

Planning

Given:

- A description of the effects and preconditions of the actions
- A description of the initial state
- A goal to achieve

find a sequence of actions that is possible and will result in a state satisfying the goal.

Forward Planning

Idea: search in the state-space graph.

- The nodes represent the states
- The arcs correspond to the actions: The arcs from a state s represent all of the actions that are legal in state s .
- A plan is a path from the state representing the initial state to a state that satisfies the goal.

Example state-space graph

Actions

mc: move clockwise

mac: move anticlockwise

nm: no move

puc: pick up coffee

dc: deliver coffee

pum: pick up mail

dm: deliver mail

mc

off, rhc, swc, mw, rhm

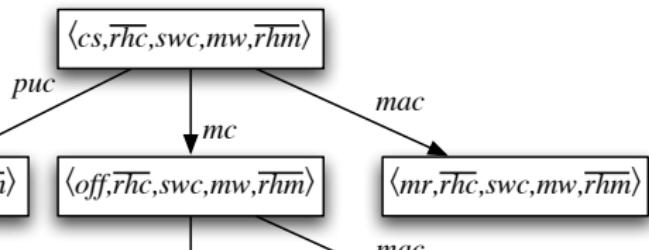
lab, rhc, swc, mw, rhm

mr, rhc, swc, mw, rhm

off, rhc, swc, mw, rhm

lab, rhc, swc, mw, rhm

mr, rhc, swc, mw, rhm



Locations:

cs: coffee shop

off: office

lab: laboratory

mr: mail room

Feature values

rhc: robot has coffee

swc: Sam wants coffee

mw: mail waiting

rhm: robot has mail

What are the errors?

Actions

mc: move clockwise

mac: move anticlockwise

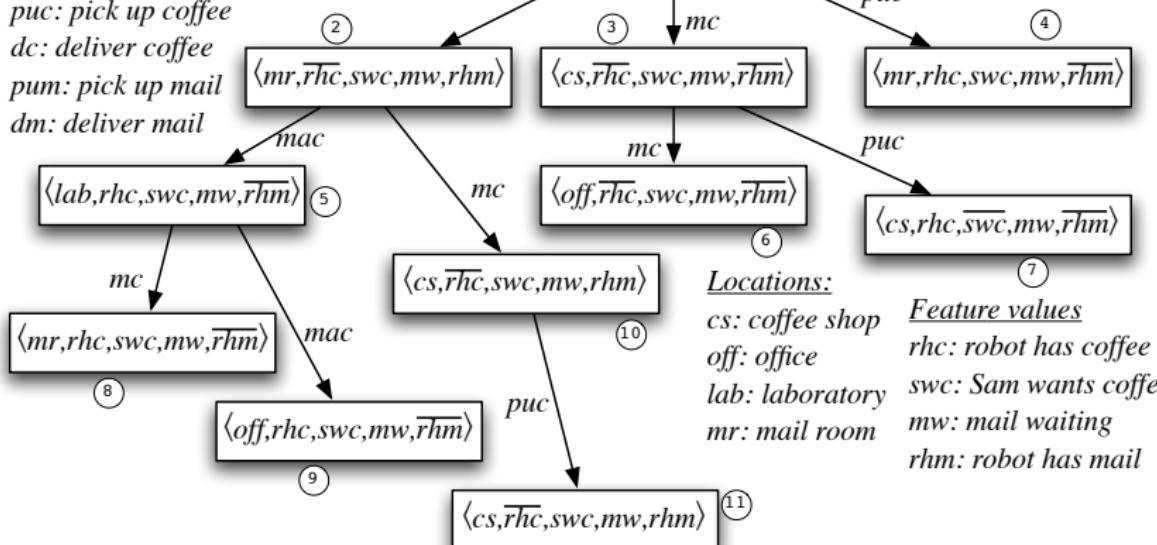
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Forward planning representation

- The search graph can be constructed on demand: you only construct reachable states.
- If you want a cycle check or multiple path-pruning, you need to be able to find repeated states.
- There are a number of ways to represent states:
 - ▶ As a specification of the value of every feature
 - ▶ As a path from the start state

Improving Search Efficiency

Forward search can use domain-specific knowledge specified as:

- a heuristic function that estimates the number of steps to the goal
- domain-specific pruning of neighbors:
 - ▶ don't go to the coffee shop unless "Sam wants coffee" is part of the goal and Rob doesn't have coffee
 - ▶ don't pick-up coffee unless Sam wants coffee
 - ▶ unless the goal involves time constraints, don't do the "no move" action.