2 Tutorial 2 : To understand state space problem ~~for~~ formulation.

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function SIMPLE-PROBLEM-SOLVING-AGENT (percept) returns an action
  static: seq an action sequence, initially empty
          state, some description of the current world state
          goals, 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
```

1.2 Tutorial 2 : To understand state space problem ~~for~~ formulation.

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

Theory : first we understand the problem solving agent. Agent first formulates goals and problem, then determines or rather searches an action sequences, after which it returns the next action to be executed in a sequential manner.

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

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

Action : It defines all possible actions available to the agent, given it is in some state s currently. It is an 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

moved 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, action (operator), transition model (sucessor 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 solution. 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

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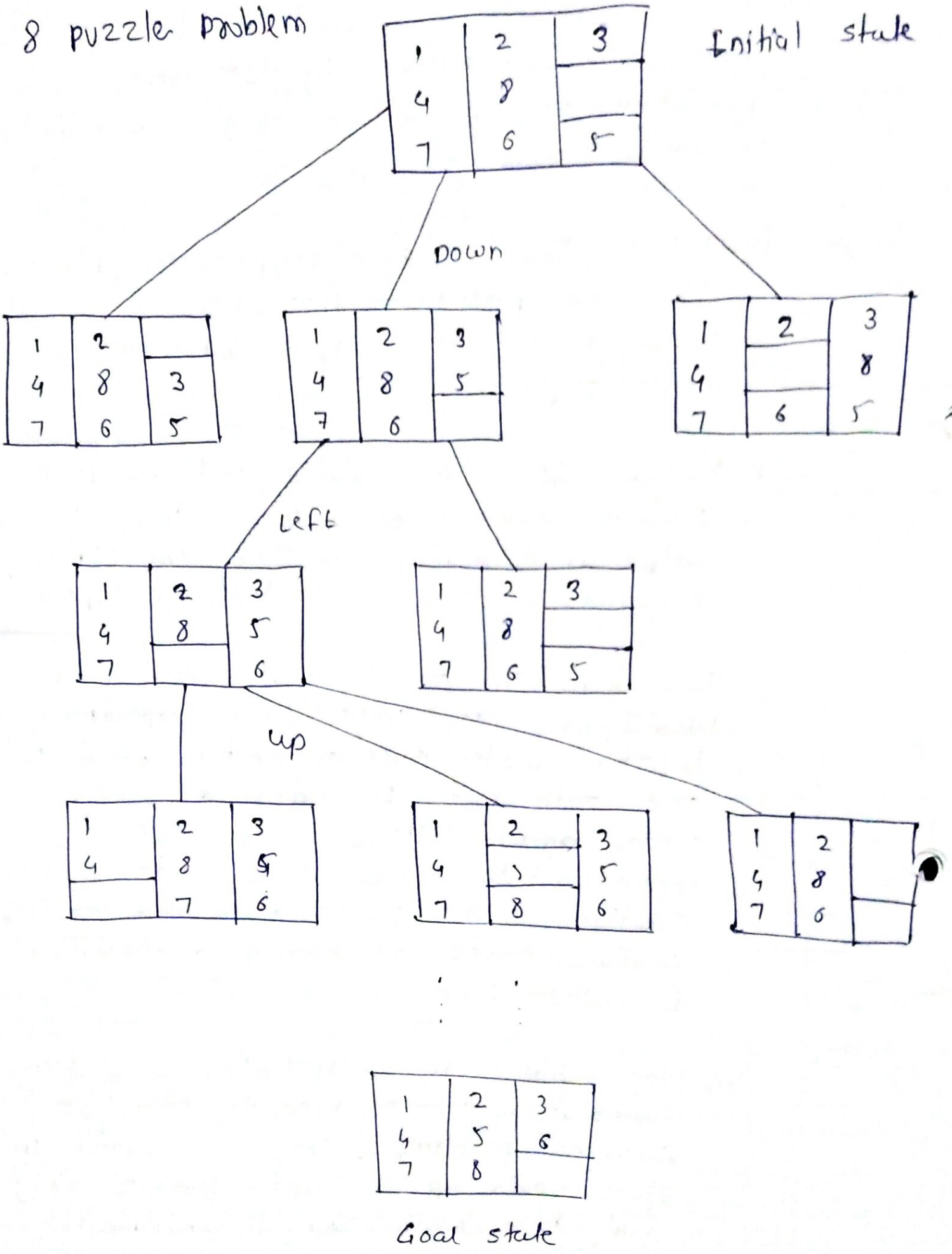
1. Navigate to KGCE Workshop from HOD IT cabin with minimum number of moves, moves can be climbing or alighting staircase, turning left, right, walking through a corridor.
2. 8 Puzzle problem.
3. The missionaries and cannibals problem. There are three missionaries and three cannibals who must cross a 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 by cannibals if. The boat cannot cross the river by itself with no people on board.
4. N Queen's problem, Arrange N queen on a N cross N chess board where no two queen attack each other.
5. Two room vacuum cleaner world.
6. Water Jug Problem.

Resource Refer to second chapter from :
Artifical Intelligence, A Modern Approach

8 puzzle problem



(i) 8 - puzzle problem

The problem can be formulated as :

- states : states can be represented by a 3x3 matrix data structure with blank denoted by an underscore '_'.
1. Initial state : {1,2,3} {4,8,-0} {7,6,5}
2. Action : The blanks space move in left, right, up, and down direction specifying the action
3. Sucesors function : If we apply 'down' operation to the start state, the next state, the next state has 'r' and '_' switched.
4. Goal test - {1,2,3}, {4,5,6}, {7,8,_}
5. Path cost : No. of steps of each to final state.

solution :-

{ {1,2,3} {4,8...} {7,6,5}} → {{1,2,3} {4,8,5} {7,6,_}}

{ {1,2,3} {4,8,5} {7,_,6}} → {{1,2,3} {4,_,5} {7,8,6}}

{ {1,2,3}, {4,5,_} {7,8,6}} → {{1,2,3} {4,5,6} {7,8,_}}

Path cost = 3 steps

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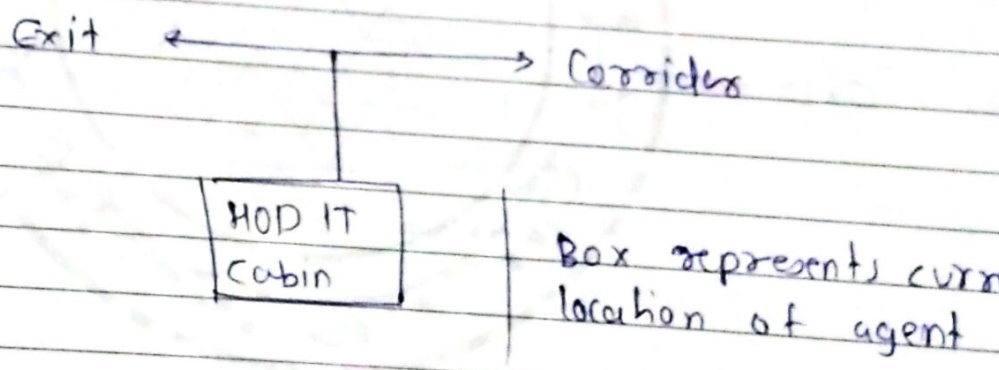
(ii) Navigate to kgce workshop from HOD IT cabin with minimum number of moves, moves can be climbing on alighting staircase, turning left, right, walking through a corridor.

- states : It can be represented as a top view of the agent along with arrows in direction left, right, forword and backword. We use 'climb' and 'alight' for moving through staircase.

1. Initial state



2. Action : The agent moves in left, right, forword and backword direction along with alighting and climbing the stairs (if any)
3. Successor function : If we apply 'right' operation to the start state the agent enters the corridor, the first step toword goal state.

4. Goal test

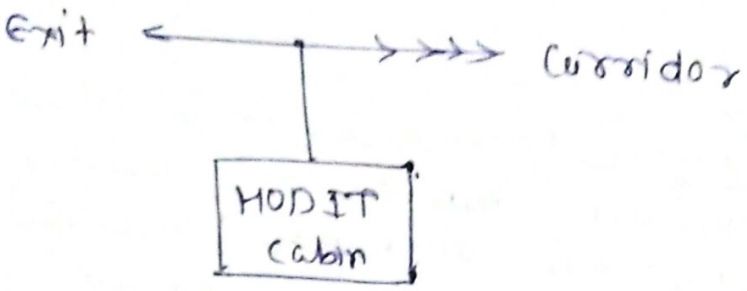
5. Path cost : No. of action to reach the workshop

Path cost = 8 direction + 4 staircases

= 12

HOD IT cabin → KGCE workshop (solution)

(2)



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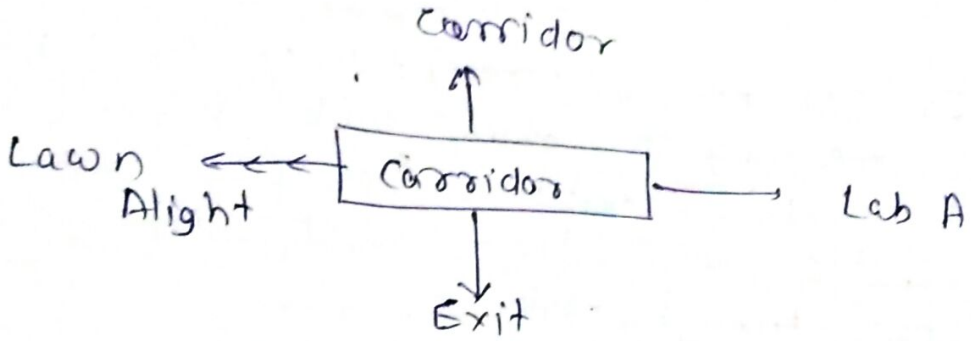

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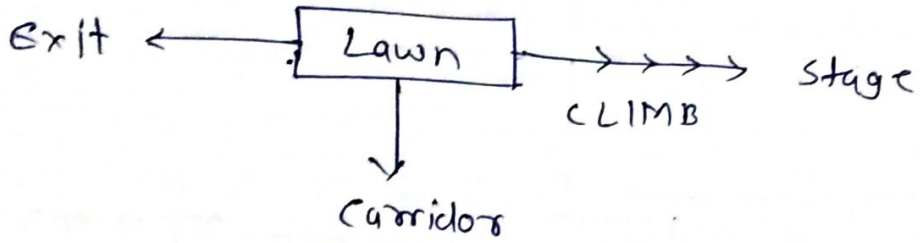

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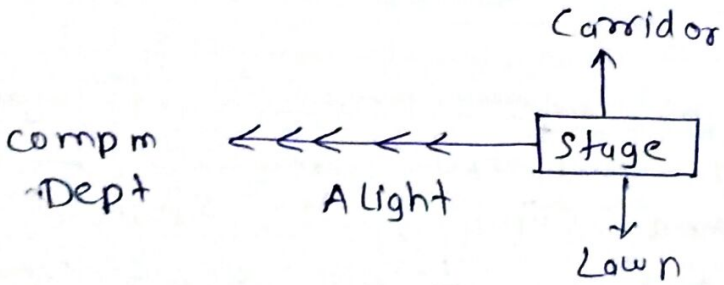

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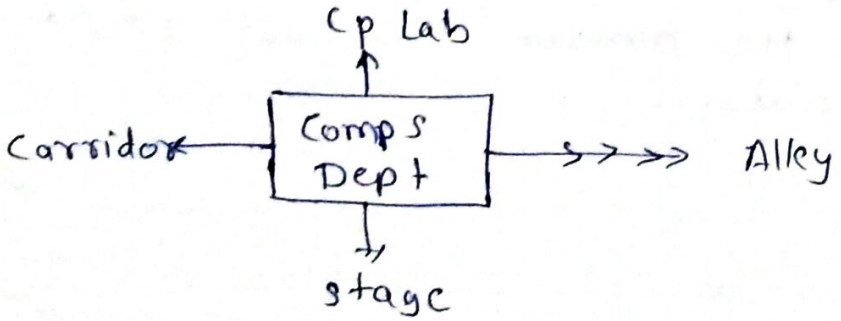

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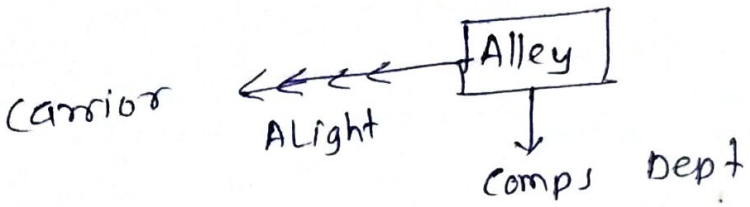

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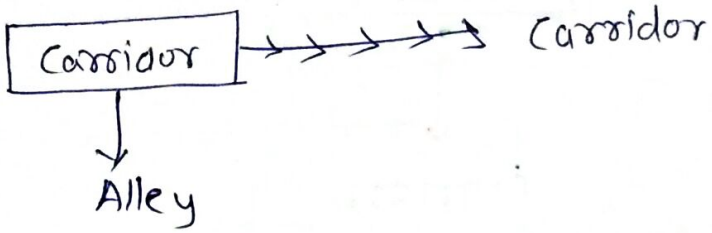

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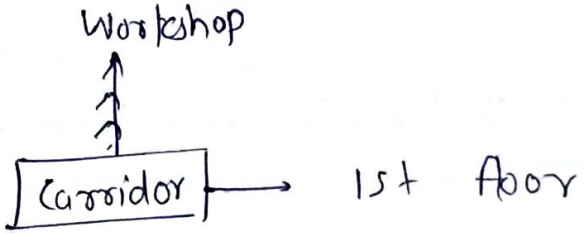
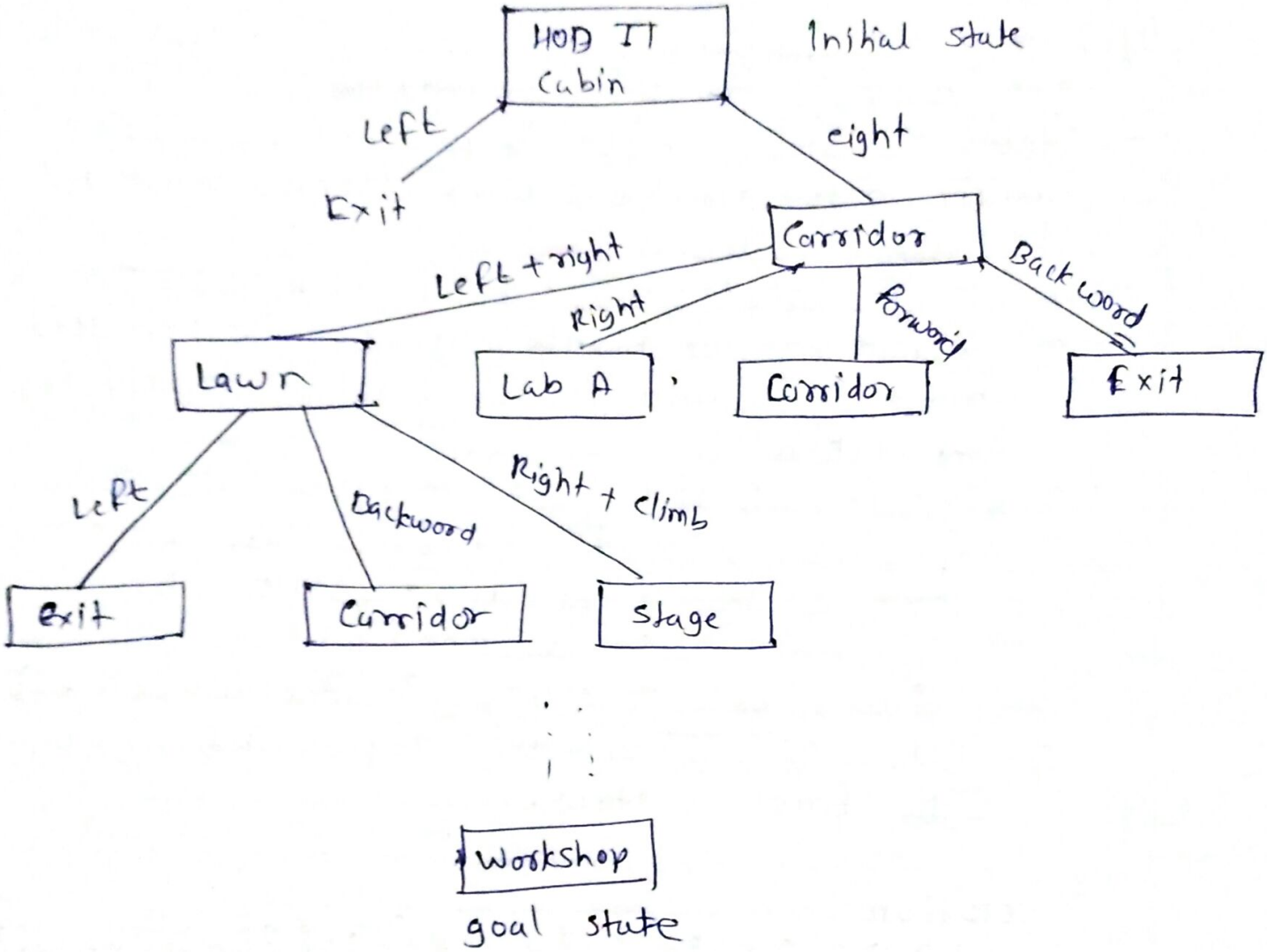


(8)

goal state

State space


HOD IT Cabin
Initial state
Left
eight
Exit
Corridor
Left + right
Right
Forword
Backword
Lawn
Lab A
Corridor
Exit
Left
Backword
Right + climb
Exit
Corridor
Stage
Workshop
goal state