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Engineering, Built Environment and IT
Department of Computer Science

COS 314

Tutorial 1

29 February 2024

Questions

1. 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 salesman at a city, looking for the cheapest root forward to the goal state
   (a) Describe what a state will look like. Each state will be a different city with a cost of travel associated with it
   (b) Define the legal moves for the problem. Legal moves would include transitions from a visited state to unvisited states
   (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.
   Best First Search/Hill Climbing, as they both search for the minimal cost path
2. 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. 8 queens placed on a board, each in it's own block
   (b) Define the legal moves for the problem. L,R,U,D
   (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.
   A Algorithm, this will evaluate possible moves for each queen to reach the goal from the initial state

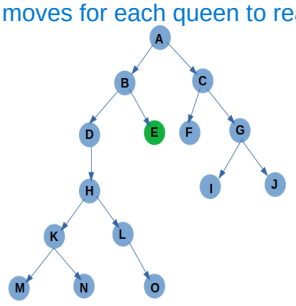


Figure 1:

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

(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).

4. 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.

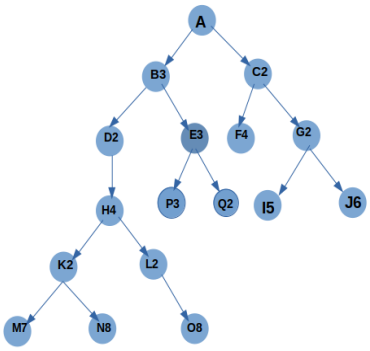


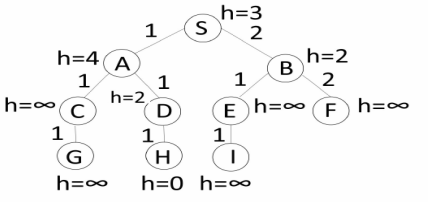
Figure 2:

(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.

5. Consider the state space given below and answer the questions that follow. Note that the goal state is H:



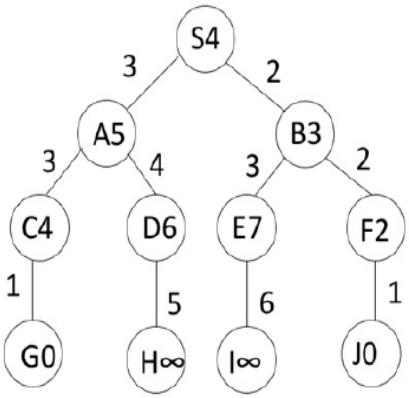
(a) List the order in which the nodes will be visited if the best-first search is used.

(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. Yes, the goal state is found at h = 0

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. Yes, h = 0 at goal state

7. For each of the following algorithms write down the pseudocode explaining the purpose of each line.

   a) Iterated Local Search.

   b) Tabu Search.

8. Given a bit string search problem where the initial state is 1001001100 and the goal state is a 10 bit string of 1's i.e 1111111111. Develop a program in Java or C++ that applies the following algorithm to the search.

   a) Iterated Local Search.

   b) Tabu Search.

   A number of variations of the algorithms exist please stick as close as possible to the algorithms presented in the notes and slides. For each algorithm list the follow:

   i) Parameters used.

   ii) Number of iterations to reach the goal state.

   iii) Duration to reach the goal state.

Iterated Local Search
S0 = initialSearch
S* = localSearch(S0)
S` = perturbation(S*, history)
S*` = localSearch(S`)
S* = AcceptanceCriterion(S*,S*`,history)