K.G.C.E.
Karjat - Raigad

Tutorial No. 2

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1.2 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 understand the problem solving agent. Algorith shown in figure 3 shows agent program for problem solving agent. Agent first formulates goal & problem, then determines or rather searches an action sequentes, after which it returns the next action to be executed in a sequential manna

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

Initial State It is the starting stat that the problem is in.

Actions It defines all possible action 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

```
function SIMPLE-PROBLEM-SOLVING-AGENT (percept)
returns an action.
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
```

Problem Solving Agent Architecture

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 & searching would stop.

Path Cost It is a accumulated cost of performing certain action sequence under consider. action is optimal.

Thus a problem can formally specified by identifying initial state, actions, transition model (successer function), goal test & 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 solution. Process of finding a solution is called search

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

1. Navigate to KGCE Workshop from HOD IT Cabin with minimum number of moves, can be climbing or alighting 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 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 attacks where no two queens attack each other.

5. Two room vaccum cleaner world.
6. Water Jug Problem.

Resources Refer to second chapter from Artificial Intelligence: A Modern Approach.