Engineering, Built Environment and IT
Department of Computer Science

COS 314

Tutorial 2

2 March 2023

Questions

1. Given the diagram in Fig 1 where the Initial State is A and the Goal State is E. Answer the questions that follow.
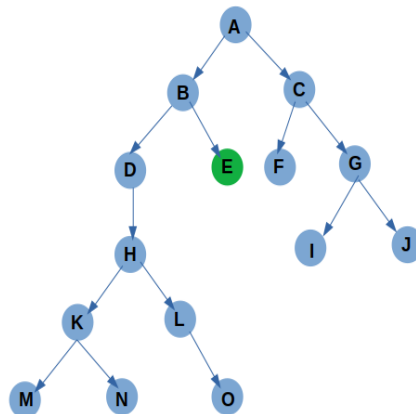

Figure 1:

    (a) List the nodes visited in performing the breadth-first Search.

    (b) List the nodes visited in performing the depth-first search.

    (c) List the nodes visited in performing the depth-first search with Iterative Deepening (depth bound 4).

2. Given the diagram in Fig. 2 where the Initial State is A and the Goal State is Q. The cost associated with each node is the numerical value in the node. Answer the questions that follow.

    (a) List the nodes visited in performing the best first search

    (b) List the nodes visited in performing the greedy-hill climbing search with Backtracking.

    (c) Briefly differentiate between greedy-hill climbing and the best-first search.
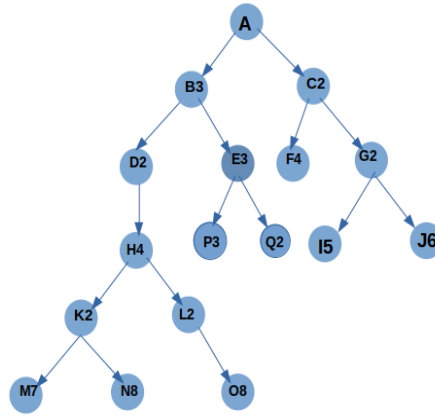
Figure 2:

3. Consider the following problem and answer the questions that follow:
   The Travelling Salesman Problem: A salesman must visit a number of cities starting and ending at the same city. The salesman cannot revisit a city. The problem involves determining a minimum cost route that the salesman must travel.

   (a) Describe what a state will look like.
   (b) Define the legal moves for the problem.
   (c) Define a heuristic function for the above problem.
   (d) Which search method should be used to find a solution to this problem? Give reasons for your answer.

4. Consider the following problem and answer the questions that follow: The Eight Queens Problem This problem involves placing eight queens (a queen refers to a chess piece) on an 8x8 board. A queen can be placed on the board or removed from the board. The initial state is an empty board. The goal state is the 8x8 board with all eight queens placed on the board in such a way that each queen is not able to attack another queen. A queen can attack another queen if they are placed in the same row, column or along the same diagonal. A solution to the problem is the steps that must be performed to get from the initial state to the goal state.

   (a) Describe what a state will look like.
   (b) Define the legal moves for the problem.
   (c) Define a heuristic function for the above problem.
   (d) Which search method should be used to find a solution to this problem? Give reasons for your answer.

5. Consider the state space given below and answer the questions that follow. Note that the goal state is H:
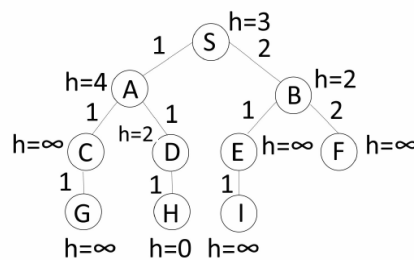
   (a) List the order in which the nodes will be visited if the best-first search is used.
   (b) List the order in which the nodes will be visited if the hill-climbing search is applied to the state space.
   (c) List the order in which the nodes will be visited if the A algorithm is applied to the state space.
   (d) Is h(n) admissible? Substantiate your answer.

6. Consider the state space given below and answer the questions that follow. Note that the goal states are G and J:

   (a) List the order in which the nodes will be visited if the best-first search is used.
   (b) List the order in which the nodes will be visited if the hill-climbing search is applied to the state space.
   (c) List the order in which the nodes will be visited if the A algorithm is applied to the state space.
   (d) Is h(n) admissible? Substantiate your answer.

S4

3 — A5 — 2 — B3

A5: 3, 4   B3: 3, 2

C4   D6   E7   F2

1   5   6   1

G0   H∞   I∞   J0
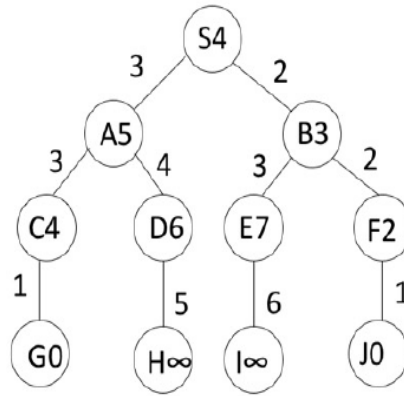
7. The 8-puzzle problem is a well studied problem in artificial intelligence. Develop a program to compare the performance of the best-first search and the A* algorithm in solving the following instances of the 8-puzzle problem of differing difficulty. (Please note the programs must be implemented in Java.

Table 1: 8-Puzzle Problem Instances.

Instance	Start State	Goal State	Known Optimum
1	123804765	134862705	5
2	123804765	281043765	9
3	123804765	281463075	12
4	123804765	231804765	16
5	867254301	123456780	31