MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL
Paper Code : MCAN-302   Artificial Intelligence

Time Allotted : 3 Hours   **Full Marks :70**

The Figures in the margin indicate full marks
Candidate are required to give their answers in their own words as far as practicable

Group-A (Very Short Answer Type Question)

1. Answer any ten of the following :   [1 x 10 = 10]

   (I) Which search is similar to Minmax search?

   (II) What is fuzzy logic?

   (III) Which modes are used by Inference engine to derive the solutions?

   (IV) What are the two meanings of a Prolog clause?

   (V) What does the language of FOPL consists of?

   (VI) Backtracking search on a graph uses which type of searching technique?

   (VII) Write down the cost function for A* algorithm.

   (VIII) In which evolutionary algorithm mutation and crossover takes place?

   (IX) If two fuzzy sets A and B are given with membership functions $\mu A(x) = \{0.2, 0.4, 0.8, 0.5, 0.1\}$ $\mu B(x) = \{0.1, 0.3, 0.6, 0.3, 0.2\}$ Then find the value of $\mu A(x) \cap \mu B(x)$.

   (X) What is the use of Waltz algorithm?

   (XI) What is an agent?

   (XII) When A* is guaranteed to give optimal solution?

Group-B (Short Answer Type Question)
Answer any three of the following   [5 x 3 = 15]

2. Define the following relations in Prolog given basic parent(X,Y) relation: [5]
   i) offspring(X,Y)
   ii) grandparent(X,Y)
   iii) mother(X,Y)
   iv) predecessor(X,Y)
   v) happy(X) [parents having two children are happy]

3. Represent the following sentences using Predicate logic: [5]
   i) All employees earning greater than Rs.200000 per year pay taxes.
   ii) Some employees are sick today.
   iii) No employee earns more than his manager.

4. Write a Prolog program to find out GCD of two numbers.   [5]

5. What are Modus Ponens and Modus Tollens?   [5]

6. Differentiate between supervised and unsupervised learning? Clustering algorithms falls under which category?   [5]

Group-C (Long Answer Type Question)
Answer any three of the following   [15 x 3 = 45]

7. a) What is a Production System?   [2+4+2+7]
   b) What are the characteristics of a Production System?
   c) Describe the Water-jug problem in AI.
   d) Represent the Water-jug problem as a Production System and give a solution to the problem. Also draw the state space search graph with respect to the solutions obtained.

8. a) Is P-->q a Horn clause? Justify your answer.
   b) What is logical equivalence? Give example.
   c) Represent the following sentences using Predicate logic:
   i) All employees earning greater than Rs.200000 per year pay taxes.
   ii) Some employees are absent today.
   iii) No employee earns more than his manager.
   d) What is Modus Ponen?

9. Consider the missionary and unbeliever problem, where 3 missionaries and 3 unbelievers stand at the left bank [3+4+3+5] of the river. They wish to cross the river. There is a small boat (without boatman) to ferry them across but it can hold at most 2 persons. Whenever there are more missionaries than unbelievers on either bank of the river, the missionary will convert the unbeliever. The problem is to find whether there is any possible sequence of ferrying for the 6 persons to cross the river without any of the unbelievers getting converted.
   i) Formulate the problem as a state space search problem.
   ii) Draw the implicit search graph.
   iii) Does any solution exist to the problem? If so, specify the solution, otherwise clearly explain why there is no solution.
   b) Given the following text:

   - "Everyone who enters in a theatre has to buy a ticket.
   Person who does not have money cannot buy a ticket.
   Vinod enters a theatre."

   Prove by resolution that "Vinod buys a ticket".

10. Convert the following sentences into first order predicate logic: [6+4-
    i) Everyone loves Ram.
    ii) Not everyone likes Ravana.
    iii) No frogs are birds.
    iv) Some vehicles are not motorcycles.
    v) No person buys an expensive policy.
    b) Art is the father of John. Bob is the father of Kin. Fathers are parents. Prove that Art is the parent of John.
    c) Draw conceptual graph for the following sentence:
    "The dog scratches its ear with its paw".

11. A farmer has a wolf, goat and cabbage. He wants to cross a river with all its possessions. He has a single boat [7+
    that can carry at most one of his possessions on any trip. Moreover, an unattended wolf eats goat, and an unattended goat eats cabbage. How does he do the transportation? Describe production system stating clearly the production rules and control strategies. Now show that your proposed production system solution can solve this problem.
    b) What are the pitfalls of the Hill Climbing search techniques?
    c) When one has cold, one usually has a high temperature (80% of the time). At any time around 1 in every 10000 people has a cold and 1 in every 1000 people has a high temperature. Now, suppose that you have a high temperature. What is the probability that you have cold?

*** END OF PAPER ***