Ref. No. EX/CSE/T/412A/2019

B. COMPUTER SCIENCE AND ENGINEERING 4TH YEAR, 1ST SEMESTER EXAMINATION, 2019

ARTIFICIAL INTELLIGENCE

Time: Three Hours | Full Marks: 100

Question No. 1 is compulsory.
Answer any two from Question Nos. 2, 3 and 4.
Answer any one from Question Nos. 5 and 6.
Answer any one from Question Nos. 7 and 8.

1. (a) Comment on -"The aim of artificial intelligence (AI) is to make machines intelligent".

   (b) Discuss on Turing Test in connection to intelligence of a machine. Is there any limitation of this test? - Discuss.

   (c) Elaborate on "Systems that act rationally".

   (d) Justify -- "An agent could be visualized as a search process".

   (e) Describe the criteria for evaluating search strategies. 4x5

2. Justify each of the following statements:
   (a) General Graph Search Algorithm is applicable for a wide variety of search processes.
   (b) The minimum average time required to find a goal node using a search algorithm is $O(b^d)$ (b: number of branches of the tree, d: depth of the goal node).
   (c) Breadth first search and depth first search are special cases of best first search.
   (d) Bidirectional search procedures are applicable for all kinds of problems.
   (e) A* search is a combination of past and future. 4x5

3. (a) Derive the time complexity of Iterative Deepening Search. Why is it called an "optimal" search strategy? 4+4
   (b) Justify: "No search method that makes use of heuristic functions can guarantee to find the shortest path from start to goal". 4
   (c) What is admissibility? If h1() and h2() are both admissible heuristic functions, is h3() admissible? (where, h3 = |h1-h2|)---Discuss 2+4
   (d) When will the maximum reduction of search time occur for island-driven search strategy? 2

4. (a) Consider the maze shown in Fig. 1. S is the initial state at location (3,2) and G is the goal state at location (5,2). Shaded squares are blocked cells. **Consider that the same state will be visited only once. The next state is expanded in the following fixed order: North, West, South, East.**

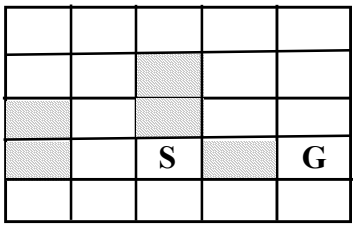

FIG. 1

i) Draw the search tree using BFS. Represent each node using its (x,y) coordinates. Number the nodes in the order visited by BFS. 4

ii) Find out the order of nodes searched using ID and IB. 3+3

iii) Now assume that each move has an associated cost--- North has cost 2 and all other moves have cost 1. What is the order in which nodes are visited using UCS? 4

(b) Write briefly on IDA* search process highlighting its concept, advantages and limitations. 6

5. (a) In a game tree, which nodes are designated as 'AND' nodes? Why? 3

(b) Does α-β pruning algorithm affect the optimality of Minimax search? -- Explain 3

(c) Consider the following game tree (Fig. 2) in which static scores are all from first player's point of view. The static scores at the leaf nodes from left to right are as follows:

2 3 8 5 7 6 0 1 5 2 8 4 10 2

------which nodes will be pruned using α-β search? 6

(d) Justify – "α-β can slow game tree search". 3

(e) Discuss with example - "AND-OR graph is applicable for solving real life problems." 5

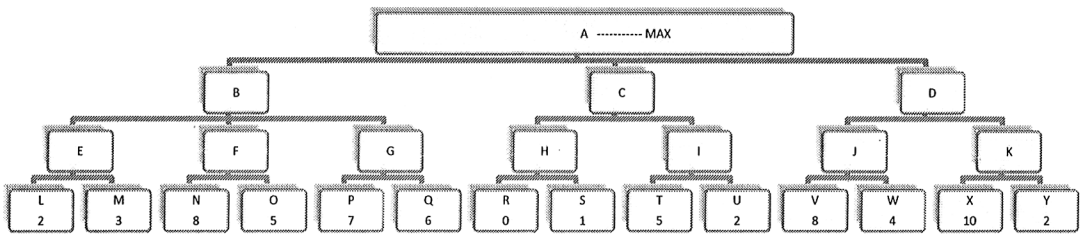

Fig. 2

6. (a) Depth first search takes one branch and pursue search as deeply as possible. Hill climbing also starts with some random solution and moves in steepest ascent/ descent direction. Write down the difference(s) of these two search processes. 4

(b) Discuss on Foothill problem of Hill Climbing. Is there any method to overcome it? 4

(c) What happens when the temperature is lowered too quickly in Simulated Annealing algorithm? What happens if it is lowered too slowly? 6

(d) Discuss on the utilities of selection, crossover and mutation used in Genetic Algorithms. 6

7. (a) Why do we require 'unification'?
Find the *mgu* of the following: {P(x,z,y), P(w,u,w), P(A,u,u)}. 3+4

(b) Write down the rules for substitution. 3

(c) Consider the following sentences.

i. Anyone who loves any lottery is a gambler.
ii. Everyone who favors the lottery proposition loves some lottery.
iii. Everyone favors the lottery proposition or opposes the lottery proposition.
iv. If every Baptist votes and opposes the lottery proposition, then the lottery proposition does not win.
v. Every Baptist who is faithful is not a gambler.

Prove using resolution ---If every Baptist votes and the lottery proposition wins, then some Baptist is not faithful. 10

8. (a) Give the clausal form for the following: $\exists x \exists y\ (p(x,y) \wedge q(x,y))$ 3

(b) Given the premises $\forall x.(p(x) \Rightarrow q(x))$ and $\forall x.(q(x) \Rightarrow r(x))$, use Resolution to prove the conclusion $\forall x.(p(x) \Rightarrow r(x))$. 4

(c) What is the task of TMS? What kind of information does a TMS use for its information? 2+3

(d) Define fuzzy set. 3

(e) Model "Old Man" using suitable membership function. Then graphically represent "Not very Old". 5