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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 the problem solving agent. Algorithm shown in Figure 3 shows agent program for problem solving agent. Agent first formulates goal and problem, then determines or rather searches an action sequence, after which it returns the next action to be executed in a sequencial manner.

```
function SIMPLE-PROBLEM-SOLVING-AGENT(percept) returns an actio
  Static: seq, an action sequence, initially empty.
          state, some description of the 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
```

Figure 3: Problem Solving Agent Architecture.

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

Initial state : It is the starting state that the problem is in.

Actions : It defines all possible actions available to the agent, given it is in some state's currently. It is a function Action (s) that returns list of all possible actions.

Transition Model : also known as successor function which define which state/s the system tend to move to when a 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 the state passed to this function is goal state it will return true and searching would stop.

Path Cost : It is accumulated cost of performing certain sequence of actions. This can help in determining weather the action sequence under consideration is optimal.

Thus a problem can formally specified by identifying initial state, actions (operators), transition model (successor function), goal test and path cost. In term of problem solving agent solution is the path from initial state to a goal state, optimal solution is the lowest path cost of all solutions. Process of finding a solution is called search.

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Based on understanding of problem formulation students need to formulate folk problems. They will clearly show state space upto 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 alighting staircase, turning left, right, walking through a corridor.
2. 8 Puzzle problem
3. The missionaries and cannibals problem. There are three missionaries and three cannibals who must cross a river using a boat which can carry at most two people, under the constraint that, for both banks, if there are missionaries present on the bank, they cannot be outnumbered by cannibals if they were, the cannibals would eat the missionaries. The boat cannot cross the 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 queens attack each other.
5. Two room vacuum cleaner world.
6. Water Jug Problem.