National Institute of Technology, Tiruchirappalli – 15
Department of Computer Science & Engineering

ASSIGNMENT # 1

Degree / Branch : B.Tech / CSE
Subject Code / Name : CSPE63/ Artificial Intelligence & its applications
Year / Semester : III / VI

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1. Solve the 8 Queen's Problem using Backtracking Technique.

2. Consider a sliding block puzzle with the following initial configuration :

B	B	B	W	W	W	E

There are 3 black tiles (B), 3 white tiles (W), and an empty cell (E). The puzzle has the following moves:

(a) A tile may move into an adjacent empty cell with unit cost.

(b) A tile may hop over at most two other tiles into an empty cell with a cost equal to the number of tiles hopped over.

The goal of the puzzle is to have all of the white tiles to the left of all of the black tiles (without regard for the position of the blank cell).

Specify an evaluation function, f, for this problem as :

$$f(n) = d(n) + c(n)$$

Where

d(n) -- > depth of a node n in the search tree

c(n) -- > cost of moving a tile into an empty cell at node n.

Show the search tree produced by algorithm A* using this evaluation function.

3. Consider a 8 puzzle with the following initial configuration :

2	**1**	**6**
4	**__**	**8**
7	**5**	**3**

The goal of the puzzle is to reach the following configuration :

1	**2**	**3**
8	**__**	**4**
7	**6**	**5**

Specify a Heuristic evaluation function, f, for this problem as :

f(n) = d(n) + w(n)

Where

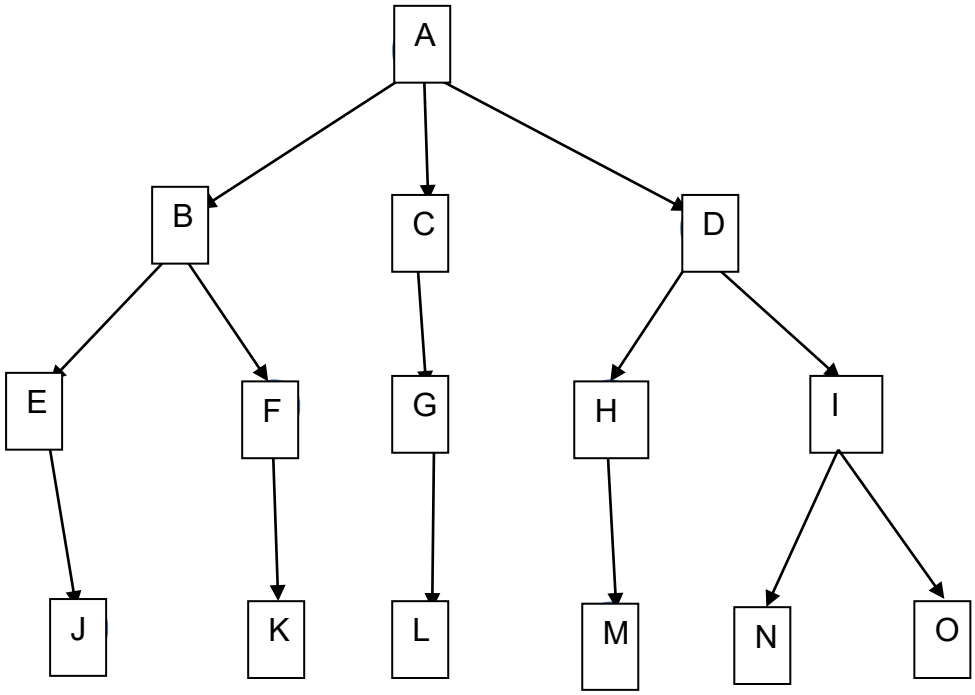
d(n) -- > Depth of a Node n in the search tree
w(n) -- > Number of misplaced tiles in Node n

Show the search tree produced by algorithm A* using this evaluation function.

4. In the water-jug puzzle, we are given a 3-litre jug, named Three and a 4-litre jug, named Four. Initially, Three and Four are empty. Either jug can be filled with water from a tap,T, and we can discard water from either jug down a drain,D. Water may be poured from one jug into the other. There is no additional measuring device. Find a set of operations that will leave precisely two liters of water in Four.

Draw a graph of all of the distinct state-space nodes that are within three moves of the start node, label each node by its state description, and show at least one path to each node in the graph – labeling each arc by the name of the appropriate operator. In addition to these nodes, show also all of the nodes and arcs (properly labeled) on a path to the solution.

5. List the order in which nodes are visited in the tree below for each of the following three search strategies (choosing leftmost branches first in all cases) :
    a. Depth-First Search
    b. Breadth-First Search



6. In the 4-Queens puzzle, we try to place four queens on a 4 X 4 chess board so that none can capture any other. (That is, only one queen can be on any row, column or diagonal of the array.) Try to solve this puzzle using the following problem space:

    The start node is labeled by an empty 4 X 4 array; the successor function creates new 4 X 4 arrays containing one additional legal placement of a queen anywhere in the array; the goal predicate is satisfied if and only if there are four queens in the array (legally positioned).

    a. Invent an admissible heuristic function for this problem based on the number of queen placements remaining to achieve the goal. (Note that all goal nodes are precisely four steps from the start node.)

    b. Use your heuristic function in an A* search to a goal node. Draw the search tree consisting of all 4 x 4 arrays produced by the search and label each array by its value of g and h. (Note that symmetry considerations mean we have to generate only three successors of the start node.)

7. Consider an 8 puzzle with the following initial configuration :

7	2	4
5	__	6
8	3	1

The goal of the puzzle is to reach the following configuration :

1	2	3
4	5	6
7	8	__

Specify a Heuristic evaluation function, f, for this problem as :

f(n) = d(n) + w(n)

Where

d(n) -- > Depth of a Node n in the search tree
w(n) -- > Number of misplaced tiles in Node n

Show the search tree produced by algorithm A* using this evaluation function.
