name	m	n	$nz(A)$	factors	factor time	total time	status	$\|r\|$
BAS1LP	9825	5411	587775	3078236	0.19	0.93	0	5.5447E+01
BAXTER	30733	27441	111576	25904371	0.10	3.61	0	5.9286E+01
BCDOUT	7078	5412	67344	2167514	0.04	0.36	0	3.5344E+01
CO9	22924	10789	109651	1188478	0.10	0.10	0	8.9188E+01
CONT11_L	1961394	1468599	5382999	147967730	5.26	8.61	0	8.0916E+02
DBIR1	45775	18804	1077025	260137	0.02	0.02	0	3.4934E+01
DBIR2	45877	18906	1158159	117251868	0.39	72.80	0	1.6669E+02
D2Q06C	5831	2171	33081	141400121	0.41	46.14	0	1.6651E+02
DELF000	5543	3128	13741	136015	0.02	0.02	0	5.3817E+01
GE	16369	10099	44825	730178	0.05	0.06	0	7.2447E+01
LARGE001	7176	4162	18887	195019	0.02	0.02	0	6.0680E+01
LPL1	129959	39951	386218	12926410	0.31	1.27	0	7.0878E+01
MOD2	66409	34774	199810	4209242	0.17	0.32	0	1.3872E+02
MODEL10	16819	4400	150372	733403	0.08	0.08	0	5.3554E+01
MPSBCD03	7078	5412	66210	2163800	0.05	0.37	0	3.5246E+01
NSCT2	37563	23003	697738	16602700	0.27	4.57	0	1.8379E+02
NSIR2	10057	4453	154939	704032	0.06	0.13	0	8.0492E+01
PDE1	271792	270595	990587	-	-	-	9	-
PDS-100	514577	156016	1096002	189690066	1.12	60.36	0	2.8489E+02
PDS-90	475448	142596	1014136	180340804	1.04	56.21	0	2.6847E+02
PILOT-JA	2267	940	14977	105443	0.01	0.01	0	3.1987E+01
PILOTNOV	2446	975	13331	103809	0.01	0.02	0	3.2873E+01
RAIL2586	923269	2586	8011362	1531996	3.32	2.19	0	1.4113E+02
RAIL4284	1096894	4284	11284032	6895656	4.52	4.00	0	1.6948E+02
SPAL_004	321696	10203	46168124	47074959	17.98	124.87	0	3.5136E-14
STAT96V2	957432	29089	2852184	1741109	2.50	0.40	0	9.7273E+02
STAT96V3	1113780	33841	3317736	2033605	2.95	0.41	0	1.0492E+03
STAT96V4	63076	3173	491336	155889	0.24	0.07	0	1.2052E+02
STORMG21K	1377306	526185	3459881	>406183656	>48.23	-	10	-
WATSON_1	386992	201155	1055093	8455310	1.01	0.67	0	2.5495E+02
WATSON_2	677224	352013	1846391	14968100	1.77	1.26	0	3.3569E+02
WORLD	67147	34506	198883	4015154	0.17	0.32	0	1.4068E+02

Table 3.27: Complete results for subset UF problems solving the normal equations via `HSL_MA97` factors.

name	m	n	$nz(A)$	factors	factor time	total time	status	$\|r\|$
12month1	872622	12471	22624727	>13133836	>165.18	-	10	-
162bit	3606	3476	37118	2378948	0.18	0.19	0	1.1771E+01
176bit	7441	7150	82270	8383997	0.80	0.82	0	1.8417E+01
192bit	13691	13093	154303	46204979	9.90	10.00	0	2.4854E+01
208bit	24430	23191	299756	132705125	47.80	48.07	0	3.8499E+01
beaflw	500	492	53403	367705	0.12	0.12	0	4.1622E+00
c8_mat11	5761	4562	2462970	9692833	24.13	24.20	0	2.1290E+01
connectus	394707	458	1127525	32052	0.17	0.22	0	6.2791E+02
ESOC	327062	37349	6019939	47830600	9.03	9.38	0	5.2308E-10
EternityII_Etilde	204304	10054	1170516	5383429	0.44	0.52	0	3.5654E-14
f855_mat9	2511	2456	171214	7250113	1.87	1.89	0	2.1402E+02
GL7d16	955127	460260	14488881	>1327570176	>60.27	-	10	-
GL7d17	1548649	955127	25978098	>211108386	>185.83	-	10	-
GL7d18	1955309	1548645	35590540	-	>417.03	-	10	-
GL7d19	1955296	1911130	37322725	-	>71.78	-	9	-
GL7d20	1911124	1437546	29893084	>2214333761	>317.00	-	10	-
GL7d21	1437546	822922	18174775	>291709185	>110.01	-	10	-
GL7d22	822906	349443	8251000	318893119	>38.17	-	10	-
GL7d23	349443	105054	2695430	>557267849	>11.29	-	10	-
graphics	29493	11822	117954	450522	0.05	0.06	0	3.0333E-04
HFE18_96_in	2372	2371	933343	2810872	3.38	3.41	0	4.9063E-01
IG5-15	11369	6146	323509	13602718	2.15	2.19	0	5.4855E+01
IG5-16	18846	9519	588326	31140231	5.53	5.60	0	7.1509E+01
IG5-17	30162	14060	1035008	69825388	18.09	18.24	0	9.1038E+01
IG5-18	47894	20818	1790490	153672995	58.55	58.91	0	1.1518E+02
IMDB	896302	303617	3782463	>7625707183	>25.71	-	10	-
kneser_10_4_1	349651	330751	992252	>176051300	>97.12	-	10	-
landmark	71952	2673	1146848	368699	0.18	0.21	0	1.1271E-05
LargeRegFile	2111154	801374	4944201	14314381	1.05	1.63	0	4.4422E+02
Maragal_6	21251	10144	537694	22561128	24.36	24.41	0	1.0685E+01
Maragal_7	46845	26525	1200537	68305889	146.14	146.29	0	1.3685E+01
Maragal_8	60845	33093	1308415	163207703	88.43	88.78	0	2.3777E+02
mri1	114637	65536	589824	17833859	1.54	1.63	0	2.6742E+01
mri2	104597	63240	569160	>8316379	>59.24	-	10	-
NotreDame_actors	383640	127823	1470404	>428559270	>20.41	-	10	-
psse0	26722	11028	102432	338043	0.03	0.04	0	6.6358E+01
psse1	14318	11028	57376	345004	0.03	0.04	0	3.5919E+01
psse2	28634	11028	115262	359698	0.03	0.04	0	7.8596E+01
rel9	5921786	274667	23667183	>40800758	>29.86	-	10	-
relat9	9746232	274667	38955420	>53209865	>34.84	-	10	-
Rucci1	1977885	109900	7791168	197328655	21.88	22.45	0	7.2798E+02
sls	1748122	62729	6804304	52048692	12.23	12.72	0	9.3169E-14
TF14	3159	2644	29862	2427532	0.18	0.19	0	6.6300E-15
TF15	7741	6334	80057	14097226	1.43	1.46	0	1.0720E-14
TF16	19320	15437	216173	83788762	16.18	16.34	0	1.7573E-14
TF17	48629	38132	586218	>537526176	>6.82	-	10	-
TF18	123867	95368	1597545	>1273959539	>7.62	-	10	-
TF19	317955	241029	4370721	>2785976433	>31.67	-	10	-
tomographic1	59360	45908	647495	127261944	33.93	34.19	0	4.1845E+01
Trec14	15904	3159	2872265	14324608	20.31	20.37	0	1.1217E+02
wheel_601	902103	723605	2170814	>21906082	>42.90	-	10	-

Table 3.28: Complete results for subset CUTEst problems solving the augmented system equations via HSL_MA97 factors.

name	m	n	$nz(A)$	factors	factor time	total time	status	$\|r\|$
BAS1LP	9825	5411	587775	5129403	0.25	0.77	0	5.5447E+01
BAXTER	30733	27441	111576	25904371	0.10	4.11	0	5.9286E+01
BCDOUT	7078	5412	67344	1438560	0.04	0.18	0	3.5344E+01
CO9	22924	10789	109651	2518847	0.11	0.21	0	8.9188E+01
CONT11_L	1961394	1468599	5382999	183302666	5.27	8.22	0	8.0916E+02
DBIR1	45775	18804	1077025	619663	0.02	0.06	0	3.4934E+01
DBIR2	45877	18906	1158159	117251868	0.38	69.46	0	1.6669E+02
D2Q06C	5831	2171	33081	141422623	0.40	44.37	0	1.6651E+02
DELF000	5543	3128	13741	275571	0.02	0.04	0	5.3817E+01
GE	16369	10099	44825	1270801	0.05	0.13	0	7.2447E+01
LARGE001	7176	4162	18887	410955	0.03	0.06	0	6.0680E+01
LPL1	129959	39951	386218	12926410	0.32	0.86	0	7.0878E+01
MOD2	66409	34774	199810	7816884	0.17	0.54	0	1.3872E+02
MODEL10	16819	4400	150372	2260118	0.08	0.22	0	5.3554E+01
MPSBCD03	7078	5412	66210	1329966	0.04	0.15	0	3.5246E+01
NSCT2	37563	23003	697738	16597903	0.29	2.23	0	1.8379E+02
NSIR2	10057	4453	154939	5027510	0.06	0.65	0	8.0492E+01
PDE1	271792	270595	990587	32660939	0.87	1.65	0	3.0302E+02
PDS-100	514577	156016	1096002	189690066	1.13	30.78	0	2.8489E+02
PDS-90	475448	142596	1014136	180340804	1.03	29.36	0	2.6847E+02
PILOT-JA	2267	940	14977	484304	0.02	0.05	0	3.1987E+01
PILOTNOV	2446	975	13331	309408	0.01	0.04	0	3.2873E+01
RAIL2586	923269	2586	8011362	14596546	3.35	3.48	0	1.4113E+02
RAIL4284	1096894	4284	11284032	28171500	4.54	6.29	0	1.6948E+02
SPAL_004	321696	10203	46168124	99742292	17.74	27.75	0	-
STAT96V2	957432	29089	2852184	11864618	2.53	1.78	0	9.7273E+02
STAT96V3	1113780	33841	3317736	13865517	2.93	2.17	0	1.0492E+03
STAT96V4	63076	3173	491336	1109133	0.25	0.23	0	1.2052E+02
STORMG21K	1377306	526185	3459881	157600211	3.44	24.08	0	8.9636E+02
WATSON_1	386992	201155	1055093	18771988	1.01	1.60	0	2.5495E+02
WATSON_2	677224	352013	1846391	32393702	1.77	2.65	0	3.3569E+02
WORLD	67147	34506	198883	7550890	0.17	0.49	0	1.4068E+02

Table 3.28: Complete results for subset UF problems solving the augmented system via HSL_MA97 factors.

name	m	n	$nz(A)$	factors	factor time	total time	status	$\|r\|$
12month1	872622	12471	22624727	>131338363	>25.44	-	10	-
162bit	3606	3476	37118	5920524	0.49	0.50	0	1.1771E+01
176bit	7441	7150	82270	19735029	2.29	2.33	0	1.8417E+01
192bit	13691	13093	154303	46204979	7.34	7.44	0	2.4854E+01
208bit	24430	23191	299756	132705125	32.47	32.73	0	3.8499E+01
beaflw	500	492	53403	367705	0.06	0.07	0	4.1622E+00
c8_mat11	5761	4562	2462970	38098563	18.35	18.43	0	2.1290E+01
connectus	394707	458	1127525	1764236	0.58	0.69	0	6.2791E+02
ESOC	327062	37349	6019939	>113457316	>39.68	-	10	-
EternityII_Etilde	204304	10054	1170516	21879566	1.28	1.41	0	6.4122E-14
f855_mat9	2511	2456	171214	7250113	0.90	0.91	0	1.6983E+01
GL7d16	955127	460260	14488881	>8806464035	>600.46	-	10	-
GL7d17	1548649	955127	25978098	>10000000000	>600.33	-	10	-
GL7d18	1955309	1548645	35590540	-	>348.61	-	9	-
GL7d19	1955296	1911130	37322725	-	>66.17	-	9	-
GL7d20	1911124	1437546	29893084	>10000000000	>600.72	-	10	-
GL7d21	1437546	822922	18174775	>10000000000	>600.01	-	10	-
GL7d22	822906	349443	8251000	>4991575802	>198.71	-	10	-
GL7d23	349443	105054	2695430	>1479816904	>25.53	-	10	-
graphics	29493	11822	117954	7160362	0.51	0.53	0	3.0333E-04
HFE18_96_in	2372	2371	933343	10075752	1.75	1.78	0	4.9063E-01
IG5-15	11369	6146	323509	19027038	2.78	2.82	0	5.4855E+01
IG5-16	18846	9519	588326	43058163	9.81	9.90	0	7.1509E+01
IG5-17	30162	14060	1035008	92149701	24.74	24.92	0	9.1038E+01
IG5-18	47894	20818	1790490	217563752	91.59	92.02	0	1.1518E+02
IMDB	896302	303617	3782463	>1449015477	>27.54	-	10	-
kneser_10_4_1	349651	330751	992252	>176051300	>46.83	-	10	-
landmark	71952	2673	1146848	12594307	1.24	1.29	0	1.1271E-05
LargeRegFile	2111154	801374	4944201	81927340	2.40	3.22	0	4.4422E+02
Maragal_6	21251	10144	537694	22561128	3.06	3.11	0	1.0685E+01
Maragal_7	46845	26525	1200537	68302631	15.88	16.03	0	1.3685E+01
Maragal_8	60845	33093	1308415	163224287	70.90	71.24	0	2.3777E+02
mri1	114637	65536	589824	17833862	1.09	1.18	0	2.6742E+01
mri2	104597	63240	569160	>8316379	>43.93	-	10	-
NotreDame_actors	383640	127823	1470404	>1194242638	>9.30	-	10	-
psse0	26722	11028	102432	974345	0.11	0.12	0	6.6358E+01
psse1	14318	11028	57376	699004	0.09	0.09	0	3.5919E+01
psse2	28634	11028	115262	1069819	0.12	0.13	0	7.8596E+01
rel9	5921786	274667	23667183	>1440421408	>64.79	-	10	-
relat9	9746232	274667	38955420	>1560786735	>94.03	-	10	-
Rucci1	1977885	109900	7791168	347843894	30.53	31.69	0	7.2798E+02
sls	1748122	62729	6804304	171698472	19.75	21.37	0	1.4102E-13
TF14	3159	2644	29862	3513385	0.22	0.23	0	6.2028E-15
TF15	7741	6334	80057	18003413	1.92	1.95	0	9.8431E-15
TF16	19320	15437	216173	101707188	22.18	22.38	0	1.6078E-14
TF17	48629	38132	586218	>614387412	>8.22	-	10	-
TF18	123867	95368	1597545	>1812698354	>12.13	-	10	-
TF19	317955	241029	4370721	>8100380190	>123.20	-	10	-
tomographic1	59360	45908	647495	127313610	22.91	23.15	0	4.1845E+01
Trec14	15904	3159	2872265	14324608	4.34	4.39	0	1.1217E+02
wheel_601	902103	723605	2170814	259754834	132.17	133.17	0	4.2265E+02

Table 3.29: Complete results for subset CUTEst problems solving the normal equations via SPQR factors.

name	m	n	$nz(A)$	factors	factor time	total time	status	$\|r\|$
BAS1LP	9825	5411	587775	7042250	0.93	0.96	0	5.5447E+01
BAXTER	30733	27441	111576	16771401	0.98	0.99	0	7.3906E+01
BCDOUT	7078	5412	67344	4081257	0.18	0.19	0	3.5344E+01
CO9	22924	10789	109651	2956838	0.27	0.27	0	8.9188E+01
CONT11_L	1961394	1468599	5382999	200776442	28.63	28.96	0	8.0916E+02
DBIR1	45775	18804	1077025	905467	0.07	0.07	0	3.4934E+01
DBIR2	45877	18906	1158159	23593894	1.72	1.75	0	1.6669E+02
D2Q06C	5831	2171	33081	24956160	1.80	1.84	0	1.6651E+02
DELF000	5543	3128	13741	176865	0.03	0.03	0	5.3817E+01
GE	16369	10099	44825	1248595	0.14	0.15	0	7.2447E+01
LARGE001	7176	4162	18887	264668	0.04	0.04	0	6.0680E+01
LPL1	129959	39951	386218	35893199	2.84	2.87	0	7.0878E+01
MOD2	66409	34774	199810	11178250	0.83	0.84	0	1.3872E+02
MODEL10	16819	4400	150372	4568775	0.24	0.25	0	5.3554E+01
MPSBCD03	7078	5412	66210	3310690	0.17	0.17	0	3.5246E+01
NSCT2	37563	23003	697738	34196715	2.49	2.52	0	1.8379E+02
NSIR2	10057	4453	154939	2183289	0.12	0.13	0	8.0492E+01
PDE1	271792	270595	990587	-	>0.23	-	10	-
PDS-100	514577	156016	1096002	1063903337	297.85	298.00	0	2.8489E+02
PDS-90	475448	142596	1014136	982306163	284.86	285.00	0	2.6847E+02
PILOT-JA	2267	940	14977	277631	0.02	0.02	0	3.1987E+01
PILOTNOV	2446	975	13331	293468	0.02	0.02	0	3.2873E+01
RAIL2586	923269	2586	8011362	997450496	89.44	89.74	0	1.4113E+02
RAIL4284	1096894	4284	11284032	-	>1.95	-	10	-
SPAL_004	321696	10203	46168124	-	>7.53	-	10	-
STAT96V2	957432	29089	2852184	71550468	1.83	1.91	0	9.7273E+02
STAT96V3	1113780	33841	3317736	85208368	2.33	2.41	0	1.0492E+03
STAT96V4	63076	3173	491336	4142651	0.15	0.17	0	1.2052E+02
STORMG21K	1377306	526185	3459881	-	>1.26	-	10	-
WATSON_1	386992	201155	1055093	21971466	2.19	2.25	0	2.5495E+02
WATSON_2	677224	352013	1846391	36655208	3.92	4.00	0	3.3569E+02
WORLD	67147	34506	198883	11277087	0.78	0.80	0	1.4068E+02

Table 3.29: Complete results for subset UF problems solving the normal equations via SPQR factors.

name	m	n	$nz(A)$	factors	factor time	total time	status	$\|r\|$
12month1	872622	12471	22624727	-	>7.75	-	10	-
162bit	3606	3476	37118	5344819	0.28	0.28	0	1.1771E+01
176bit	7441	7150	82270	20630272	1.51	1.52	0	1.8417E+01
192bit	13691	13093	154303	61823862	5.80	5.82	0	2.4854E+01
208bit	24430	23191	299756	182155733	32.80	32.85	0	3.8499E+01
beaflw	500	492	53403	173400	0.01	0.02	0	4.1622E+00
c8_mat11	5761	4562	2462970	20739042	2.19	2.20	0	2.1290E+01
connectus	394707	458	1127525	48761778	2.12	2.12	0	6.2791E+02
ESOC	327062	37349	6019939	474419042	60.96	61.04	0	5.9769E-09
EternityII_Etilde	204304	10054	1170516	199022005	10.44	10.46	0	6.3141E-13
f855_mat9	2511	2456	171214	4833044	0.36	0.36	0	4.3783E+03
GL7d16	955127	460260	14488881	-	>147.61	-	10	-
GL7d17	1548649	955127	25978098	-	>468.72	-	10	-
GL7d18	1955309	1548645	35590540	-	>600.00	-	10	-
GL7d19	1955296	1911130	37322725	-	>600.04	-	10	-
GL7d20	1911124	1437546	29893084	-	>600.10	-	10	-
GL7d21	1437546	822922	18174775	-	>525.53	-	10	-
GL7d22	822906	349443	8251000	-	>155.36	-	10	-
GL7d23	349443	105054	2695430	-	>24.73	-	10	-
graphics	29493	11822	117954	794014	0.09	0.09	0	3.0333E-04
HFE18_96_in	2372	2371	933343	4202461	0.31	0.31	0	4.9063E-01
IG5-15	11369	6146	323509	46130272	6.46	6.48	0	5.4855E+01
IG5-16	18846	9519	588326	113921410	16.67	16.71	0	7.1509E+01
IG5-17	30162	14060	1035008	281197774	88.62	88.67	0	9.1038E+01
IG5-18	47894	20818	1790490	661959431	302.37	302.47	0	1.1518E+02
IMDB	896302	303617	3782463	-	>9.84	-	10	-
kneser_10_4_1	349651	330751	992252	708694615	441.75	441.95	0	1.6310E+02
landmark	71952	2673	1146848	53271639	2.92	2.93	0	1.1271E-05
LargeRegFile	2111154	801374	4944201	93276939	15.53	15.59	0	4.4422E+02
Maragal_6	21251	10144	537694	152480313	81.28	81.31	0	1.0738E+01
Maragal_7	46845	26525	1200537	282609058	155.24	155.29	0	1.3721E+01
Maragal_8	60845	33093	1308415	97442466	23.59	23.60	0	2.3777E+02
mri1	114637	65536	589824	16936058	1.55	1.56	17	8.0938E+13
mri2	104597	63240	569160	40879941	1.14	1.14	17	9.2430E+24
NotreDame_actors	383640	127823	1470404	-	>1.35	-	10	-
psse0	26722	11028	102432	543438	0.07	0.08	0	6.6358E+01
psse1	14318	11028	57376	361496	0.05	0.05	0	3.5919E+01
psse2	28634	11028	115262	684237	0.08	0.08	0	7.8596E+01
rel9	5921786	274667	23667183	-	>54.24	-	10	-
relat9	9746232	274667	38955420	-	>72.00	-	10	-
Rucci1	1977885	109900	7791168	2075853034	329.38	329.54	0	7.2798E+02
sls	1748122	62729	6804304	-	>12.16	-	10	-
TF14	3159	2644	29862	5321279	0.33	0.34	0	5.8292E-14
TF15	7741	6334	80057	34848904	4.52	4.53	0	1.3149E-13
TF16	19320	15437	216173	219699095	82.21	82.26	0	3.0910E-13
TF17	48629	38132	586218	-	>1.27	-	10	-
TF18	123867	95368	1597545	-	>8.52	-	10	-
TF19	317955	241029	4370721	-	>84.52	-	10	-
tomographic1	59360	45908	647495	117674294	16.52	16.55	0	4.1845E+01
Trec14	15904	3159	2872265	40974154	5.37	5.39	0	1.1217E+02
wheel_601	902103	723605	2170814	-	>5.87	-	10	-

Table 3.30: Storage required for factors (or for GMRES) for subset CUTEst problems by each method

name	m	n	$nz(A)$	no	diagonal	MIQR	RIF	BA-G	MI35	MI30-MIN	MA97
BAS1LP	9825	5411	587775	0	5411	154335	58422	6419411	113414	858406	3078236
BAXTER	30733	27441	111576	0	27441	166672	254733	27441	218513	709648	25904371
BCDOUT	7078	5412	67344	0	5412	227118	38953	5412	97350	214193	2167514
CO9	22924	10789	109651	0	10789	139168	52621	11802789	122520	346055	1188478
CONT11_L	1961394	1468599	5382999	0	1468599	6823917	4883216	149807602	10208898	22208667	147967730
DBIR1	45775	18804	1077025	0	2171	22404	13660	700243	30258	100726	260137
DBIR2	45877	18906	1158159	0	18804	306833	92947	7055662	264644	1977702	117251868
D2Q06C	5831	2171	33081	0	18906	311225	94898	17102778	172316	1876024	141400121
DELF000	5543	3128	13741	0	3128	9959	11667	4134128	11314	33260	136015
GE	16369	10099	44825	0	10099	98350	49164	8719998	134483	248210	730178
LARGE001	7176	4162	18887	0	4162	14243	16930	5169162	16000	46375	195019
LPL1	129959	39951	386218	0	39951	184639	143744	28745911	541699	1605246	12926410
MOD2	66409	34774	199810	0	34774	559518	229986	20505898	527770	1300573	4209242
MODEL10	16819	4400	150372	0	4400	34670	24083	1863308	78015	378047	733403
MPSBCD03	7078	5412	66210	0	5412	228815	38965	5412	98584	220678	2163800
NSCT2	37563	23003	697738	0	23003	561767	109287	4781258	165302	1407946	16602700
NSIR2	10057	4453	154939	0	4453	98551	27196	984313	54142	305406	704032
PDE1	271792	270595	990587	0	270595	-	>993046	270595	-	-	-
PDS-100	514577	156016	1096002	0	156016	1027112	618440	12019236	2891511	7696832	189690066
PDS-90	475448	142596	1014136	0	142596	950792	570713	10557652	2626289	7233396	180340804
PILOT-JA	2267	940	14977	0	940	9650	5780	427458	10870	47073	105443
PILOTNOV	2446	975	13331	0	975	9320	5958	449095	11317	44818	103809
RAIL2586	923269	2586	8011362	0	2586	6235	24447	495112	51833	9613272	1531996
RAIL4284	1096894	4284	11284032	0	4284	6345	45055	958072	89219	15880038	6895656
SPAL_004	321696	10203	46168124	0	10203	18683	>7018	20410	213972	40754070	47074959
STAT96V2	957432	29089	2852184	0	29089	38807	81055	12573814	276290	4210897	1741109
STAT96V3	1113780	33841	3317736	0	33841	45145	94273	14216653	319109	4901099	2033605
STAT96V4	63076	3173	491336	0	3173	11493	10513	415798	47295	512268	155889
STORMG21K	1377306	526185	3459881	0	526185	6933837	>1957476	526185	7505682	34433755	>406183656
WATSON_1	386992	201155	1055093	0	201155	1005650	519977	11469139	2634818	6106788	8455310
WATSON_2	677224	352013	1846391	0	352013	2808070	1171936	17251085	4648375	10588235	14968100
WORLD	67147	34506	198883	0	34506	535778	224464	20065186	511951	1288095	4015154

Table 3.30: Storage required for factors (or for GMRES) for subset UF problems by each method

name	m	n	$nz(A)$	no	diagonal	MIQR	RIF	BA-G	MI35	MI30-MIN	MA97
12month1	872622	12471	22624727	0	12471	73375	>65361	764511	260889	34096963	>13133836
162bit	3606	3476	37118	0	3476	193542	28550	1215038	70512	166083	2378948
176bit	7441	7150	82270	0	7150	388870	56269	5121390	145649	349258	8383997
192bit	13691	13093	154303	0	13093	685467	96275	14109093	267084	654954	46204979
208bit	24430	23191	299756	0	23191	1202798	168273	24217191	471420	1177025	132705125
beaflw	500	492	53403	0	492	28073	5307	475792	9814	71656	367705
c8_mat11	5761	4562	2462970	0	4562	78255	49640	4562	95477	2621770	9692833
connectus	394707	458	1127525	0	458	478	1744	1850	5185	1527818	32052
ESOC	327062	37349	6019939	0	37349	698366	>271701	37349	776570	12993333	47830600
EternityII_Etilde	204304	10054	1170516	0	10054	24368	103380	4019398	205375	4202504	5383429
f855_mat9	2511	2456	171214	0	2456	136743	26961	2456	51366	264054	7250113
GL7d16	955127	460260	14488881	0	460260	9346036	>342783	4602708	9665201	36508148	>1327570176
GL7d17	1548649	955127	25978098	0	955127	31102238	>342999	8596231	20057165	-	>211108386
GL7d18	1955309	1548645	35590540	0	1548645	>82048471	>375925	17035225	>32520973	-	-
GL7d19	1955296	1911130	37322725	0	1911130	>178396100	>572915	19111408	40133312	-	-
GL7d20	1911124	1437546	29893084	0	1437546	>118385247	>544782	8625316	30188087	-	>2214333761
GL7d21	1437546	822922	18174775	0	822922	49569906	>537760	5760508	17281075	-	>291709185
GL7d22	822906	349443	8251000	0	349443	12616485	>552082	2446155	7337962	30115416	318893119
GL7d23	349443	105054	2695430	0	105054	1721600	>569276	735432	2205827	10424076	>557267849
graphics	29493	11822	117954	0	11822	31960	30470	11822	24901	194127	450522
HFE18_96_in	2372	2371	933343	0	2371	10978	26016	3376371	49576	1028976	2810872
IG5-15	11369	6146	323509	0	6146	189538	62626	580318	128833	643103	13602718
IG5-16	18846	9519	588326	0	9519	279931	97466	1470142	199678	1115361	31140231
IG5-17	30162	14060	1035008	0	14060	409603	145262	1758938	295028	1843157	69825388
IG5-18	47894	20818	1790490	0	20818	587680	216979	2260114	436954	2992054	153672995
IMDB	896302	303617	3782463	0	303617	15909318	>521169	303617	5858164	13438747	>7625707183
kneser_10_4_1	349651	330751	992252	0	330751	6394519	-	330751	6759341	11405272	>176051300
landmark	71952	2673	1146848	0	2673	11307	17778	75654	26909	873043	368699
LargeRegFile	2111154	801374	4944201	0	801374	3615761	>462274	6411062	4106048	24923112	14314381
Maragal_6	21251	10144	537694	0	10144	246737	71907	3727498	212144	679769	22561128
Maragal_7	46845	26525	1200537	0	26525	662167	166881	1835053	553856	1641051	68305889
Maragal_8	60845	33093	1308415	0	33093	1702715	229119	33093	597971	1392093	163207703
mri1	114637	65536	589824	0	65536	519051	325965	62016508	636290	1776829	17833859
mri2	104597	63240	569160	0	63240	1486341	392461	47669568	781491	2575072	>8316379
NotreDame_actors	383640	127823	1470404	0	127823	6768455	>708013	127823	2506265	6151175	>428559270
psse0	26722	11028	102432	0	11028	31603	23833	12042028	35197	180414	338043
psse1	14318	11028	57376	0	11028	40288	28925	12042028	35771	133438	345004
psse2	28634	11028	115262	0	11028	38437	34657	12042028	40814	216020	359698
rel9	5921786	274667	23667183	0	274667	498966	>320081	3570851	5764774	-	>40800758
relat9	9746232	274667	38955420	0	274667	337475	>272798	3845546	5763434	-	>53209865
Rucci1	1977885	109900	7791168	0	109900	638743	932200	109900	2306811	19056222	197328655
sls	1748122	62729	6804304	0	62729	71400	>108831	3013342	1226997	13636543	52048692
TF14	3159	2644	29862	0	2644	150764	28727	3649644	55249	148306	2427532
TF15	7741	6334	80057	0	6334	379663	69250	6334	132747	368065	14097226
TF16	19320	15437	216173	0	15437	933646	169320	15437	323886	928743	83788762
TF17	48629	38132	586218	0	38132	2304372	418887	38132	800458	2359904	>537526176
TF18	123867	95368	1597545	0	95368	5699962	>829968	95368	2002386	6080905	>1273959539
TF19	317955	241029	4370721	0	241029	14260905	>817427	241029	5061262	15718547	>2785976433
tomographic1	59360	45908	647495	0	45908	988212	280726	45908	906437	2247216	127261944
Trec14	15904	3159	2872265	0	3159	11942	34692	2661039	66099	3251107	14324608
wheel_601	902103	723605	2170814	0	723605	7796970	4253762	723605	14201674	25831230	>21906082

Table 3.31: Iterations required for subset CUTEst problems by each method

name	m	n	$nz(A)$	no	diagonal	MIQR	RIF	BA-G	MI35	MI30-MIN
BAS1LP	9825	5411	587775	14870	7610	48420	28	4406	7983	11477
BAXTER	30733	27441	111576	>100000	>100000	103	>100000	-	>100000	>100000
BCDOUT	7078	5412	67344	>100000	>100000	>100000	>100000	-	>100000	>100000
C09	22924	10789	109651	24925	5063	3611	7006	2619	381	194
CONT11_L	1961394	1468599	5382999	206	206	>2	60	101	22	19
DBIR1	45775	18804	1077025	58936	1597	471	12283	284	209	18
DBIR2	45877	18906	1158159	1451	2229	30673	>100000	367	1863	62307
D2Q06C	5831	2171	33081	19090	2208	33838	>100000	864	833	>84581
DELF000	5543	3128	13741	>100000	26469	693	30637	3616	60	58
GE	16369	10099	44825	69445	6249	572	830	799	28	81
LARGE001	7176	4162	18887	52505	26782	53686	>100000	6589	75	90
LPL1	129959	39951	386218	30201	3175	563	>100000	706	420	66
MOD2	66409	34774	199810	10664	1370	1515	46350	579	151	88
MODEL10	16819	4400	150372	34369	2229	5870	>100000	388	743	202
MPSBCD03	7078	5412	66210	>100000	>100000	>100000	>100000	-	>100000	>100000
NSCT2	37563	23003	697738	9991	1395	13525	>100000	205	615	>100000
NSIR2	10057	4453	154939	9611	1037	20205	9	210	386	72961
PDE1	271792	270595	990587	906	965	-	-	-	-	-
PDS-100	514577	156016	1096002	681	342	228	203	76	90	64
PDS-90	475448	142596	1014136	639	331	216	195	73	88	76
PILOT-JA	2267	940	14977	>100000	2344	61	28197	334	323	54
PILOTNOV	2446	975	13331	83448	1927	43	17920	340	214	20
RAIL2586	923269	2586	8011362	919	401	816	233	178	151	9
RAIL4284	1096894	4284	11284032	887	733	923	375	212	224	19
SPAL_004	321696	10203	46168124	>2572	>2507	>2740	-	1	>1047	535
STAT96V2	957432	29089	2852184	986	726	462	414	425	19	22
STAT96V3	1113780	33841	3317736	1055	765	485	435	414	20	27
STAT96V4	63076	3173	491336	4144	810	1767	449	125	17	24
STORMG21K	1377306	526185	3459881	1383	183	>6446	-	-	2285	>4234
WATSON_1	386992	201155	1055093	2160	422	165	249	56	73	8
WATSON_2	677224	352013	1846391	1812	349	119	185	48	54	7
WORLD	67147	34506	198883	9811	1369	1084	24796	571	154	70

Table 3.31: Iterations required for subset UF problems by each method

name	m	n	$nz(A)$	no	diagonal	MIQR	RIF	BA-G	MI35	MI30-MIN
12month1	872622	12471	22624727	>6310	268	972	-	60	371	294
162bit	3606	3476	37118	29396	2540	728	1495	319	247	252
176bit	7441	7150	82270	>100000	6537	2710	3894	655	454	981
192bit	13691	13093	154303	>100000	12203	4790	7236	6005	1282	1521
208bit	24430	23191	299756	>100000	17073	9764	13993	6219	2198	3131
beaflw	500	492	53403	43875	40985	38436	>5	485	33967	>100000
c8_mat11	5761	4562	2462970	40787	38344	>100000	>100000	-	29944	>76276
connectus	394707	458	1127525	1748	7	114	7	3	6	3
ESOC	327062	37349	6019939	5604	15004	>20935	-	-	>21629	>14678
EternityII_Etilde	204304	10054	1170516	1354	1122	2098	883	384	585	81
f855_mat9	2511	2456	171214	19017	20354	>100000	>100000	-	12372	>100000
GL7d16	955127	460260	14488881	61	48	264	-	9	32	35
GL7d17	1548649	955127	25978098	58	48	422	-	8	28	-
GL7d18	1955309	1548645	35590540	80	64	-	-	10	-	-
GL7d19	1955296	1911130	37322725	205	53	-	-	9	46	-
GL7d20	1911124	1437546	29893084	136	31	-	-	5	28	-
GL7d21	1437546	822922	18174775	143	26	196	-	6	25	-
GL7d22	822906	349443	8251000	238	24	124	-	6	22	30
GL7d23	349443	105054	2695430	340	24	91	-	6	21	22
graphics	29493	11822	117954	>100000	>100000	>100000	>100000	-	1891	224
HFE18_96_in	2372	2371	933343	30697	15102	30130	12433	1632	14659	16095
IG5-15	11369	6146	323509	4577	608	126	321	92	239	535
IG5-16	18846	9519	588326	7406	863	150	478	151	348	772
IG5-17	30162	14060	1035008	7264	828	169	410	123	326	706
IG5-18	47894	20818	1790490	7282	738	205	447	107	309	886
IMDB	896302	303617	3782463	>12955	>10670	>3303	-	-	>5974	>4263
kneser_10_4_1	349651	330751	992252	17209	10781	>8403	>1	-	3257	1867
landmark	71952	2673	1146848	19937	894	36	274	27	12	25
LargeRegFile	2111154	801374	4944201	795	54	167	-	7	12	21
Maragal_6	21251	10144	537694	5178	1942	8699	>100000	354	679	1291
Maragal_7	46845	26525	1200537	2769	1071	1444	5718	68	264	477
Maragal_8	60845	33093	1308415	>100000	>100000	>43720	>100000	-	>71973	65802
mri1	114637	65536	589824	6108	6116	8810	1575	932	2217	65
mri2	104597	63240	569160	11852	11822	4315	>1	744	2935	10271
NotreDame_actors	383640	127823	1470404	>52691	>49880	>9971	-	-	>18396	>12190
psse0	26722	11028	102432	82324	43122	1210	22445	28003	71	30
psse1	14318	11028	57376	64151	50610	4588	>100000	37887	575	136
psse2	28634	11028	115262	81831	58572	7677	>100000	43868	722	174
rel9	5921786	274667	23667183	110	81	107	-	12	37	-
relat9	9746232	274667	38955420	88	76	82	-	13	36	-
Rucci1	1977885	109900	7791168	17837	8330	>15623	1823	-	>12455	553
sls	1748122	62729	6804304	638	189	620	-	47	68	13
TF14	3159	2644	29862	34727	25709	44760	12914	1758	11418	1087
TF15	7741	6334	80057	>100000	81922	>100000	43460	-	41034	1744
TF16	19320	15437	216173	>100000	>100000	>100000	>100000	-	>100000	1107
TF17	48629	38132	586218	>100000	>100000	>43947	>100000	-	>84020	1199
TF18	123867	95368	1597545	>100000	>93527	>16944	-	-	>28500	1463
TF19	317955	241029	4370721	>32164	>30368	>5798	-	-	>8670	1087
tomographic1	59360	45908	647495	65455	18905	>72373	12	-	1867	1840
Trec14	15904	3159	2872265	2007	1593	8533	>1	690	1603	16005
wheel_601	902103	723605	2170814	>19475	>18285	>5102	>7367	-	>4024	>4585

Table 3.32: Time required for factors for subset CUTEst problems by each method

name	m	n	$nz(A)$	no	diagonal	MIQR	RIF	BA-G	MI35	MI30-MIN	MA97
BAS1LP	9825	5411	587775	0.00	0.00	0.57	7.25	0.00	1.33	1.03	0.19
BAXTER	30733	27441	111576	0.00	0.00	0.30	1.32	0.00	0.29	0.80	0.10
BCDOUT	7078	5412	67344	0.00	0.00	0.40	1.51	0.00	0.46	0.27	0.04
C09	22924	10789	109651	0.00	0.00	0.16	1.04	0.00	0.22	0.77	0.10
CONT11_L	1961394	1468599	5382999	0.00	0.01	16.14	45.56	0.00	9.38	18.36	5.26
DBIR1	45775	18804	1077025	0.00	0.00	0.04	0.07	0.00	0.04	0.14	0.02
DBIR2	45877	18906	1158159	0.00	0.00	1.32	40.98	0.00	2.24	4.57	0.39
D2Q06C	5831	2171	33081	0.00	0.00	0.83	47.59	0.00	2.14	4.18	0.41
DELF000	5543	3128	13741	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.02
GE	16369	10099	44825	0.00	0.00	0.07	0.17	0.00	0.08	0.37	0.05
LARGE001	7176	4162	18887	0.00	0.00	0.02	0.01	0.00	0.01	0.02	0.02
LPL1	129959	39951	386218	0.00	0.00	0.28	0.44	0.00	0.94	3.25	0.31
MOD2	66409	34774	199810	0.00	0.00	0.44	2.15	0.00	1.07	1.21	0.17
MODEL10	16819	4400	150372	0.00	0.00	0.20	0.39	0.00	0.09	0.48	0.08
MPSBCD03	7078	5412	66210	0.00	0.00	0.39	1.57	0.00	0.42	0.33	0.05
NSCT2	37563	23003	697738	0.00	0.00	1.46	37.53	0.00	2.51	3.88	0.27
NSIR2	10057	4453	154939	0.00	0.00	0.21	2.41	0.00	0.21	0.17	0.06
PDE1	271792	270595	990587	0.00	0.00	>600.00	>600.00	0.00	0.01	>600.00	>1.00
PDS-100	514577	156016	1096002	0.00	0.00	1.21	22.34	0.00	1.74	14.03	1.12
PDS-90	475448	142596	1014136	0.00	0.00	1.09	21.45	0.00	1.44	12.86	1.04
PILOT-JA	2267	940	14977	0.00	0.00	0.02	0.04	0.00	0.03	0.02	0.01
PILOTNOV	2446	975	13331	0.00	0.00	0.02	0.03	0.00	0.02	0.02	0.01
RAIL2586	923269	2586	8011362	0.00	0.01	2.37	110.43	0.00	2.43	4.31	3.32
RAIL4284	1096894	4284	11284032	0.00	0.01	4.82	338.76	0.00	4.65	13.08	4.52
SPAL_004	321696	10203	46168124	0.00	0.04	9.67	>600.00	0.00	74.72	42.00	17.98
STAT96V2	957432	29089	2852184	0.00	0.00	0.15	0.60	0.00	0.27	1.29	2.50
STAT96V3	1113780	33841	3317736	0.00	0.00	0.17	0.77	0.00	0.31	1.28	2.95
STAT96V4	63076	3173	491336	0.00	0.00	0.04	2.16	0.00	0.08	0.21	0.24
STORMG21K	1377306	526185	3459881	0.00	0.01	66.80	>600.00	0.00	30.83	56.90	>48.23
WATSON_1	386992	201155	1055093	0.00	0.00	1.69	0.49	0.00	1.50	0.99	1.01
WATSON_2	677224	352013	1846391	0.00	0.00	5.04	4.11	0.00	2.85	2.15	1.77
WORLD	67147	34506	198883	0.00	0.00	0.41	2.19	0.00	0.76	3.42	0.17

Table 3.32: Time required for factors for subset UF problems by each method

name	m	n	$nz(A)$	no	diagonal	MIQR	RIF	BA-G	MI35	MI30-MIN	MA97
12month1	872622	12471	22624727	0.00	0.06	23.18	>600.00	0.00	171.69	373.85	-165.18
162bit	3606	3476	37118	0.00	0.00	0.47	1.76	0.00	0.15	0.15	0.18
176bit	7441	7150	82270	0.00	0.00	1.23	8.31	0.00	0.28	0.45	0.80
192bit	13691	13093	154303	0.00	0.00	2.55	30.08	0.00	0.47	0.69	9.90
208bit	24430	23191	299756	0.00	0.00	5.52	109.21	0.00	0.97	1.79	47.80
beaflw	500	492	53403	0.00	0.00	0.08	0.19	0.00	0.11	0.12	0.12
c8_mat11	5761	4562	2462970	0.00	0.00	7.82	63.80	0.00	31.86	7.41	24.13
connectus	394707	458	1127525	0.00	0.00	0.12	2.23	0.00	0.24	0.58	0.17
ESOC	327062	37349	6019939	0.00	0.01	6.75	>600.00	0.00	3.32	316.35	9.03
EternityII_Etilde	204304	10054	1170516	0.00	0.00	0.67	37.16	0.00	1.14	2.17	0.44
f855_mat9	2511	2456	171214	0.00	0.00	0.62	2.89	0.00	0.89	0.51	1.87
GL7d16	955127	460260	14488881	0.00	0.01	397.42	>600.00	0.00	50.70	220.47	>60.27
GL7d17	1548649	955127	25978098	0.00	0.03	1148.65	>600.00	0.00	301.96	>600.00	>185.83
GL7d18	1955309	1548645	35590540	0.00	0.04	>600.00	>600.00	0.00	>600.00	>600.00	>417.03
GL7d19	1955296	1911130	37322725	0.00	0.04	>600.00	>600.00	0.00	438.21	>600.00	>71.78
GL7d20	1911124	1437546	29893084	0.00	0.03	>600.00	>600.00	0.00	219.99	>600.00	>317.00
GL7d21	1437546	822922	18174775	0.00	0.02	657.94	>600.00	0.00	73.73	>600.00	>110.01
GL7d22	822906	349443	8251000	0.00	0.01	165.69	>600.00	0.00	21.64	192.74	>38.17
GL7d23	349443	105054	2695430	0.00	0.00	24.26	>600.00	0.00	5.03	94.06	>11.29
graphics	29493	11822	117954	0.00	0.00	0.08	0.16	0.00	0.04	0.08	0.05
HFE18_96_in	2372	2371	933343	0.00	0.00	1.08	14.28	0.00	6.11	0.70	3.38
IG5-15	11369	6146	323509	0.00	0.00	0.96	9.73	0.00	0.71	1.81	2.15
IG5-16	18846	9519	588326	0.00	0.00	1.85	26.86	0.00	1.68	1.48	5.53
IG5-17	30162	14060	1035008	0.00	0.00	3.28	70.05	0.00	2.76	7.00	18.09
IG5-18	47894	20818	1790490	0.00	0.00	5.87	179.05	0.00	6.76	10.04	58.55
IMDB	896302	303617	3782463	0.00	0.01	51.71	>600.00	0.00	40.04	124.49	>25.71
kneser_10_4_1	349651	330751	992252	0.00	0.00	9.50	0.00	0.00	5.69	14.40	>97.12
landmark	71952	2673	1146848	0.00	0.00	0.27	1.67	0.00	0.29	0.48	0.18
LargeRegFile	2111154	801374	4944201	0.00	0.01	11.14	>600.00	0.00	2.21	78.63	1.05
Maragal_6	21251	10144	537694	0.00	0.00	2.28	40.18	0.00	13.56	2.10	24.36
Maragal_7	46845	26525	1200537	0.00	0.00	8.42	144.30	0.00	47.14	8.13	146.14
Maragal_8	60845	33093	1308415	0.00	0.00	16.12	210.23	0.00	5.27	2.96	88.43
mri1	114637	65536	589824	0.00	0.00	1.26	93.78	0.00	2.24	1.95	1.54
mri2	104597	63240	569160	0.00	0.00	4.09	67.78	0.00	4.95	6.26	>59.24
NotreDame_actors	383640	127823	1470404	0.00	0.00	11.41	>600.00	0.00	9.20	28.88	>20.41
psse0	26722	11028	102432	0.00	0.00	0.07	0.04	0.00	0.02	0.07	0.03
psse1	14318	11028	57376	0.00	0.00	0.10	0.05	0.00	0.03	0.04	0.03
psse2	28634	11028	115262	0.00	0.00	0.08	0.13	0.00	0.04	0.06	0.03
rel9	5921786	274667	23667183	0.00	0.02	16.10	>600.00	0.00	44.03	>600.00	>29.86
relat9	9746232	274667	38955420	0.00	0.03	14.26	>600.00	0.00	53.35	>600.00	>34.84
Rucci1	1977885	109900	7791168	0.00	0.01	2.37	172.24	0.00	2.49	40.80	21.88
sls	1748122	62729	6804304	0.00	0.01	1.56	>600.00	0.00	6.44	15.05	12.23
TF14	3159	2644	29862	0.00	0.00	0.24	0.43	0.00	0.06	0.21	0.18
TF15	7741	6334	80057	0.00	0.00	0.75	2.61	0.00	0.21	0.43	1.43
TF16	19320	15437	216173	0.00	0.00	2.38	17.44	0.00	0.45	1.05	16.18
TF17	48629	38132	586218	0.00	0.00	7.59	119.28	0.00	1.22	3.77	>6.82
TF18	123867	95368	1597545	0.00	0.00	23.83	>600.00	0.00	3.58	12.20	>7.62
TF19	317955	241029	4370721	0.00	0.00	82.22	>600.00	0.00	12.75	37.71	>31.67
tomographic1	59360	45908	647495	0.00	0.00	2.86	3.00	0.00	1.48	1.49	33.93
Trec14	15904	3159	2872265	0.00	0.00	2.35	57.38	0.00	27.41	10.68	20.31
wheel_601	902103	723605	2170814	0.00	0.01	20.39	36.75	0.00	51.45	46.90	>42.90

Table 3.33: Total time required for subset CUTEst problems by each method

name	m	n	$nz(A)$	no	diagonal	MIQR	RIF	BA-G	MI35	MI30-MIN	MA97
BAS1LP	9825	5411	587775	27.18	14.10	133.70	7.31	119.59	21.71	32.51	0.93
BAXTER	30733	27441	111576	>67.29	>86.64	0.52	>79.54	>600.00	>293.46	>305.83	3.61
BCDOUT	7078	5412	67344	>28.51	>32.47	>137.51	>50.06	>600.00	>92.58	>66.19	0.36
C09	22924	10789	109651	12.93	2.98	5.20	7.03	37.17	0.79	1.06	0.10
CONT11_L	1961394	1468599	5382999	8.47	10.76	>16.44	52.40	32.92	13.68	22.88	8.61
DBIR1	45775	18804	1077025	8.87	0.27	0.18	2.97	0.42	0.11	0.15	0.02
DBIR2	45877	18906	1158159	5.44	8.79	185.29	>518.59	7.21	13.04	455.44	72.80
D2Q06C	5831	2171	33081	82.11	9.45	213.36	>288.71	24.89	6.80	>600.00	46.14
DELF000	5543	3128	13741	>7.77	2.65	0.15	4.99	12.78	0.03	0.02	0.02
GE	16369	10099	44825	20.64	2.29	0.64	0.71	7.22	0.12	0.46	0.06
LARGE001	7176	4162	18887	5.55	3.69	14.39	>22.47	33.58	0.04	0.05	0.02
LPL1	129959	39951	386218	65.54	7.88	2.62	>343.06	26.24	3.99	3.83	1.27
MOD2	66409	34774	199810	11.92	1.83	7.56	117.56	13.36	1.93	1.72	0.32
MODEL10	16819	4400	150372	18.64	1.28	5.02	>70.89	1.43	0.88	0.73	0.08
MPSBCD03	7078	5412	66210	>28.30	>32.57	>137.96	>49.69	>600.00	>92.08	>66.27	0.37
NSCT2	37563	23003	697738	25.19	3.80	81.95	>200.45	2.74	5.19	>526.77	4.57
NSIR2	10057	4453	154939	5.12	0.59	21.23	2.41	0.56	0.58	65.32	0.13
PDE1	271792	270595	990587	6.27	8.38	-	-	>600.00	-	-	-
PDS-100	514577	156016	1096002	6.08	5.24	5.18	25.07	3.18	5.19	17.16	60.36
PDS-90	475448	142596	1014136	5.18	4.60	4.57	23.91	2.78	3.93	16.12	56.21
PILOT-JA	2267	940	14977	>5.76	0.18	0.03	2.57	0.16	0.08	0.03	0.01
PILOTNOV	2446	975	13331	4.47	0.12	0.03	1.60	0.14	0.03	0.02	0.02
RAIL2586	923269	2586	8011362	40.50	17.64	39.62	121.17	41.97	10.55	4.98	2.19
RAIL4284	1096894	4284	11284032	70.04	55.71	77.84	368.38	77.62	25.03	14.91	4.00
SPAL_004	321696	10203	46168124	>600.00	>600.00	>600.00	-	3.87	>600.00	125.69	124.87
STAT96V2	957432	29089	2852184	11.18	8.21	5.56	5.79	13.11	0.54	2.19	0.40
STAT96V3	1113780	33841	3317736	13.93	10.46	6.84	7.25	15.55	0.64	2.54	0.41
STAT96V4	63076	3173	491336	6.63	1.35	3.15	2.94	1.41	0.11	0.28	0.07
STORMG21K	1377306	526185	3459881	30.85	5.14	>600.00	-	>600.00	258.65	>600.00	-
WATSON_1	386992	201155	1055093	14.67	3.39	4.27	3.48	4.89	3.58	1.25	0.67
WATSON_2	677224	352013	1846391	22.73	5.25	9.26	8.48	5.18	5.73	2.60	1.26
WORLD	67147	34506	198883	10.53	1.82	5.24	64.30	12.43	1.58	3.83	0.32

Table 3.33: Total time required for subset UF problems by each method

name	m	n	$nz(A)$	no	diagonal	MIQR	RIF	BA-G	MI35	MI30-MIN	MA97
12month1	872622	12471	22624727	>600.00	26.26	122.52	-	27.96	207.50	417.74	-
162bit	3606	3476	37118	3.76	0.39	1.21	2.17	0.81	0.31	0.27	0.19
176bit	7441	7150	82270	40.30	2.14	7.60	10.50	6.30	0.85	1.43	0.82
192bit	13691	13093	154303	173.37	7.66	23.69	37.80	132.01	3.34	4.15	10.00
208bit	24430	23191	299756	>600.00	21.08	84.25	139.45	213.97	10.38	18.28	48.07
beaflw	500	492	53403	4.07	4.04	8.67	>0.19	0.51	5.44	>17.42	0.12
c8_mat11	5761	4562	2462970	175.75	171.65	>527.77	>535.49	>600.00	183.17	>600.00	24.20
connectus	394707	458	1127525	7.56	0.03	0.62	2.27	0.13	0.28	0.65	0.22
ESOC	327062	37349	6019939	157.20	332.98	>600.00	-	>600.00	>600.00	>600.00	9.38
EternityII_Etilde	204304	10054	1170516	6.67	5.69	12.34	42.12	9.30	5.02	3.49	0.52
f855_mat9	2511	2456	171214	6.03	6.81	>95.00	>45.52	>600.00	9.55	>66.90	1.89
GL7d16	955127	460260	14488881	13.99	13.44	478.30	-	6.75	58.59	235.09	-
GL7d17	1548649	955127	25978098	23.38	24.26	>600.00	-	14.72	318.66	-	-
GL7d18	1955309	1548645	35590540	57.09	39.84	-	-	25.33	-	-	-
GL7d19	1955296	1911130	37322725	100.66	28.33	-	-	34.12	486.49	-	-
GL7d20	1911124	1437546	29893084	56.31	16.13	-	-	20.63	242.04	-	-
GL7d21	1437546	822922	18174775	33.19	7.33	>600.00	-	9.27	84.13	-	-
GL7d22	822906	349443	8251000	20.68	2.35	190.26	-	3.33	25.17	202.06	-
GL7d23	349443	105054	2695430	6.90	0.53	27.75	-	0.92	5.91	95.99	-
graphics	29493	11822	117954	>600.00	>47.86	>82.32	>68.95	>600.00	1.68	0.35	0.06
HFE18_96_in	2372	2371	933343	48.69	24.58	55.29	36.58	61.33	35.13	47.90	3.41
IG5-15	11369	6146	323509	3.08	0.43	1.16	10.03	1.39	1.06	2.90	2.19
IG5-16	18846	9519	588326	9.53	1.22	2.29	27.69	2.75	2.58	4.48	5.60
IG5-17	30162	14060	1035008	18.04	2.39	4.12	71.35	4.09	4.24	11.96	18.24
IG5-18	47894	20818	1790490	40.50	4.55	7.75	182.09	10.44	9.48	21.55	58.91
IMDB	896302	303617	3782463	>600.00	>600.00	>600.00	-	>600.00	>600.00	>600.00	-
kneser_10_4_1	349651	330751	992252	186.42	142.54	>600.00	>0.10	>600.00	203.24	120.88	-
landmark	71952	2673	1146848	43.35	1.96	0.36	2.73	1.94	0.32	0.60	0.21
LargeRegFile	2111154	801374	4944201	29.43	2.44	24.47	-	3.03	3.51	86.25	1.63
Maragal_6	21251	10144	537694	5.87	2.32	24.61	>199.43	4.19	15.27	5.44	24.41
Maragal_7	46845	26525	1200537	8.76	3.47	18.94	169.55	2.87	48.97	11.43	146.29
Maragal_8	60845	33093	1308415	>600.00	>422.80	>600.00	>600.00	>600.00	>600.00	504.85	88.78
mri1	114637	65536	589824	16.60	18.17	63.25	101.51	83.92	23.14	2.62	1.63
mri2	104597	63240	569160	24.04	30.06	51.52	>67.78	41.31	29.66	118.90	-
NotreDame_actors	383640	127823	1470404	>600.00	>600.00	>600.00	-	>600.00	>600.00	>600.00	-
psse0	26722	11028	102432	31.74	20.05	1.09	16.34	428.84	0.08	0.10	0.04
psse1	14318	11028	57376	18.95	18.91	3.77	>65.68	479.57	0.51	0.14	0.04
psse2	28634	11028	115262	34.75	29.48	7.10	>81.34	554.11	0.76	0.28	0.04
rel9	5921786	274667	23667183	34.16	26.57	47.50	-	24.30	56.86	-	-
relat9	9746232	274667	38955420	48.46	44.81	55.63	-	39.89	73.79	-	-
Rucci1	1977885	109900	7791168	596.42	321.85	>600.00	243.72	>600.00	>600.00	109.48	22.45
sls	1748122	62729	6804304	33.75	9.84	27.46	-	9.42	9.92	17.18	12.72
TF14	3159	2644	29862	3.42	3.03	35.01	3.12	6.81	5.55	0.61	0.19
TF15	7741	6334	80057	26.85	24.25	>198.99	24.76	>600.00	47.82	2.06	1.46
TF16	19320	15437	216173	209.74	>75.68	>545.35	>149.74	>600.00	392.60	4.33	16.34
TF17	48629	38132	586218	>600.00	>212.92	>600.00	>493.09	>600.00	>600.00	14.09	-
TF18	123867	95368	1597545	>600.00	>600.00	>600.00	-	>600.00	>600.00	57.35	-
TF19	317955	241029	4370721	>600.00	>600.00	>600.00	-	>600.00	>600.00	144.15	-
tomographic1	59360	45908	647495	145.39	48.55	>600.00	3.05	>600.00	17.23	17.52	34.19
Trec14	15904	3159	2872265	14.54	9.78	54.43	>57.39	53.76	39.68	170.66	20.37
wheel_601	902103	723605	2170814	>600.00	>600.00	>600.00	>600.00	>600.00	>600.00	>600.00	-

Table 3.34: Residuals obtained for subset CUTEst problems by each method

name	no	diagonal	MIQR	RIF	BA-G	MI35	MI30-MIN	MA97	MA97-aug	SPQR
BAS1LP	5.54E+1	5.54E+1	5.54E+1	8.02E+1	5.54E+1	5.54E+1	5.54E+1	5.54E+1	5.54E+1	5.54E+1
BAXTER	-	-	8.61E+1	-	-	-	6.61E+1	5.92E+1	5.92E+1	7.39E+1
BCDOUT	-	-	-	-	-	-	3.54E+1	3.53E+1	3.53E+1	3.53E+1
C09	8.91E+1	8.91E+1	8.91E+1	8.91E+1	8.91E+1	8.91E+1	8.92E+1	8.91E+1	8.91E+1	8.91E+1
CONT11_L	8.09E+2	8.09E+2	-	8.09E+2	8.09E+2	8.09E+2	8.09E+2	8.09E+2	8.09E+2	8.09E+2
DBIR1	3.49E+1	3.49E+1	3.49E+1	3.49E+1	3.49E+1	3.49E+1	3.49E+1	3.49E+1	3.49E+1	3.49E+1
DBIR2	1.67E+2	1.66E+2	1.66E+2	-	1.66E+2	1.67E+2	1.67E+2	1.66E+2	1.66E+2	1.66E+2
D2Q06C	1.67E+2	1.66E+2	1.66E+2	-	1.66E+2	1.67E+2	1.67E+2	1.66E+2	1.66E+2	1.66E+2
DELF000	-	5.38E+1	5.38E+1	5.38E+1	5.38E+1	5.38E+1	5.38E+1	5.38E+1	5.38E+1	5.38E+1
GE	7.25E+1	7.24E+1	7.24E+1	7.24E+1	7.24E+1	7.24E+1	7.24E+1	7.24E+1	7.24E+1	7.24E+1
LARGE001	6.06E+1	6.06E+1	6.06E+1	-	6.06E+1	6.06E+1	6.07E+1	6.06E+1	6.06E+1	6.06E+1
LPL1	7.08E+1	7.08E+1	7.08E+1	-	7.08E+1	7.08E+1	7.09E+1	7.08E+1	7.08E+1	7.08E+1
MOD2	1.38E+2	1.38E+2	1.38E+2	1.38E+2	1.38E+2	1.38E+2	1.39E+2	1.38E+2	1.38E+2	1.38E+2
MODEL10	5.35E+1	5.35E+1	5.35E+1	-	5.35E+1	5.35E+1	5.36E+1	5.35E+1	5.35E+1	5.35E+1
MPSBCD03	-	-	-	-	-	-	3.54E+1	3.52E+1	3.52E+1	3.52E+1
NSCT2	1.83E+2	1.83E+2	1.83E+2	-	1.83E+2	1.83E+2	1.84E+2	1.83E+2	1.83E+2	1.83E+2
NSIR2	8.05E+1	8.04E+1	8.04E+1	9.93E+1	8.04E+1	8.05E+1	8.05E+1	8.04E+1	8.04E+1	8.04E+1
PDE1	3.03E+2	3.03E+2	-	-	-	-	-	-	3.03E+2	-
PDS-100	2.84E+2	2.84E+2	2.84E+2	2.84E+2	2.84E+2	2.84E+2	2.85E+2	2.84E+2	2.84E+2	2.84E+2
PDS-90	2.68E+2	2.68E+2	2.68E+2	2.68E+2	2.68E+2	2.68E+2	2.68E+2	2.68E+2	2.68E+2	2.68E+2
PILOT-JA	-	3.19E+1	3.19E+1	3.19E+1	3.19E+1	3.19E+1	3.20E+1	3.19E+1	3.19E+1	3.19E+1
PILOTNOV	3.50E+1	3.28E+1	3.28E+1	3.28E+1	3.28E+1	3.28E+1	3.29E+1	3.28E+1	3.28E+1	3.28E+1
RAIL2586	1.41E+2	1.41E+2	1.41E+2	1.41E+2	1.41E+2	1.41E+2	1.41E+2	1.41E+2	1.41E+2	1.41E+2
RAIL4284	1.69E+2	1.69E+2	1.69E+2	1.69E+2	1.69E+2	1.69E+2	1.69E+2	1.69E+2	1.69E+2	-
SPAL_004	-	-	-	-	3.27E-11	-	1.47E+0	3.51E-14	-	-
STAT96V2	9.72E+2	9.72E+2	9.72E+2	9.72E+2	9.72E+2	9.72E+2	9.73E+2	9.72E+2	9.72E+2	9.72E+2
STAT96V3	1.04E+3	1.04E+3	1.04E+3	1.04E+3	1.04E+3	1.04E+3	1.05E+3	1.04E+3	1.04E+3	1.04E+3
STAT96V4	1.20E+2	1.20E+2	1.20E+2	1.20E+2	1.20E+2	1.20E+2	1.21E+2	1.20E+2	1.20E+2	1.20E+2
STORMG21K	8.96E+2	8.96E+2	-	-	-	8.96E+2	8.96E+2	-	8.96E+2	-
WATSON_1	2.54E+2	2.54E+2	2.54E+2	2.54E+2	2.54E+2	2.54E+2	2.55E+2	2.54E+2	2.54E+2	2.54E+2
WATSON_2	3.35E+2	3.35E+2	3.35E+2	3.35E+2	3.35E+2	3.35E+2	3.36E+2	3.35E+2	3.35E+2	3.35E+2
WORLD	1.40E+2	1.40E+2	1.40E+2	1.40E+2	1.40E+2	1.40E+2	1.41E+2	1.40E+2	1.40E+2	1.40E+2

Table 3.34: Residuals obtained for subset UF problems by each method

name	no	diagonal	MIQR	RIF	BA-G	MI35	MI30-MIN	MA97	MA97-aug	SPQR
12month1	-	9.27E+2	9.27E+2	-	9.27E+2	9.27E+2	9.27E+2	-	-	-
162bit	1.17E+1	1.17E+1	1.17E+1	1.17E+1	1.17E+1	1.17E+1	1.18E+1	1.17E+1	1.17E+1	1.17E+1
176bit	1.84E+1	1.84E+1	1.84E+1	1.84E+1	1.84E+1	1.84E+1	1.84E+1	1.84E+1	1.84E+1	1.84E+1
192bit	2.48E+1	2.48E+1	2.48E+1	2.48E+1	2.48E+1	2.48E+1	2.49E+1	2.48E+1	2.48E+1	2.48E+1
208bit	-	3.85E+1	3.84E+1	3.85E+1	3.84E+1	3.84E+1	3.85E+1	3.84E+1	3.84E+1	3.84E+1
beaflw	5.05E+0	4.57E+0	4.60E+0	-	4.35E+0	4.69E+0	4.56E+0	4.16E+0	4.16E+0	4.16E+0
c8_mat11	2.21E+1	2.19E+1	-	-	-	2.19E+1	2.18E+1	2.12E+1	2.12E+1	2.12E+1
connectus	6.27E+2	6.27E+2	6.27E+2	6.27E+2	6.27E+2	6.27E+2	6.28E+2	6.27E+2	6.27E+2	6.27E+2
ESOC	4.04E+2	2.23E+1	-	-	-	-	4.36E-3	5.23E-10	-	5.97E-9
EternityII_Etilde	4.45E-6	4.51E-6	4.47E-6	4.43E-6	5.33E-6	4.42E-6	1.21E-4	3.56E-14	6.41E-14	6.31E-13
f855_mat9	1.79E+1	1.79E+1	-	-	-	1.79E+1	1.65E+1	2.14E+2	1.69E+1	4.37E+3
GL7d16	7.48E+2	7.48E+2	7.48E+2	-	7.48E+2	7.48E+2	7.49E+2	-	-	-
GL7d17	8.98E+2	8.98E+2	8.98E+2	-	8.98E+2	8.98E+2	-	-	-	-
GL7d18	9.31E+2	9.31E+2	-	-	9.31E+2	-	-	-	-	-
GL7d19	1.04E+3	1.04E+3	-	-	1.04E+3	1.04E+3	-	-	-	-
GL7d20	1.09E+3	1.09E+3	-	-	1.09E+3	1.09E+3	-	-	-	-
GL7d21	1.00E+3	1.00E+3	1.00E+3	-	1.00E+3	1.00E+3	-	-	-	-
GL7d22	7.89E+2	7.89E+2	7.89E+2	-	7.89E+2	7.89E+2	7.89E+2	-	-	-
GL7d23	5.35E+2	5.35E+2	5.35E+2	-	5.35E+2	5.35E+2	5.36E+2	-	-	-
graphics	-	-	-	-	-	3.03E-4	3.03E-4	3.03E-4	3.03E-4	3.03E-4
HFE18_96_in	4.91E-1	4.90E-1	4.90E-1	4.90E-1	4.90E-1	4.90E-1	4.91E-1	4.90E-1	4.90E-1	4.90E-1
IG5-15	5.48E+1	5.48E+1	5.48E+1	5.48E+1	5.48E+1	5.48E+1	5.49E+1	5.48E+1	5.48E+1	5.48E+1
IG5-16	7.15E+1	7.15E+1	7.15E+1	7.15E+1	7.15E+1	7.15E+1	7.15E+1	7.15E+1	7.15E+1	7.15E+1
IG5-17	9.10E+1	9.10E+1	9.10E+1	9.10E+1	9.10E+1	9.10E+1	9.10E+1	9.10E+1	9.10E+1	9.10E+1
IG5-18	1.15E+2	1.15E+2	1.15E+2	1.15E+2	1.15E+2	1.15E+2	1.15E+2	1.15E+2	1.15E+2	1.15E+2
IMDB	-	-	-	-	-	-	8.04E+2	-	-	-
kneser_10_4_1	1.62E+2	1.62E+2	-	-	-	1.62E+2	1.62E+2	-	-	1.63E+2
landmark	1.31E-5	1.12E-5	1.12E-5	1.12E-5	1.15E-5	1.12E-5	8.36E-5	1.12E-5	1.12E-5	1.12E-5
LargeRegFile	4.44E+2	4.44E+2	4.44E+2	-	4.44E+2	4.44E+2	4.44E+2	4.44E+2	4.44E+2	4.44E+2
Maragal_6	1.06E+1	1.06E+1	1.06E+1	-	1.06E+1	1.06E+1	1.07E+1	1.06E+1	1.06E+1	1.07E+1
Maragal_7	1.36E+1	1.36E+1	1.36E+1	1.36E+1	1.36E+1	1.36E+1	1.37E+1	1.36E+1	1.36E+1	1.37E+1
Maragal_8	-	-	-	-	-	-	2.39E+2	2.37E+2	2.37E+2	2.37E+2
mri1	2.67E+1	2.67E+1	2.67E+1	2.67E+1	2.67E+1	2.67E+1	2.67E+1	2.67E+1	2.67E+1	8.09E+13
mri2	1.41E+2	1.41E+2	1.41E+2	-	1.41E+2	1.41E+2	1.41E+2	-	-	9.24E+24
NotreDame_actors	-	-	-	-	-	-	5.19E+2	-	-	-
psse0	6.63E+1	6.63E+1	6.63E+1	6.63E+1	6.63E+1	6.63E+1	6.64E+1	6.63E+1	6.63E+1	6.63E+1
psse1	3.59E+1	3.59E+1	3.59E+1	-	3.59E+1	3.59E+1	3.59E+1	3.59E+1	3.59E+1	3.59E+1
psse2	7.85E+1	7.85E+1	7.85E+1	-	7.85E+1	7.85E+1	7.86E+1	7.85E+1	7.85E+1	7.85E+1
rel9	1.54E+3	1.54E+3	1.54E+3	-	1.54E+3	1.54E+3	-	-	-	-
relat9	3.05E+3	3.05E+3	3.05E+3	-	3.05E+3	3.05E+3	-	-	-	-
Rucci1	7.27E+2	7.27E+2	-	7.27E+2	-	-	7.28E+2	7.27E+2	7.27E+2	7.27E+2
sls	1.30E-5	1.23E-5	1.27E-5	-	2.09E-4	1.05E-5	1.74E-5	9.31E-14	1.41E-13	-
TF14	5.57E-7	5.58E-7	5.50E-7	5.55E-7	5.37E-9	5.61E-7	6.24E-3	6.63E-15	6.20E-15	5.82E-14
TF15	8.78E-7	8.78E-7	-	8.74E-7	-	8.77E-7	1.13E-2	1.07E-14	9.84E-15	1.31E-13
TF16	1.38E-6	-	-	-	-	1.38E-6	1.52E-2	1.75E-14	1.60E-14	3.09E-13
TF17	-	-	-	-	-	-	2.17E-2	-	-	-
TF18	-	-	-	-	-	-	3.21E-2	-	-	-
TF19	-	-	-	-	-	-	4.26E-2	-	-	-
tomographic1	4.20E+1	4.19E+1	-	6.84E+1	-	4.19E+1	4.19E+1	4.18E+1	4.18E+1	4.18E+1
Trec14	1.12E+2	1.12E+2	1.12E+2	-	1.12E+2	1.12E+2	1.12E+2	1.12E+2	1.12E+2	1.12E+2
wheel_601	-	-	-	-	-	-	4.23E+2	-	4.22E+2	-