

[illegible]

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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 & problem, then determines or rather searches an action sequence, after which it returns the next action to be executed in a sequential manner.

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

Static: seq, an action seq., 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

[illegible]

goal \leftarrow FORMULATE-GOAL (state)
problem \leftarrow FORMULATE-PROBLEM (state, goal)
seq \leftarrow SEARCH (problem)

action \leftarrow FIRST(seq)

seq ← REST (seq)

return action

Figure 3: Problem Solving Agent Architecture

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 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 & searching would stop.

Path Cost:

It is accumulated cost of performing certain sequence of actions

This can help in determining whether 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 & 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.

*** Working:**

Solve following problem using State Space Search.

8 puzzle problem:

The 8 puzzle consists of eight numbered, movable tiles set in a 3×3 frame. One cell of the frame is always empty thus making it possible to move an adjacent numbered tile into the empty cell. Such a puzzle is illustrated in following figure.

2	8	3		1	2	3
1	6	4	॥ ज्ञानदीपेन भास्वता: ॥	8		4
7		5		7	6	5

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 & the control strategy. For the 8 puzzle problem that corresponds to 3 components.

These elements are the problem states, moves & goal. In this problem each tile configuration is a state. The set of all possible configuration in the problem space consists of 3,62,880 different configurations of the 8 tiles & blank space.

For the 8-puzzle, a straight forward description is a 3×3 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 & move blank down.
- These moves are modeled by production rules that operate on the state descriptions in the appropriate manner.

The goal condition form the basis for the termination. The control strategy repeatedly applies rules to state descriptions

until a description of a goal state is produced. It also keeps track of rules that have been applied so that it can compose them into sequence representing the problem solution.

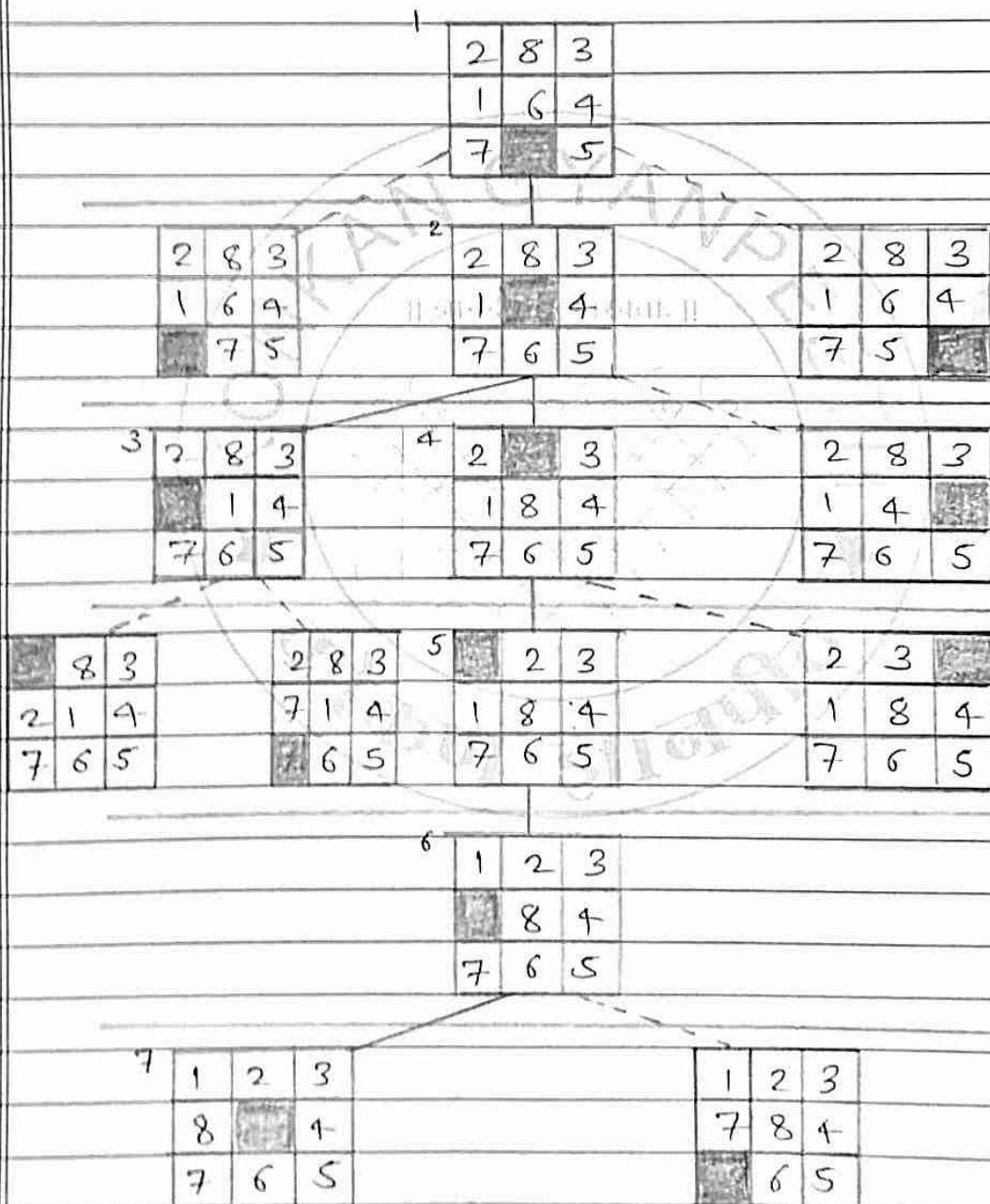


Fig. Solution of 8 puzzle problem