- 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

- 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.

precondition constraint $RLoc_i = cs \leftarrow Action_i = puc$ is violated when $RLoc_i \neq cs \land Action_i = puc$ effect constraint $rhc_{i+1} \leftarrow Act_i = puc$ is violated when $RHC_{i+1} = false \land Act_i = puc$.

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