**B. Tech Fourth Year Mid-semester Examination**

**Department: Computer Science and Engineering**

**Course Name: Artificial Intelligence** **Code: CS 461**

**Full Marks-60** **Time: 2 hours**

**Answer any six questions.**

1 (a). What is meant by intelligent agent? Briefly describe the various components of an intelligent agent.

(b). Distinguish the following terms with appropriate examples

(i). Fully observable vs. Partially observable environment

(ii). Deterministic vs. Stochastic environment 5+5

**2.** (a). Prove that breadth search is a special case of uniform-cost search.

(b). Distinguish between BFS and DFS. Show the worst-case time and space complexities of BFS algorithm. 3+7

**3.** (a). Why is heuristic search preferred over uninformed search? How are best first search, uniform cost search and A* searches related to each other?

(b). What is meant by admissible heuristics? What is the optimality criteria of A* search algorithm? Prove the optimality of A* search under this criteria. 5+5

4. (a). Mention the name of the algorithm that will result under each of the following conditions:

(i). Local beam search with K (number of successors) =1; (ii). Local beam search with K (number of successors) =∞; (iii). Uniform cost search with unit step cost; (iv). Simulated annealing with T (temperature) = 0 at all times; (v). Genetic algorithm with population size N=1.

(b). Why is repeated state generation a problem in tree search? Write down the various steps of general graph search algorithm.

5+5

**5.** (a). What are the differences between random restart search and local beam search? Mention the disadvantages of local beam search.

(b). Write down the various steps of Genetic Algorithm. Why is it preferred over other local search techniques? 4+6

6. (a). Show the various steps of hill climbing algorithm for the following 8-puzzle problem. Assume the heuristic function to be the number of misplaced tiles.

| | | |
|---|---|---|
| 2 | 8 | 3 |
| 1 | 6 | 4 |
| 7 | | 5 |

**Start Sate**

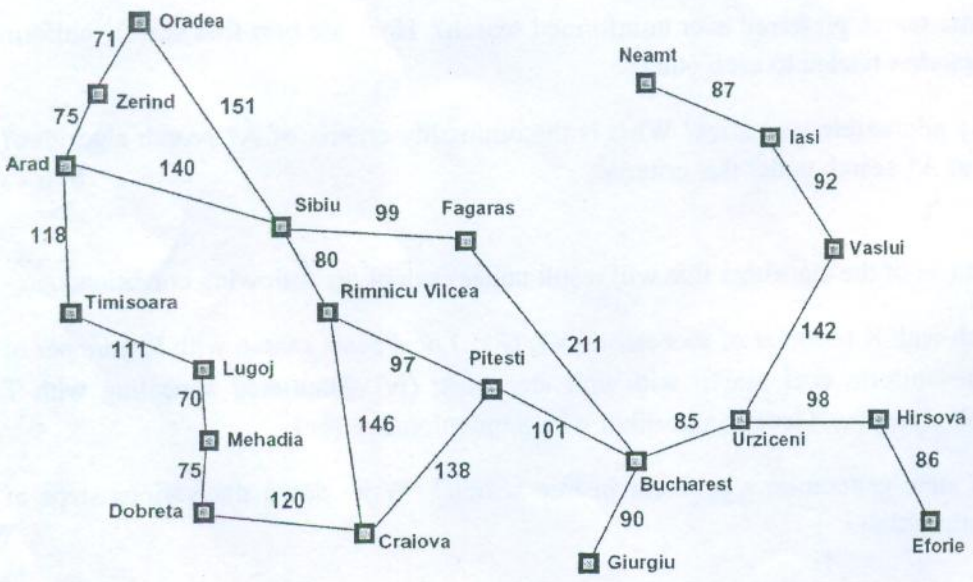
| | | |
|---|---|---|
| 1 | 2 | 3 |
| 8 | | 4 |
| 7 | 6 | 5 |

**Goal State**

(b). What are the merits and demerits of hill climbing search?

(c). In what respect simulated annealing is more effective than hill climbing? **4+3+3**

7. (a). Consider the following city tour problem. Edge labels denote the actual distances between the cities; and straight-line distances (shown right-side) denote the heuristic estimates. Show the various steps of recursive best first search algorithm for the path that starts at ***Arad*** and finishes at ***Bucharest***. Explain each step clearly.




| Straight-line distance to Bucharest | |
|---|---|
| Arad | 366 |
| Bucharest | 0 |
| Craiova | 160 |
| Dobreta | 242 |
| Eforie | 161 |
| Fagaras | 178 |
| Giurgiu | 77 |
| Hirsova | 151 |
| Iasi | 226 |
| Lugoj | 244 |
| Mehadia | 241 |
| Neamt | 234 |
| Oradea | 380 |
| Pitesti | 98 |
| Rimnicu Vilcea | 193 |
| Sibiu | 253 |
| Timisoara | 329 |
| Urziceni | 80 |
| Vaslui | 199 |
| Zerind | 374 |

(b). What are the advantages of memory bounded A* search over recursive best first search?

**8+2**