

**B. COMPUTER SCIENCE AND ENGINEERING 4<sup>TH</sup> YEAR 1<sup>ST</sup> SEMESTER EXAMINATION, 2018****ARTIFICIAL INTELLIGENCE**

Time: Three Hours

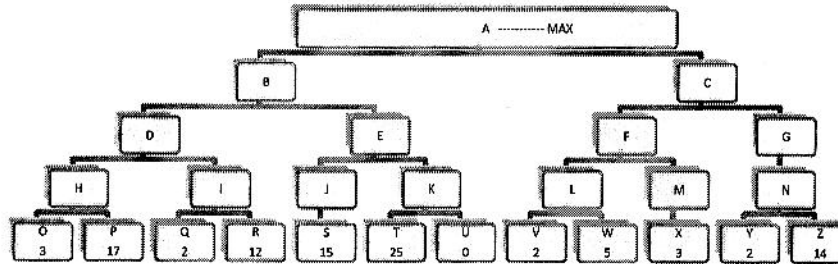
Full Marks: 100

**Answer any Five Questions**

1. (a) Discuss on the goals of AI. What conclusions can be made from 'Turing Test' in connection to the 'intelligence' of a machine? Can a machine simulate human thought processes?---Discuss. Discuss on 'Problem solving agent'. 3+4+3+5
- (b) Justify: "To obtain optimal solution time complexity of search algorithm becomes higher". 5
2. (a) What is 'State Space Graph'? How do we make an 'implicit graph' into an 'explicit' one? For any graph based search process, can we obtain the "solution path" from "order"?--- If yes, how? and if no, why? 3+2+3
- (b) Compare BFS, DFS and IDS with respect to computation time requirement (find out the ratio in terms of branching factor,  $b$  and depth value,  $d$ ). 4
- (c) Justify: IDS is an optimal search algorithm. 6
- (d) When will the maximum reduction of search time occur for island-driven search strategy? 2
3. (a) A milkman carries a full 12-litre container. He needs to deliver exactly 6 litre to a customer who only has an 8-liter and a 5-litre containers. Solve this milk-jug problem using formal search procedure (mention the start state, goal state, operators etc.) Draw the search tree and find the shortest path to the goal state. What is the cost of optimal solution? 10
- (b) What is admissibility? Why is it important? 4
- (c) Let  $h_1$  and  $h_2$  be two admissible heuristic functions. Is  $h_3$  admissible? (where,  $h_3 = \max(h_1, 0.5 \cdot h_2)$ )? ---Discuss 4
- (d) In  $A^*$ , what is the difference between cost function and heuristic function? 2
4. (a) What is 'look-ahead depth' (in a game tree)? Why the static scores differ (in a game tree) in different look-ahead depths? 4
- (b) Consider the following game tree 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: **3, 17, 2, 12, 15, 25, 0, 2, 5, 3, 2, 14**)

Find the best move for the MAX player using the MINIMAX procedure.  
Perform a **right-to-left**  $\alpha$ - $\beta$  pruning of the tree. Indicate where the cut offs occur. 8

- (c) For the said tree, what ordering of leaf nodes (from left to right) results in the most nodes being pruned with **left-to-right**  $\alpha$ - $\beta$  (maintain the child-parent relationship). Show your reordering. 4
- (d) Compare the efficiency of  $\alpha$ - $\beta$  pruning algorithm over MINIMAX with respect to time, space and correctness in obtaining a solution. 4



5. (a) Discuss on the Plateau problem of hill climbing. Is there any method to overcome it? 4
- (b) Justify: Simulated Annealing is a “random” search process. What will happen when T tends to zero in Simulated Annealing? 6
- (c) Compare the efficiency of Genetic Algorithms over single solution based search process in terms of time complexity, completeness and optimality. 5
- (e) Discuss on the utilities of mutation operator. What will happen if mutation is not used in GA? 5

6. (a) Why do we require ‘unification’?

Find the *mgu* of the following:

$$\{ Q(h(x,y), w), Q(h(g(v), a), f(v)), Q(h(g(v)), f(b)) \} \quad 2+4$$

- (b) Convert the following *wff* into clause form. 6

$$\forall x [ B(x) \rightarrow ( \exists y [ Q(x,y) \wedge \sim P(y) ] \wedge \sim \exists y [ Q(x,y) \wedge Q(y,x) ] \wedge \forall y [ \sim B(y) \rightarrow \sim E(x,y) ] ) ]$$

- (c) Consider the following facts:

Jack, Jill and Bill are members of the City Club.

Every member of the City Club is either footballer or cricketer or both.

No cricketer likes rain.

All footballers like cloud.

Bill dislikes whatever Jill likes and likes whatever Jill dislikes.

Jill likes rain and cloud.

Use resolution to answer:

Can there be anyone who is a member of the City Club who is footballer but not cricketer? 8

7. (a) When do we call a reasoning system a “non-monotonic” one? 4
- (b) What are the components of non-monotonic reasoning system? 2
- (c) Is it really necessary to use support lists for handling uncertainty? --- Discuss. What information (about a “node”) do we obtain by looking at the support list of TMS? 3+3
- (d) Write down the differences between crisp set and fuzzy set. Model “Sunny Day” using suitable membership function. 4+4
8. (a) Compare the performances of IB and ID as search processes.
- (b) Discuss on control strategies for resolution refutation method highlighting the merits and demerits (if any) of each.
- (d) Discuss on AND-OR graph and its necessity for Game playing methods. 4+8+8