Dantzig-Wolfe Decomposition for Cost Partitioning

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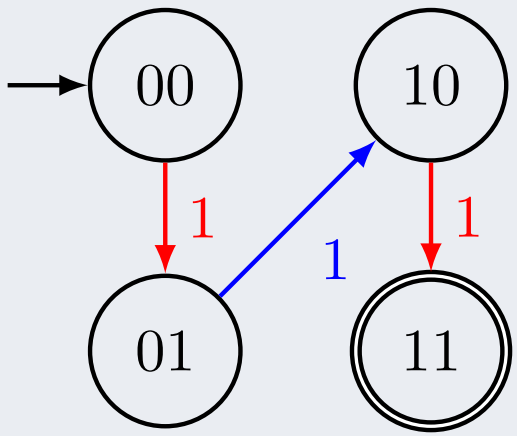
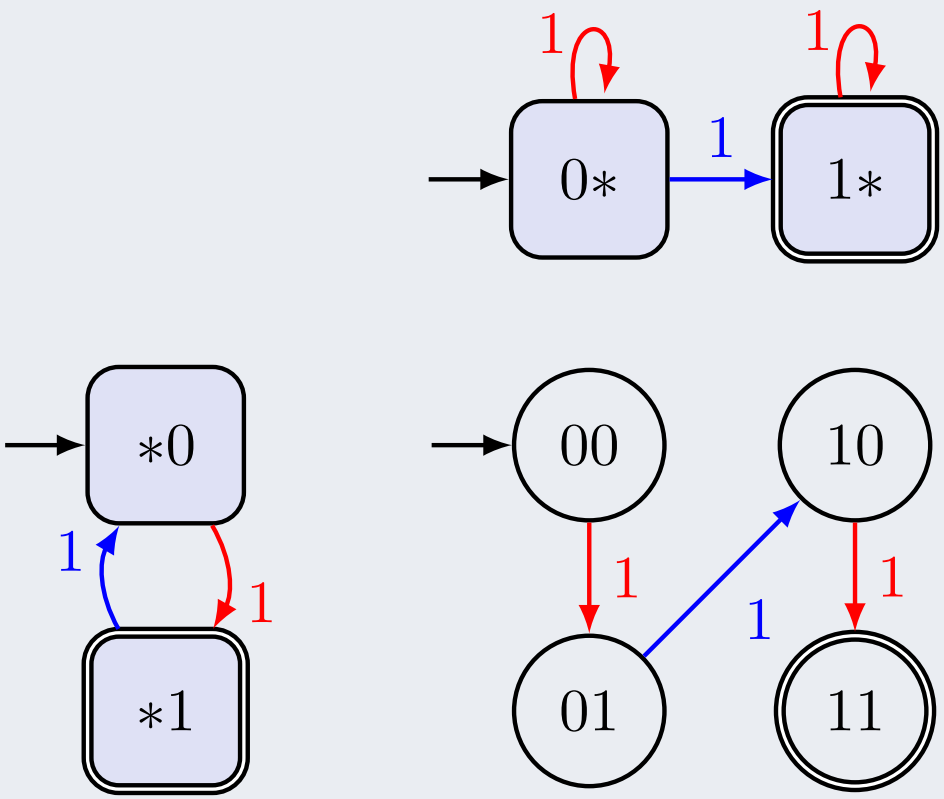
Classical Planning

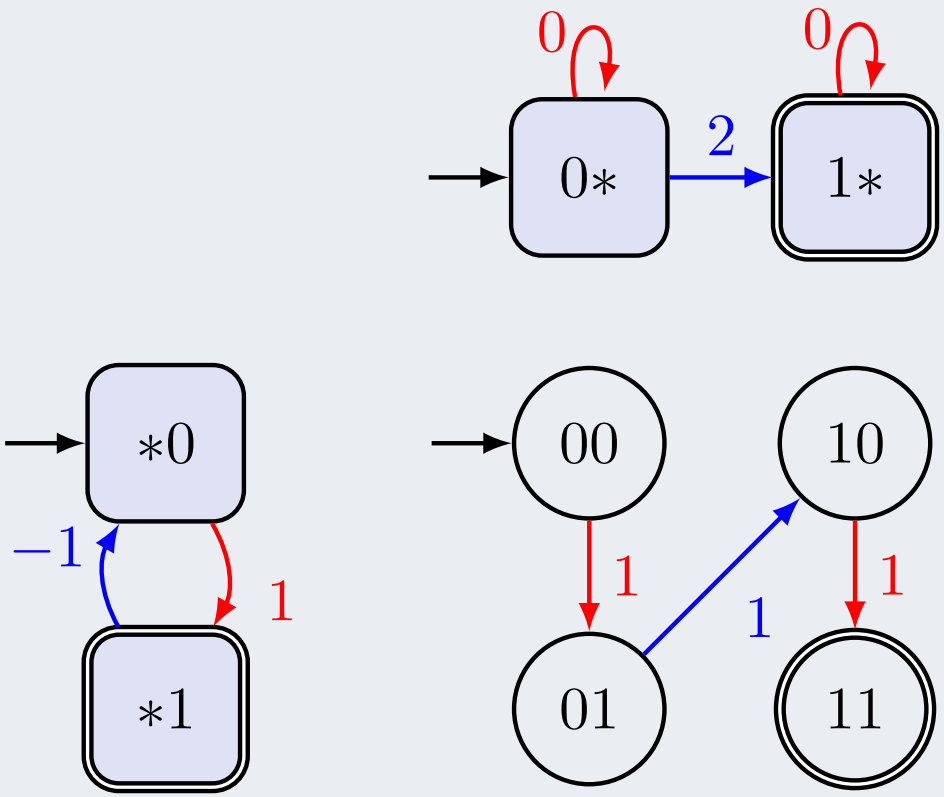


Abstraction Heuristics



Heuristic value: $\max\{1, 1\} = 1$

Cost Partitioning



Heuristic value: $2 + 1 = 3$

Optimal Cost Partitioning

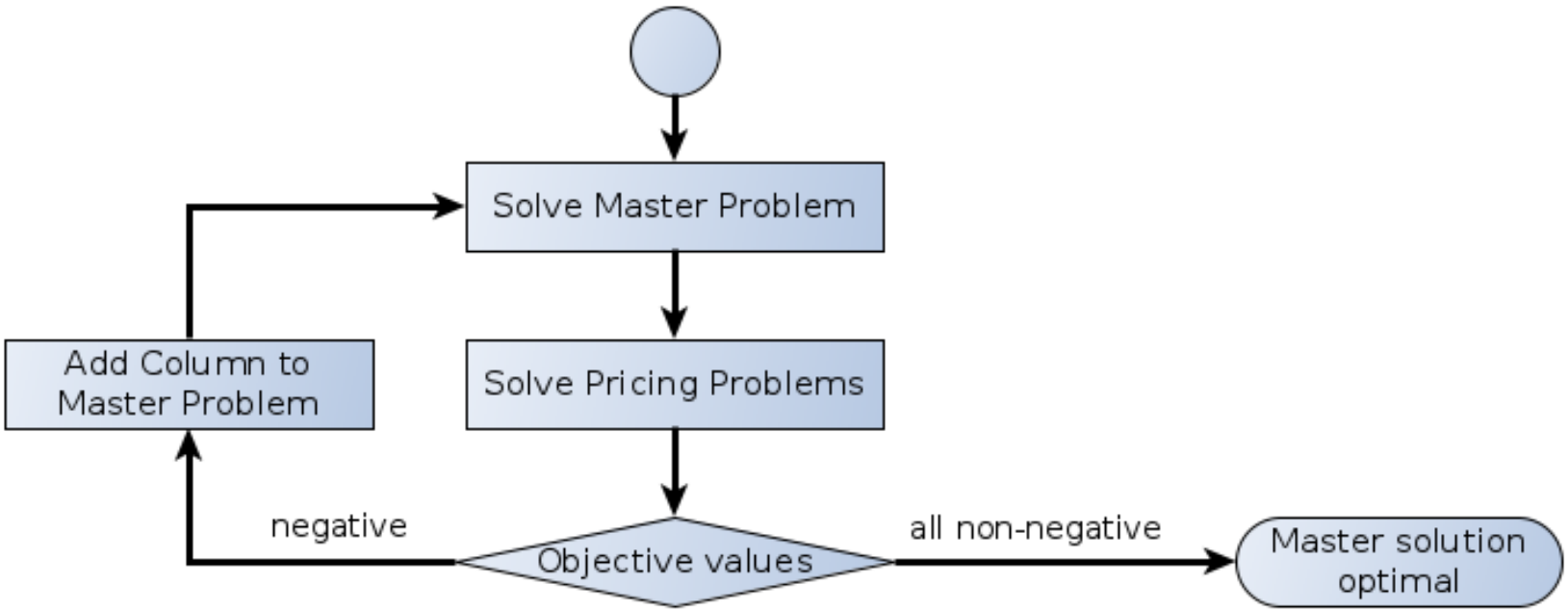
Cost Partitioning LP

$$\text{Maximize } \sum_i h_i \text{ subject to}$$

$$\sum_i c_i(o) \leq cost(o) \qquad \text{for all operators } o$$

$$h_i = \text{heuristic } i \text{ under cost } c_i \qquad \text{for all heuristics } i$$

Solving an LP with Dantzig-Wolfe Decomposition



Main Contribution

We applied Dantzig-Wolfe decomposition
to the cost partitioning LP.

Insights from the Master Problem

The master problem finds the best possible mix
from candidate cost functions added by the pricing problems.

Master Problem

$$\text{Maximize} \sum_i \sum_j \lambda_{ij} h_{ij} \text{ subject to}$$

$$\sum_i \sum_j \lambda_{ij} c_{ij}(o) \leq \mathit{cost}(o) \qquad \text{for all operators } o$$

$$\lambda_{ij} \geq 0$$

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$$\lambda_{ij} \geq 0$$

Insights from the Pricing Problems

Pricing problem for an abstraction

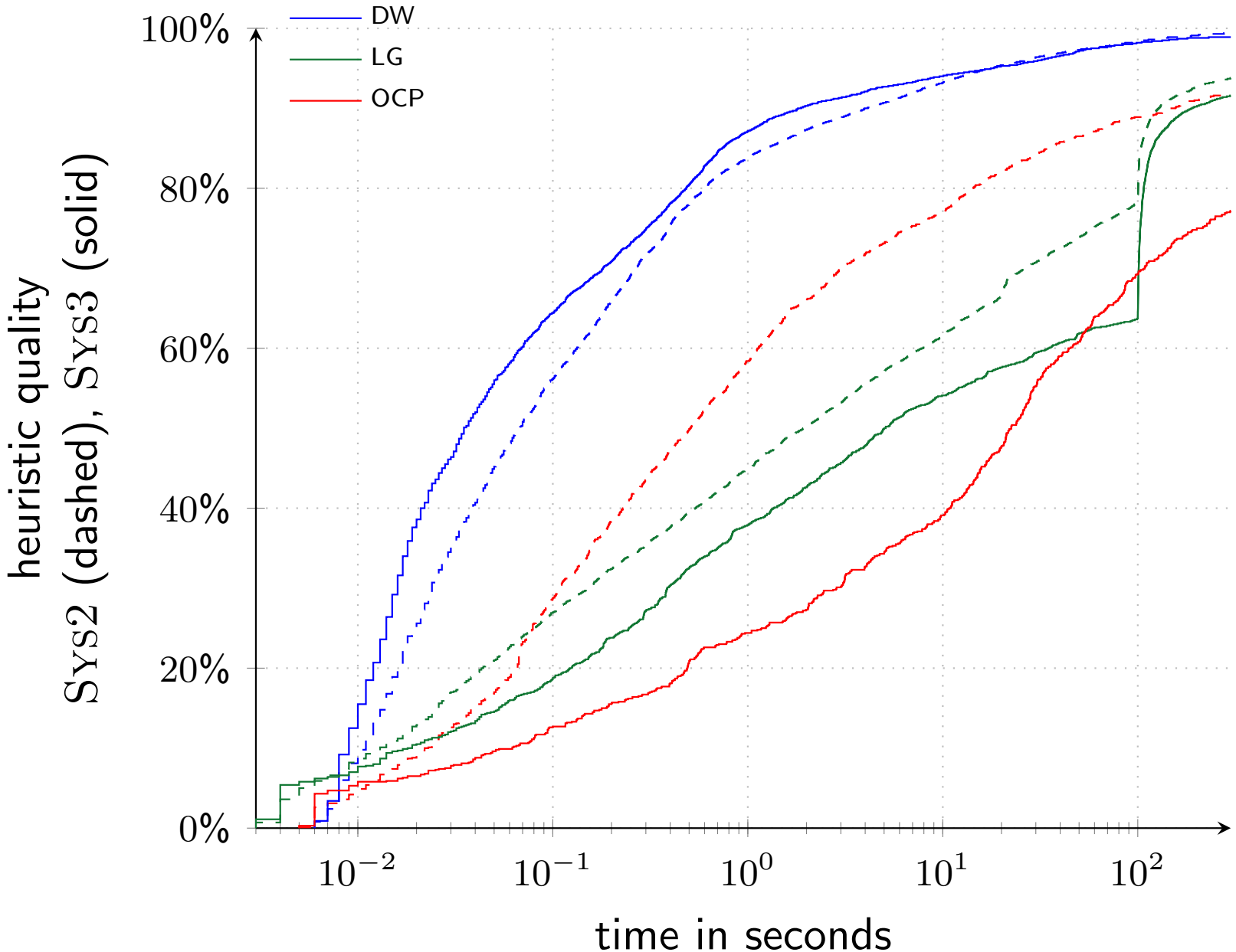
- parametrized with the dual solution y of master problem
- generates column iff y is not a valid flow

Pricing Problem

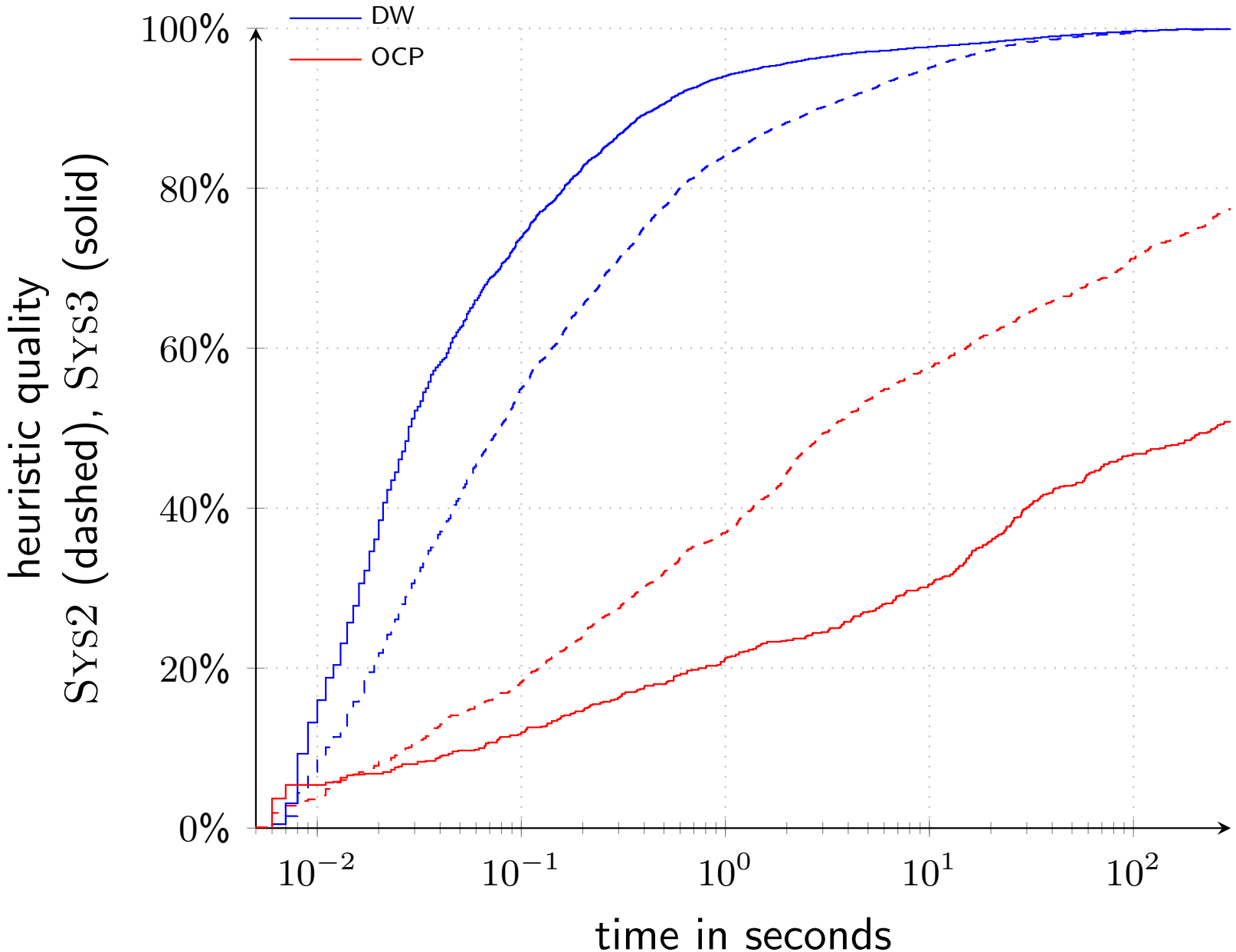
Minimize $c(y) - h$ subject to

$h \leq$ heuristic i under cost c

Heuristic Quality (non-negative costs)



Heuristic Quality (general costs)



Future Work

Potential use as a planner

- Stop when solution is a flow in all considered abstractions.
- Otherwise add an abstraction where this is not a flow.