M.Sc. 2nd Semester Examination, 2023

COMPUTER SCIENCE

PAPER – COS-203(M1 & M2)

Full Marks : 50

Time : 2 hours

The figures in the right hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

PAPER – COS 203(M1)

(*Artificial Intelligence*)

[*Marks* : 25]

GROUP – A

Answer any **two** questions : 2×2

1. What is the cut off for Iterative Deeping A* algorithm ?

2. Why A* search is better than Uniform Cost search ?

3. Differentiate between exhaustive search and adversarial search.

4. What do you mean by heuristic search ?

GROUP – B

Answer any **two** questions : 4 × 2

5. Consider the following problem : A water jug problem : You are given two jugs, a four gallon and a three-gallon, a pump which has unlimited water which you can use to fill the jugs and the ground on which water may be poured. Neither jar has any measuring markings on it. How can you get exactly two gallons of water in the four-gallon jug ?
Formulate the problem as state space search problem. 4

6. Translate following English sentence into predicate logic": Every mail message larger than one megabyte will be compressed". 4

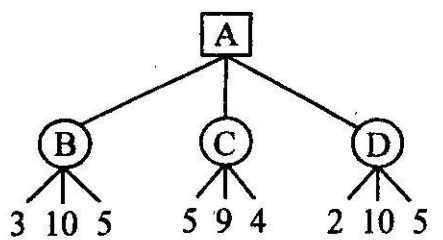
7. What are the differences between simulated annealing and Hill climbing ? 4

8. What is roulette wheel selection in Genetic Algorithm ? How it works ? 2 + 2

GROUP – C

Answer any **one** questions : 8×1

9. Consider the following game tree in which the static scores at the tip nodes are from the first player's perspective. Assume that the first player is the maximizing (MAX) player.



(*i*) What is the minimax value for the root ? Indicate which action of the first player would choose assuming a fully rational opponent.

(*ii*) In the tree, cross out the nodes that would not be evaluated if alpha-beta pruning were applied.

(*iii*) Reorder the nodes of the game tree given above such that alpha-beta will prune more nodes than were pruned in your previous answer. In reordering the nodes, A should remain the root, and B, C and D should still be its children. More generally, all parent, child and sibling relationships should be maintained. Draw the new tree and cross out the nodes that will be pruned. 2 + 3 + 3

10. The sliding-tile puzzle consists of three black tiles, three white tiles and an empty space in the configuration shown in figure.

B	B	B		W	W	W

The puzzle has two legal moves with associated costs : A tile may move into an adjacent empty location. This has a cost of 1. A tile can hop over one or two other tiles into an empty position. This has a cost equal to the number of tiles jumped over.

The goal is to have all the white tiles to the left of all the black tiles. The position of the blank is not important.

(*i*) Solve this problem.

(*ii*) Propose a heuristic for solving this problem and analyse it with respect to admissibility. 3 + 5

[*Internal Assessment* – 5 Marks]

PAPER – COS 203(M2)

(*Soft Computing*)

[*Marks* : 25]

GROUP – A

Answer any **two** questions : 2 × 2

11. What do you mean by rule of inclusion and exclusion ?

12. Define fuzzy set with suitable example.

13. What is the difference between supervised and unsupervised learning ?

14. What do you mean by fuzzification ?

GROUP – B

Answer any **two** questions : 4×2

15. Given two fuzzy sets -

$$\tilde{A} = \{(x_1, 0.2), (x_2, 0.5), (x_3, 0.6)\}$$

$$\tilde{B} = \{(x_1, 0.1), (x_2, 0.4), (x_3, 0.5)\}$$

Find (*i*) $\tilde{A} \oplus \tilde{B}$

(*ii*) $\tilde{A} - \tilde{B}$. $2 + 2$

16. Given two fuzzy sets -

$$\tilde{I} = \{(F, 0.4), (E, 0.3), (X, 0.1), (Y, 0.1), (I, 0.9), (T, 0.8)\}$$

$$F = \{(F, 0.99), (E, 0.8), (X, 0.1), (Y, 0.2), (J, 0.5), (T, 0.5)\}$$

verify De Morgan's law $(\tilde{I} \cup \tilde{F})^c = \tilde{I}^c \cap \tilde{F}^c$ and $(\tilde{I} \cap \tilde{F})^c = \tilde{I}^c \cup \tilde{F}^c$. $2 + 2$

17. Show that $(p \Rightarrow Q) = (\sim p \vee Q)$ is a tautology. Define Modus tollers rule. $3 + 1$

18. Relate the Artificial networks with the biological neural system. 4

GROUP – C

Answer any **one** question : 8×1

19. Write short note on : Two point crossover, mutation with suitable example. $4 + 4$

20. Let $X = \{x_1, x_2\}$, $Y = \{y_1, y_2\}$ and $Z = (z_1, z_2, z_3\}$ consider the following fuzzy relations :

$$R = \begin{matrix} \\ x_1 \\ x_2 \end{matrix} \begin{matrix} \begin{matrix} y_1 & y_2 \end{matrix} \\ \begin{bmatrix} 0.7 & 0.6 \\ 0.8 & 0.3 \end{bmatrix} \end{matrix} \quad \text{and} \quad S = \begin{matrix} \\ y_1 \\ y_2 \end{matrix} \begin{matrix} \begin{matrix} z_1 & z_2 & z_3 \end{matrix} \\ \begin{bmatrix} 0.8 & 0.5 & 0.4 \\ 0.1 & 0.6 & 0.7 \end{bmatrix} \end{matrix}$$

Find RoS.

There are exactly three types of students in a school : the geeks, the wannabees and the athletes. Each student is classified into atleast one of these categories. And the total number of students in the school is 1000. Suppose that the following is given :

- The total number of students who are geeks is 310.
- The total number of students who are wannabees is 650.
- The total number of students who are atheletes is 440.
- Both geeks and wannabees is 170.
- Both geeks and atheletes is 150.
- Both wannabees and atheletes is 180.

Find –

(*i*) The total number of students who fit into all 3 categories.

(*ii*) Number of students geeks but not atheletes.

3 + 3 + 2

[*Internal Assessment* – 5 Marks]