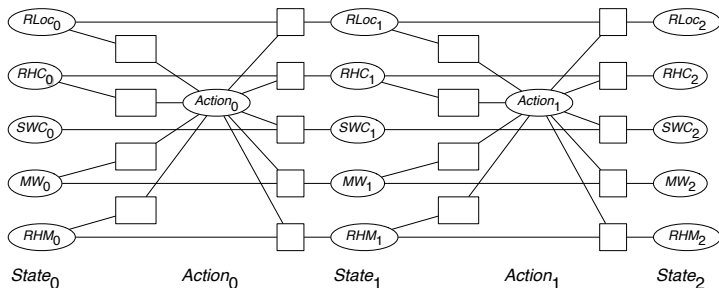


- In forward planning, the nodes considered are constrained to be reachable, even if they don't lead to goal.
- In regression planning, the nodes considered are constrained to be ones from which we can achieve the goal, even if they are not reachable.
- When representing planning as a CSP, we can constrain the states by the starting state and the goal.
... but we can only do this if we know the number of steps.
- Search over planning horizons (number of time steps).
- For each planning horizon, create a CSP constraining possible actions and features

Choose a planning horizon k .

- Create a variable for each state feature and each time from 0 to k .
- Create a variable for the action for each time in the range 0 to $k - 1$.

CSP for Delivery Robot for a planning horizon of 2



$RLoc_i$ — Rob's location
 RHC_i — Rob has coffee
 SWC_i — Sam wants coffee
 MW_i — Mail is waiting
 RHM_i — Rob has mail

$Move_i$ — Rob's move action
 PUC_i — Rob picks up coffee
 $DelC$ — Rob delivers coffee
 PUM_i — Rob picks up mail
 $DelM_i$ — Rob delivers mail

Constraints

- **precondition constraints** between state variables at time t and action variable at time t , specify constraints on what actions are available from a state.
- **effect constraints** between state variables at time t , action variable at time t and state variables at time $t + 1$ constrain the resulting state to be one that satisfies the effects.
- **frame constraints** among state variables at time t , action variables at time t , and state variables at time $t + 1$ for values of variables that do not change.
- **initial state constraints** that are usually domain constraints on the initial state (at time 0).
- **goal constraints** that constrains the final state to be a state that satisfies the goals that are to be achieved.

Example Constraints

precondition constraint $RLoc_i = cs \leftarrow Action_i = puc$

is violated when $RLoc_i \neq cs \wedge Action_i = puc$

effect constraint $rhc_{i+1} \leftarrow Act_i = puc$

is violated when $RHC_{i+1} = false \wedge Act_i = puc$.

frame constraint Rob has mail at any time if it had mail before and the action wasn't to pickup mail or deliver mail:

$$RHM_{i+1} = RHM_i \leftarrow Act_i \notin \{pum, dm\}$$

violated when

$$RHM_{i+1} \neq RHM_i \wedge Act_i \neq pum \wedge Act_i \neq dm$$

