K.G.C.E.
Karjat - Raigad

Tutorial No :- 2

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Tutorial No-2

Tutorial 2 :- To understand state space problem ~~formulation~~ 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 formulated goal and problem, then determines or rather searches an action sequence, after which it return the next action to be executed in a sequential maner.

```
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
```

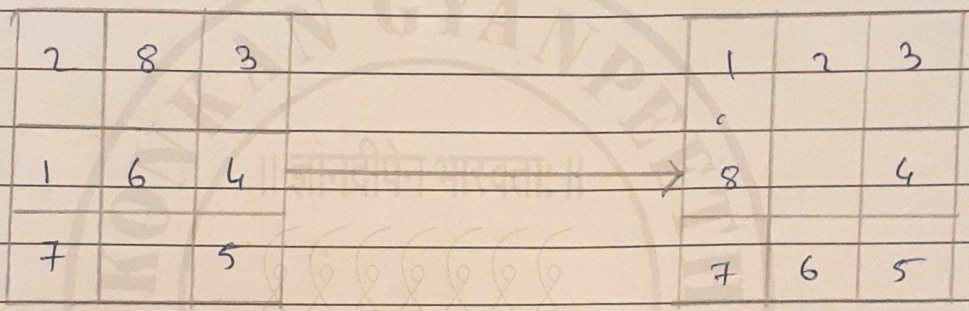
Defining the problem is referred to as problem formulation. It involves defining following five things:

- 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 currently. It is a function Action that return list of all possible actions.
- Transition model also known as successor function which define which state is 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 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 consider-action is optimal.

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

II 8 Puzzle Problem :

The 8 Puzzle consist of eight numbered, movable tiles set in a 3x3 frame. one cell of the frame is always empty thus making it possible to move an adjacent numbered file into the empty cell. such a puzzle is illustrated in following figure.



Initial State Goal State

fig. example of 8 Puzzle

This program is to change the initial configuration into the goal config. A solution to the problem is an appropriate sequence of moves, such as "move tile 5 to the right, move tile 7 to the left, move the tile 6 to the down" etc. --

To solve a problem, we must specify the global database the rules and the control strategy. for the 8 Puzzle problem that coresponds to 3 components.

These elements are the problem states, moves and goal. In this Problem each tile configuration is a stack. The set of all possible configuration in the problem space

consist of 3,62,880 different configurations of the 8 tiles and blank space.

for the 8-puzzle a straight forward description is a 3x3 array of matrix of numbers. Initial global database is this description of the initial problem state virtually any kind of data structure can be used to describe states.

A move transforms one problem state into another state. The 8-puzzle is conveniently interpreted as having the following for moves.

- move empty space (blank) to the left, move blank up. move blank to the right and move blank down.
- These moves are modeled by production rules that operate on the state description in the appropriate manner.

The goal condition from the basis for the termination. The control strategy repeatedly applies rules to state descriptions. until a description of a good state is produced It also keeps track of rule that have been applied so that it can compose them into sequence representing the problem solution.

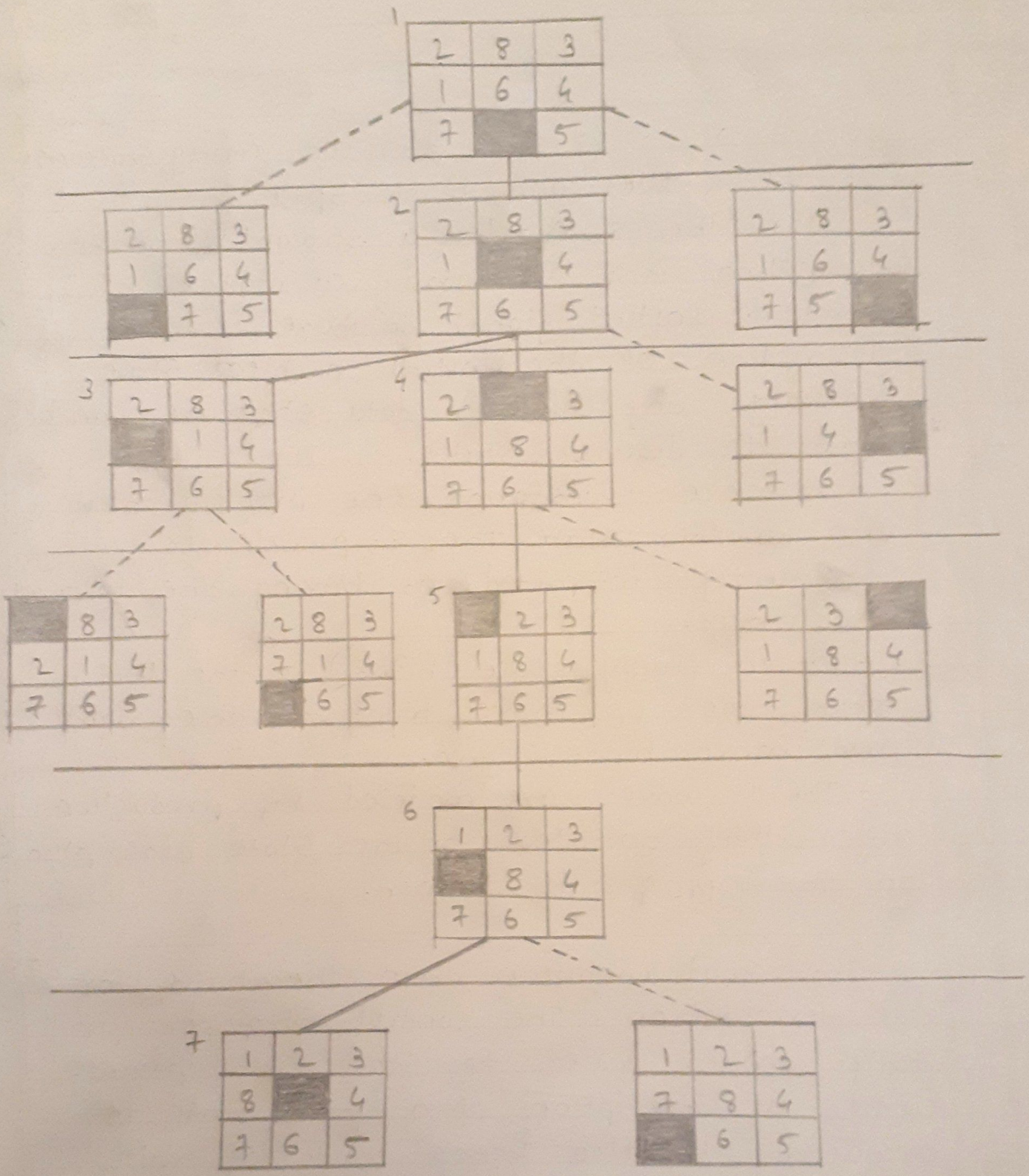
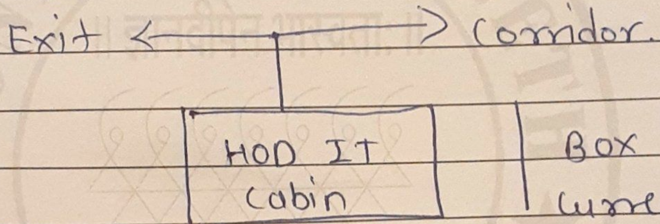


Fig. Solution of 8 Puzzle Problem

2] Navigate to KGCE workshop from HOD IT cabin with minimum number of moves, moves can be climbing or aligting staircase, turning left, right, walking through a corridor

States :- It can be represented as a top view of the agent along with arrows in ~~dir~~ directions left, right, forward and backword. we use 'climb' and 'alight' for moving through staircases

1] Initial state :

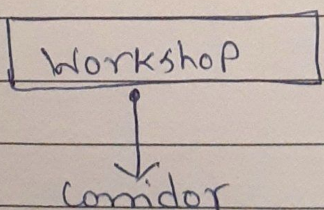


Box represents current location of agent.

2] Actions : The agent moves in left, right, forward and backword directions 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 towards goal state.

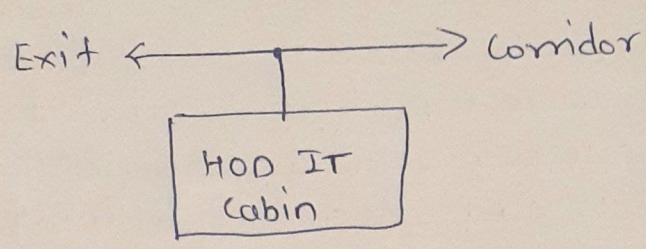
4] Goal test



5] Path cost : No. of actions to reach the workshop.

Path cost = 8 directions + 4 staircases
= 12

HOD IT Cabin → KGLE Workshop (solution)



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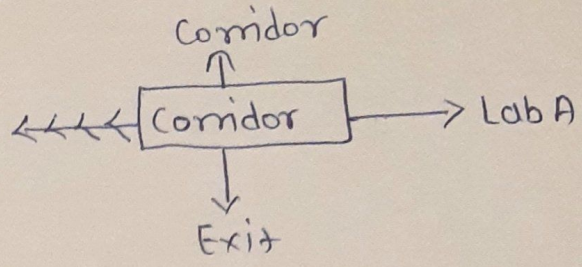

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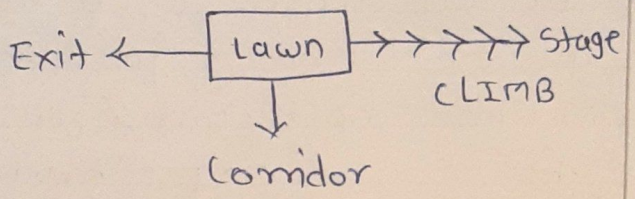

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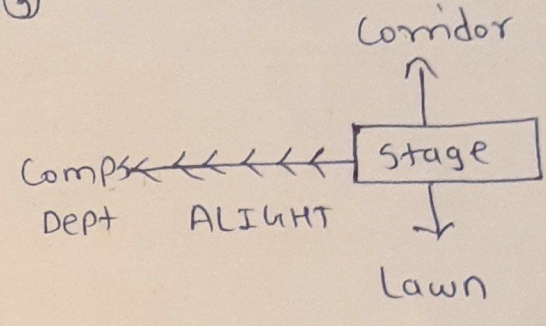

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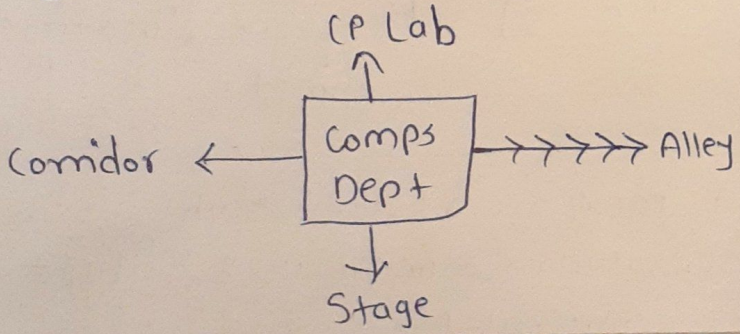

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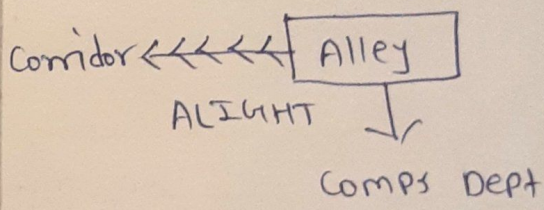

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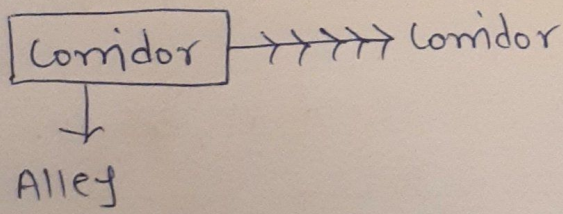

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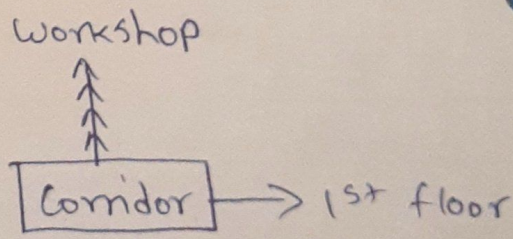

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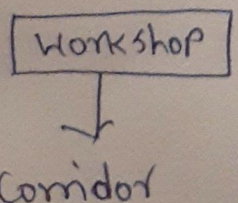
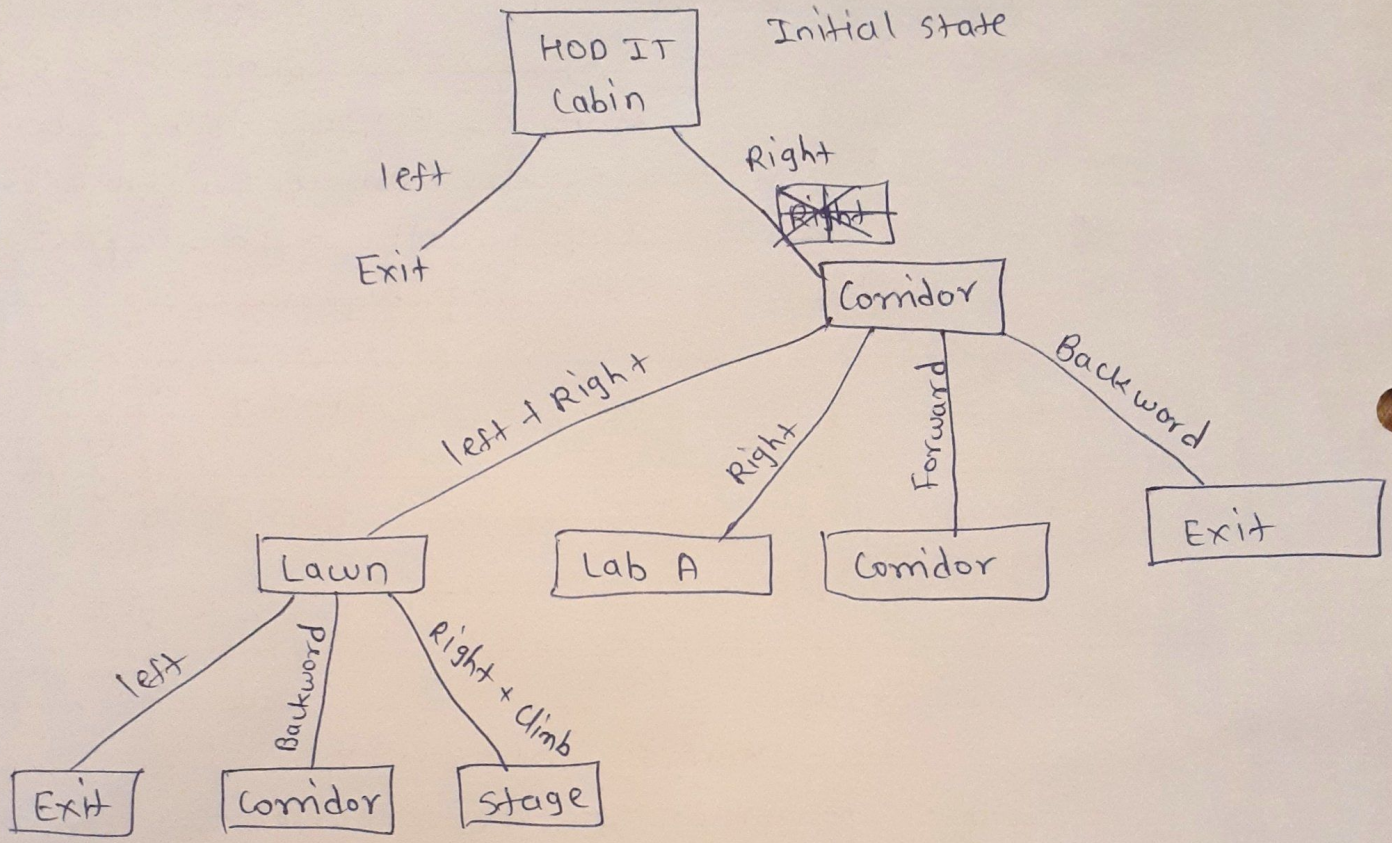


Goal state

State space


HOD IT Cabin
Initial state
left
Exit
Right
Right
Corridor
left + Right
Right
Forward
Backword
Exit
Lawn
Lab A
Comidor
left
Backword
Right + climb
Exit
Corridor
Stage