

Learning and Exploiting Progress States in Greedy Best-First Search

Patrick Ferber Liat Cohen Jendrik Seipp Thomas Keller

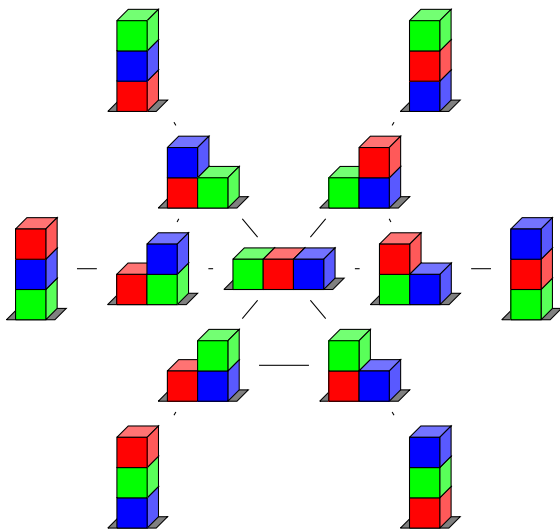


31th International Joint Conference on Artificial Intelligence

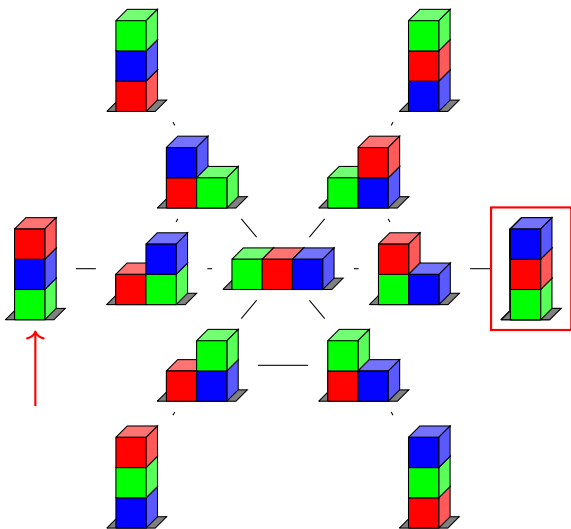
July, 2022



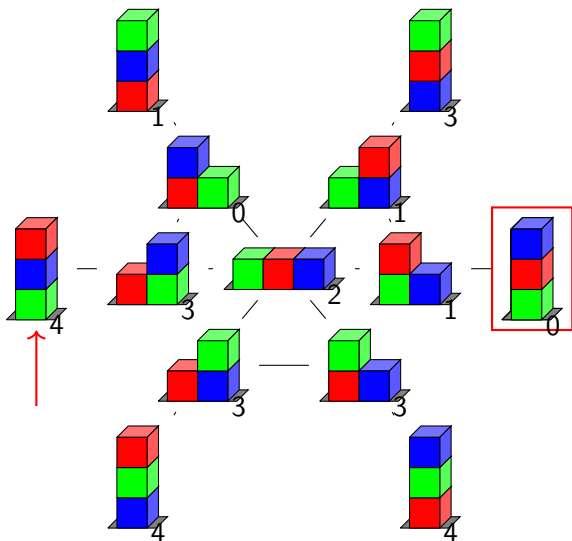
Greedy Best-First Search



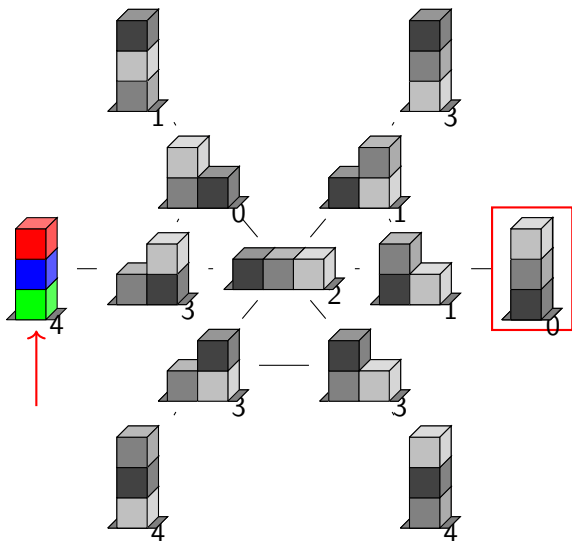
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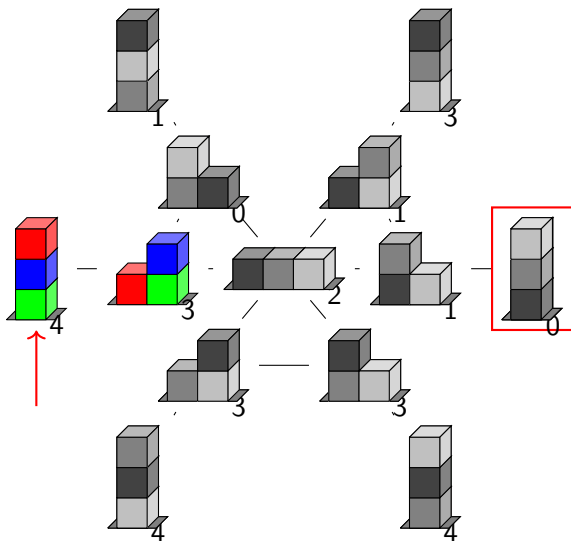
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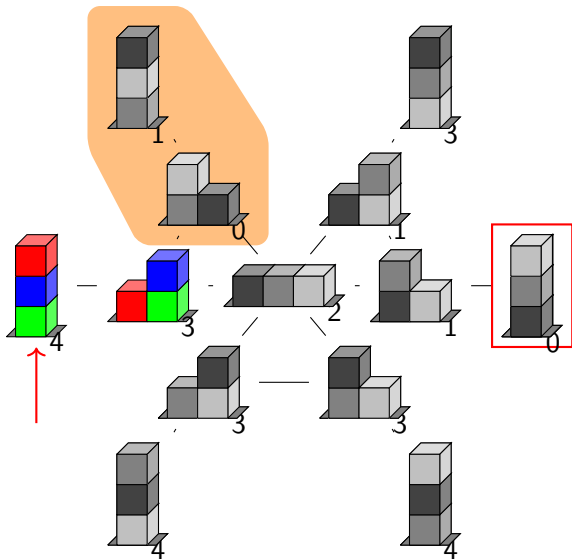
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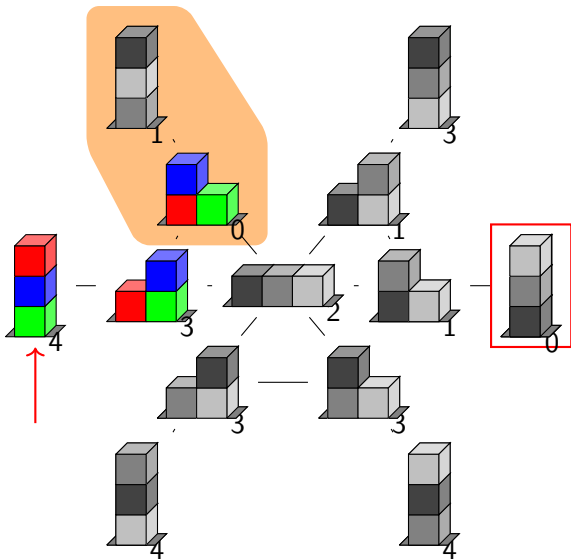
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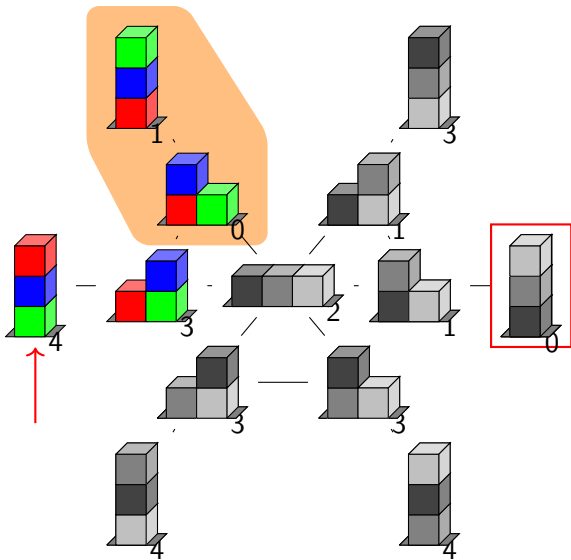
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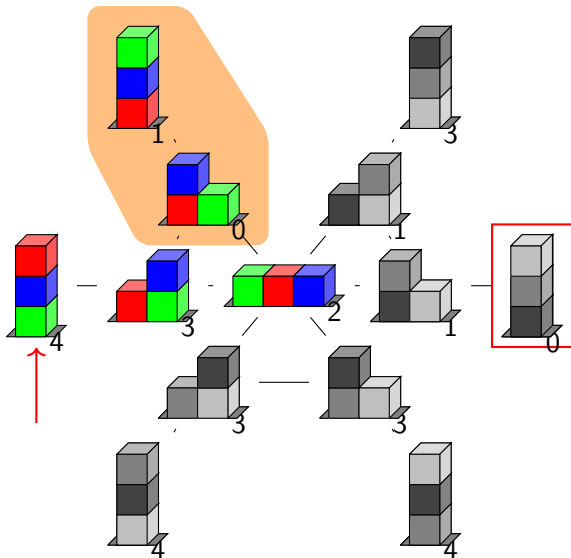
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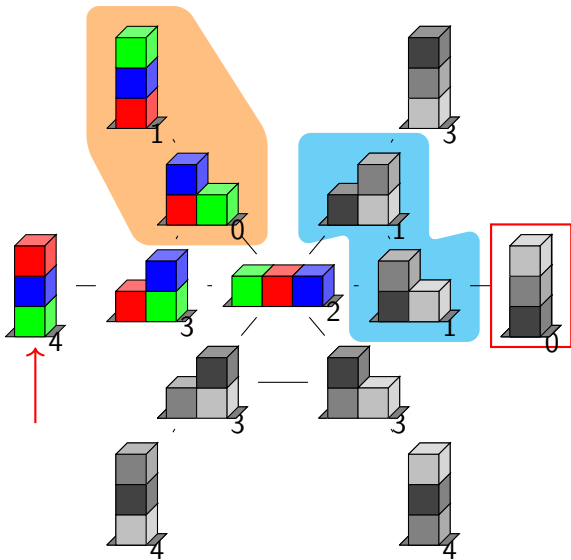
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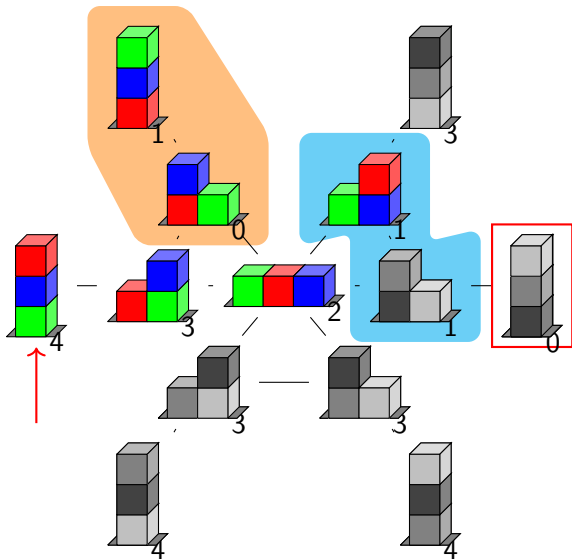
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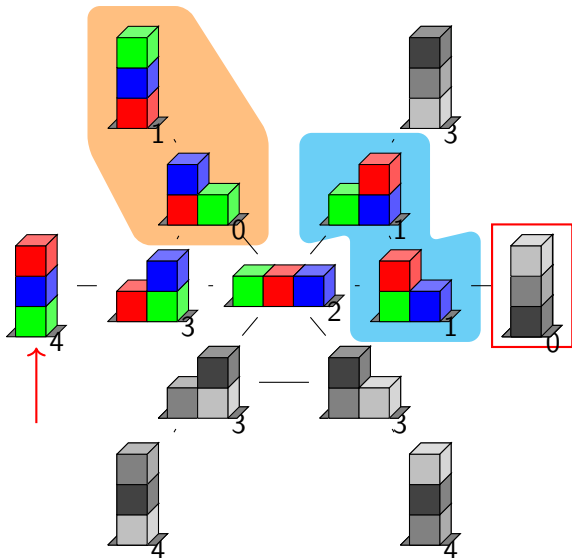
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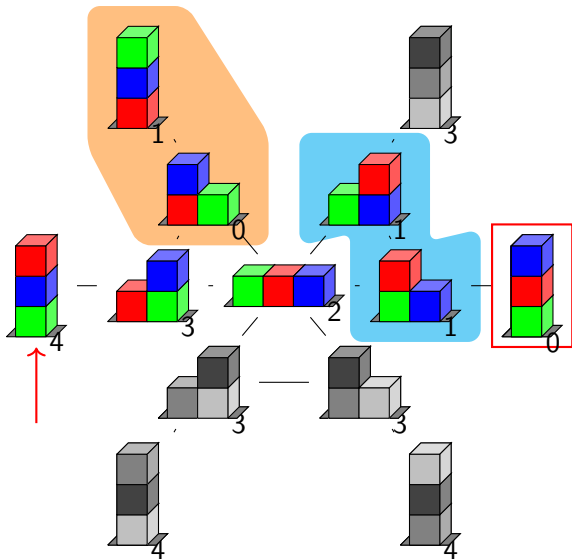
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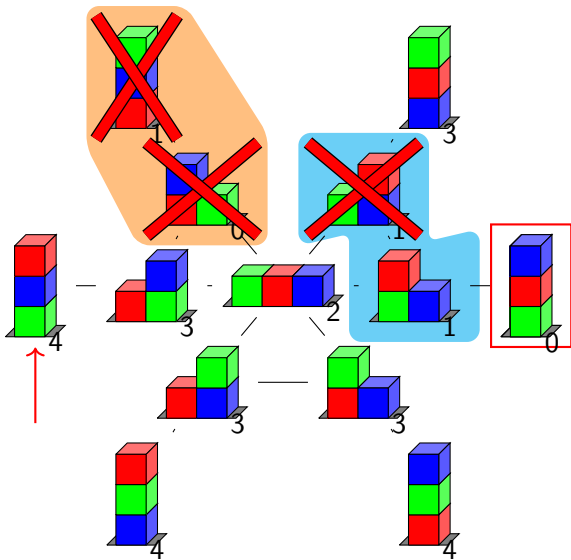
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Progress States

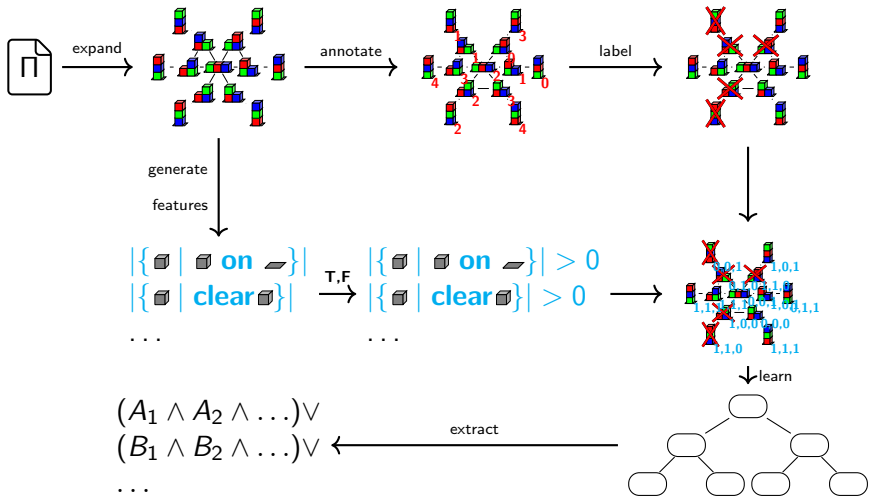


Contribution

Learn DNF formulas which identify progress states

Exploit progress state knowledge during search

Framework



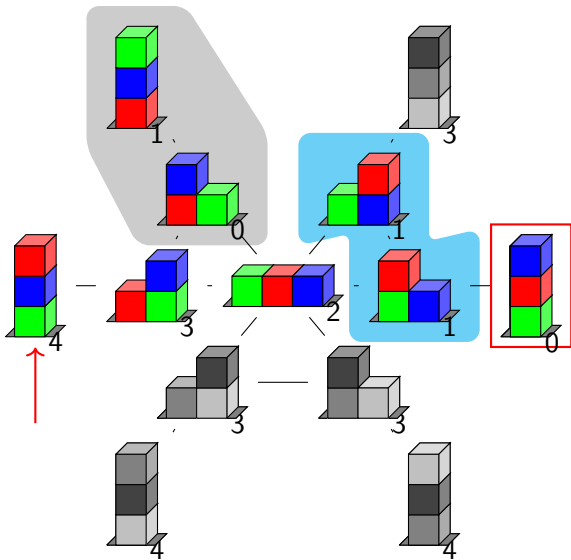
Formula for h^+ in Gripper

$$\begin{aligned} & (|at_s(\cdot, \text{roomA})| = 0) \vee \\ & ((|at_robby_s(\text{roomA})| > 0) \wedge (|free_s(\cdot)| > 0)) \vee \\ & ((|at_robby_s(\text{roomB})| > 0) \wedge (|carry_s(\cdot)| > 0)) \end{aligned}$$

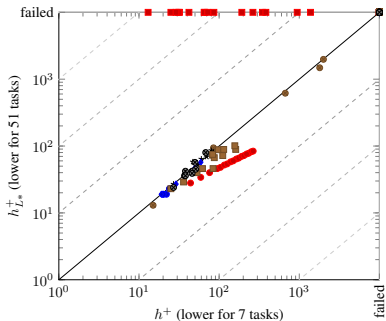
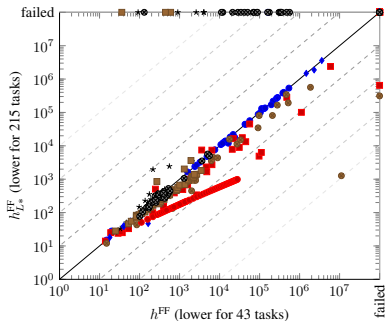
DNF Quality for h^{FF} (F1 score)

Domain	1	2	3	4	5
BARMAN	79	80	81	79	77
BLOCKSWORLD	83	-	-	-	-
CHILDSNACK	70	65	73	81	72
DRIVERLOG	81	81	89	85	85
FLOORTILE	75	85	85	85	88
GRIPPER	96	96	96	98	98
MICONIC	98	98	97	98	99
VISITALL	70	70	73	73	73

Use Case: Tie-Breaking



Expansions



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Identify Progress States

- DNF formula
- Description Logic features

Use Case for Progress States

- Reduce expansions
- often increases runtime



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Identify Progress States

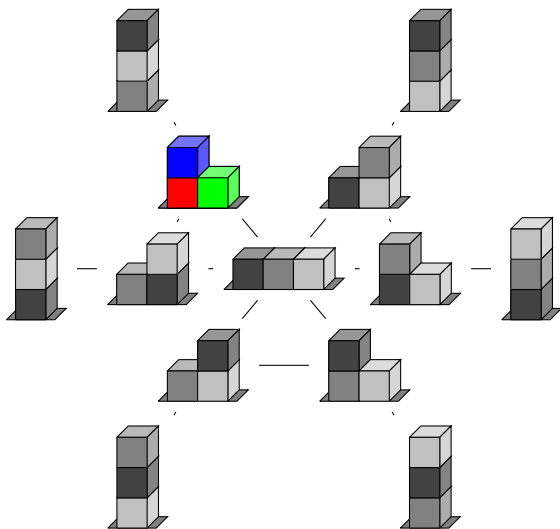
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Use Case for Progress States

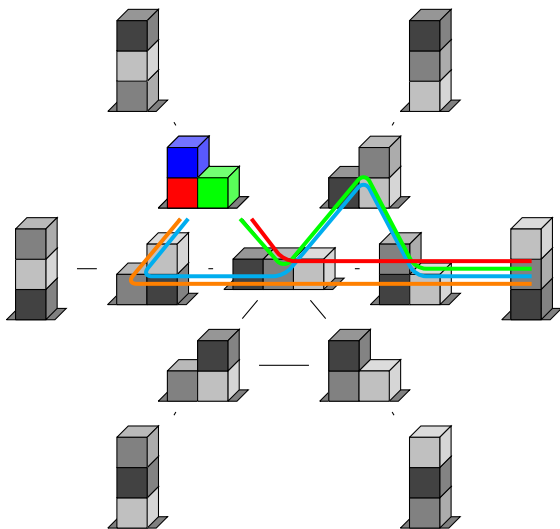
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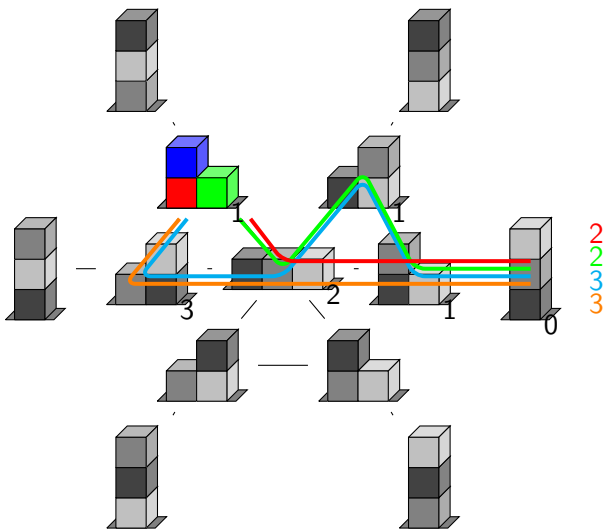
High-Water Mark



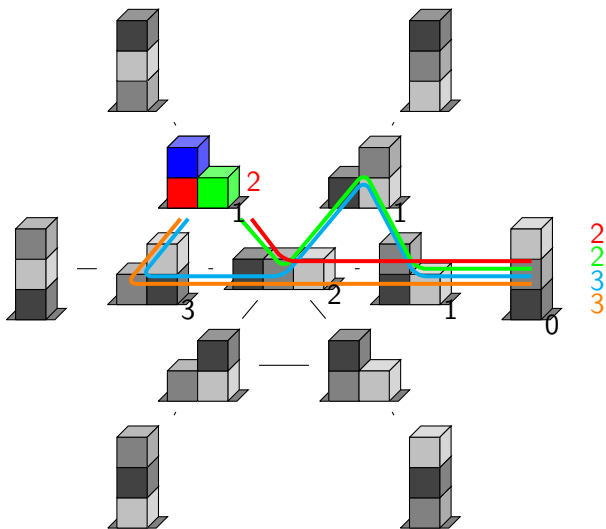
High-Water Mark



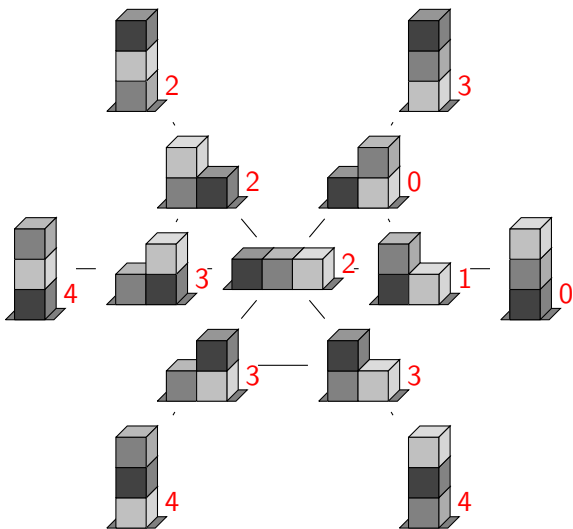
High-Water Mark



High-Water Mark



High-Water Mark



Runtime

Domain	h^{FF}	+DNF	h^+	+DNF
BARMAN	3.4	+ 462 %	161	-4 %
BLOCKSWORLD	0.3	+ 67 %	-	-
CHILDSNACK	3.5	+ 94 %	88	-1 %
DRIVERLOG	0.1	+3100 %	244	+3 %
FLOORTILE	0.4	+ 125 %	11	-0 %
GRIPPER	1.1	- 45 %	301	-12 %
MICONIC	0.2	+ 650 %	103	-8 %
VISITALL	0.0	+10700 %	305	-1 %