

Lifted delete-relaxation heuristics are competitive with their ground versions and superior to other lifted heuristics.

Heuristics	IPC	HTG	Total
Lifted Goalcount	597	382	979
Lifted Additive + Lazy P.O.	754	362	1116
Ground additive + Lazy P.O.	839	298	1137

Relaxed Reachability and Datalog

```
(:action example
:parameters (?X ?Y)
:precondition
  (and (P ?X ?Y)
        (R ?X))
:effect
  (and (not (P ?X ?Y))
        (Q ?X)
        (R ?Y)))
```

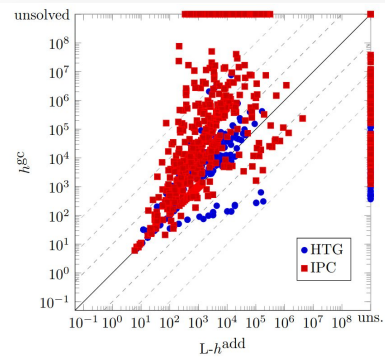
$$Q(X) \leftarrow P(X, Y), R(X).$$

$$R(Y) \leftarrow P(X, Y), R(X).$$

Features

- Additive or max heuristic
- Early stopping
- No action predicates
- Lazy Search + Preferred operators

Number of expansions, compared to to previous state-of-the-art lifted planner



Algorithm

Computing the additive heuristic

```
1: V := DEFAULTHASHTABLE(Atom, ℝ∞, ∞)
2: queue := PRIORITYQUEUE(Atom, ℝ+)
3: M := ∅
4: for fact ∈ F do
5:   V[fact] := 0
6:   queue.PUSH(fact, 0)
7: while not queue.EMPTY() do
8:   p := queue.POPMIN()
9:   if p ∉ M then
10:    M := M ∪ {p}
11:    for (head ←w body) ∈ NEWRULES(p, M, R) do
12:      cost := w + ∑q ∈ body V[q]
13:      if cost < V[head] then
14:        V[head] := cost
15:        queue.PUSH(head, cost)
16: return V
```

Delete-Relaxation Heuristics for Lifted Classical Planning.

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