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Tutorial 2 : To understand state space problem formulation

Aim : To understand state space based problem formulation of all problems so that problem solving Agent can be applied

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Tutorial 2: To understand state space problem formulation.

Aim: To understand state space based problem formulation of AI problems so that problem solving Agent can be applied

Theory: First we understand problem solving agent. Algorithm shown in fig. 3 shows agent program for problem solving agent. Agent first formulates goal & problem, then determines or rather searches an action sequences, after which it returns next action to be executed in a sequential manner.

Function Simple-problem-solving-Agent returns an action.

```
static: seq, an action sequence, initially empty
        state, some description of current world state
        goal, a goal, initially null
        problem, a problem formulation
state ← Update-state (state, percept)
if seq is empty then do
    goal ← Formulate-goal (state)
    problem ← Formulate-problem (state, goal)
    seq ← Search (problem)
action ← First (seq)
seq ← Rest (seq)
return action
```

Fig 3. Problem solving Agent Architecture

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Defining the problem is referred to as problem formulation. It involves defining following five things :

Initial state - It is starting state that problem is in

Actions - It defines all possible actions available to agent, given it is in some state currently. It is function Actions(s) that return list of all possible actions

Transition Model - also known as successor function which defines which state/s the system tend to move to when particular action is executed by the agent. Successive application of transition model gives rise to what is known as state space

Goal Test - This act as a stopping condition when state passed to this function is goal state it will return true & searching would stop.

Path cost - It is accumulated cost of performing certain sequence of action. This can help in determining whether action sequence under consideration action is optimal.

Thus a problem can formally specified by identifying initial state, actions, transition model, goal test & path cost. In term of problem solving agent solution is path from initial state to goal state. Optimal solution is lowest path cost of all solutions. Process of finding a solution is called search.

Working : Based on understanding of problem formulation students need to formulate following problems. They will clearly show state space up to depth level 3 or till goal node which ever is shallowest

1. Navigate to KGCE- Workshop from HOD IT cabin with minimum number of moves, moves can be climbing or alightning staircase, turning left, right, walking through a corridor
2. 8 puzzle problem
3. The missionaries & cannibals problem. There are three missionaries & three cannibals who must cross a river using boat which can carry at most two people, under constraint that, for both banks, if there are missionaries present on bank, they cannot be outnumbered by cannibals if they were, cannibals would eat missionaries. The boat cannot cross river by itself with no people on board.
4. N Queen's problem, Arrange N queens on a N cross N chess board where no two queen attack each other.
5. Two room vacuum cleaner world.
6. Water Jug problem