

Tutorial 2: To understand State space problem formulation.

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Aim:- To understand State Space based problem formulation of AI problem so that Problem Solving agent can be applied.

Theory.

First we understand the problem Solving agent. Algorithm shown in Figure 3 show agent Program. Problem Solving agent. Agent first formulates goal & problem, then determines or rather searches an action sequence, after which it return the next action to be executed in a Sequential manner.

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

Initial State : It is the State that the Problem is in

Action It defines all possible action available to the agent; given it is in some State S current. It is a function $Action(S)$ that return list of all possible action

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 give 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 accumulated cost of performing certain sequence of action. This can help in determining whether the action sequence under consideration is optimal.

Thus a problem can formally specified by identifying initial state, actions, transition model, goal test and path cost. In term of problem solving agent solution is the lowest path cost of all solution. Process of finding a solution is called Search.

Working

Based on understanding of problem.

Formulation: student need to formulate following problem. They will clearly show state space up to depth level 3 or till goal node which ever is shallowest.

1. Navigate to KEC 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 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.

Resources: Refer to Second Chapter from A.I. A Modern Approach.

8- puzzle problem

The problem can be formulated as

State :: state can be represented by a 3×3 matrix data structure with blank denoted by underscore.

Initial State : $\{ \{1, 2, 3\}, \{4, 8, -\}, \{7, 6, 5\} \}$

Action : The blank space moves in left right, up and down direction specifying the action

Successor function : if we apply down operation to the start state, the next has '5' and '-' switched

4 Goal test : $\{ \{1, 2, 3\}, \{4, 5, 6\}, \{7, 8, -\} \}$

5) Path cost : No of steps to reach to the final state

Solution

$\{ \{1, 2, 3\}, \{4, 8, -\}, \{7, 6, 5\} \}$
 $\rightarrow \{ \{1, 2, 3\}, \{4, 8, 5\}, \{7, 6, -\} \}$

$\{ \{1, 2, 3\}, \{4, 8, 5\}, \{7, -6\} \} \rightarrow \{ \{1, 2, 3\}, \{4, -, 5\}, \{7, 8, 6\} \}$

$\{ \{1, 2, 3\}, \{4, 5, -\}, \{7, 8, 6\} \} \rightarrow \{ \{1, 2, 3\}, \{4, 5, 6\}, \{7, 8, -\} \}$

Path cost = 5 steps

1	2	3
4	8	
7	6	5

initial state

down

1	2	
4	8	3
7	6	5

1	2	3
4	8	5
7	6	

1	2	3
4		8
7	6	5

left

1	2	3
4	8	5
7		6

1	2	3
4	8	
7	6	5

1	2	3
4	8	5
	7	6

1	2	3
4		5
7	8	6

1	2	3
4	8	5
7	6	

...

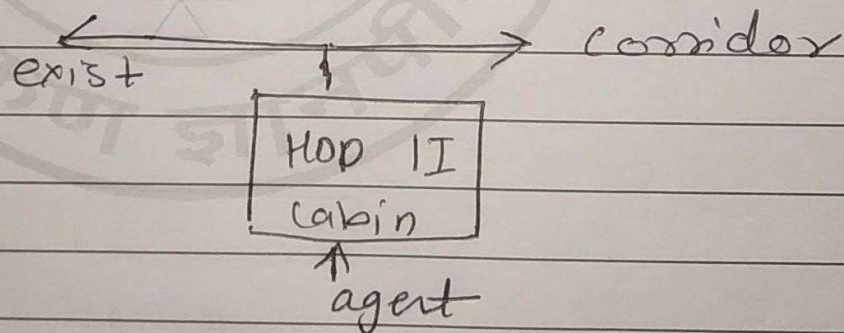
1	2	3
4	5	6
7	8	

goal state

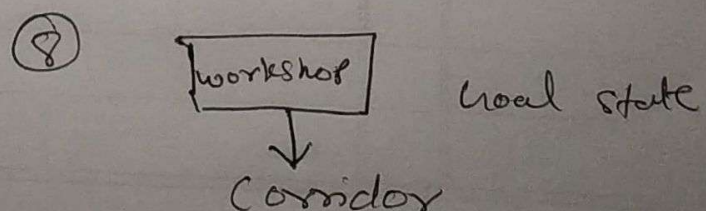
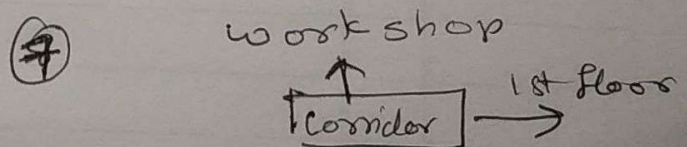
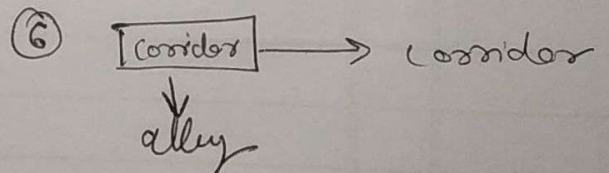
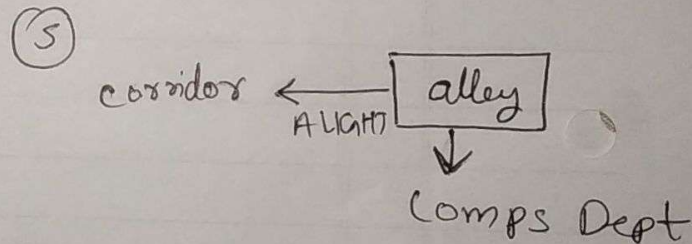
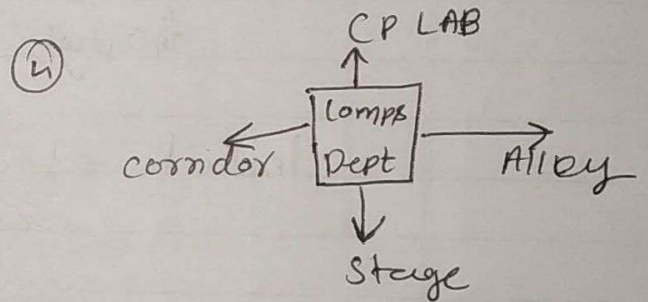
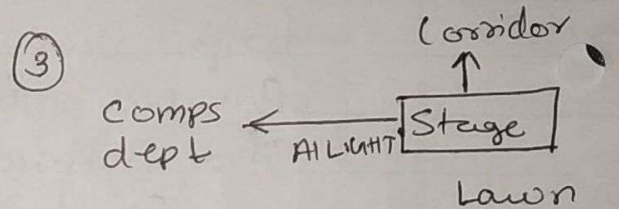
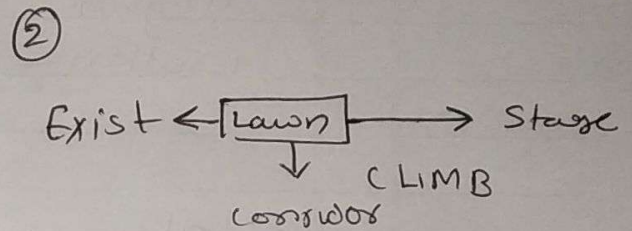
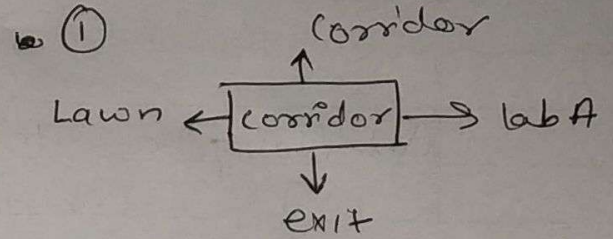
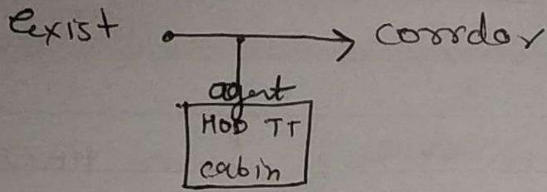
Q.2 Navigate to Kge workshop from HOD IT cabin with minimum number of moves, moves can be Climbing a alighting staircase, turning left, right walking - through a corridor.

States :- It can be represented as a top view of the agent along with arrows in direction left, right ~~to~~ forward & backward. He use Climb and alight ~~for~~ moving through staircase

Initial state



HOD IT Cabin → kgee workshop (soln)



HOD IT
cabin

Right

Corridor

left -> Alight

Lawn

right

Lab A

Forward

Lorridor

Backward

Exit

Lawn

left

Exist

Backward

Corridor

Right

+ Climb

Stage

WorkShop

goal state