

Plan-Space Search/POP

PAH (Planning and Games)

Michal Štolba

michal.stolba@agents.fel.cvut.cz

Plan-Space Search

- Also known as Partial-Order Planning – POP
- GraphPlan is an (old) instance of such
- State is a partial plan
 - Actions
 - Ordering (partial)
 - Causal links
- Search by refinements of the partial plan
 - Adding an action
 - Adding an ordering constraint
 - Adding a causal link to already added action
 - ...

Causal link

- $a_1 \overset{q}{\rightarrow} a_2$
 - q is an add effect of a_1
 - q is a precondition of a_2
- When action added, add the causal link

Threat

- Action a_t such that
 - $a_1 > a_t > a_2$ is consistent with the ordering
 - there is a causal link $a_1 \overset{q}{\rightarrow} a_2$
 - a_t deletes q
- Solution
 - Enforce ordering either
 - $a_t > a_1$ or
 - $a_2 > a_t$

Advantages

- Easily extensible to richer action models
 - Durative/Temporal actions
 - Concurrent actions
 - Multiagent planning
- Easily extensible to partially grounded actions
 - move-truck-?-B
 - can decide later
- Lower branching factor

Disadvantages

- Significantly more complex algorithm
 - Higher per-node cost
- Problematic adaptation of heuristic
 - Most heuristics are state-based, but what is the state of POP plan?

Forward-chaining POP

- Solution to the problem with heuristics
- Add only actions for which all preconditions can be satisfied
 - (with a causal link from already present actions)
- Resulting state of the plan can be determined and used for heuristic computation
- POPF planner