# University of Mumbai

## Examination Second Half 2021 under cluster __ (Lead College: _____)

**Examinations Commencing from 22nd November 2021 to 5th January 2022**

Program: Computer Engineering

Curriculum Scheme: Rev 2016

Examination: BE Semester VII

Course Code: CSC 703 and Course Name: Artificial Intelligence and Soft Computing

Time: 2 hours 30 minutes Max. Marks: 80

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| Q1. | **Choose the correct option for following questions. All the Questions are compulsory and carry equal marks** |
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| 1. | In which of the following environment the stock trading agent work? |
| Option A: | Multiagent independent |
| Option B: | Multiagent cooperative |
| Option C: | Multiagent competitive |
| Option D: | Multiagent antagonistic |
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| 2. | For McCulloch Neuron, if w1=2, w2= -1 and input vector X=[0.8 1.2]. and d= 1, Determine value of T (or w0). |
| Option A: | T= 1 |
| Option B: | T=0 |
| Option C: | T=0.3 |
| Option D: | T= -0.3 |
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| 3. | FOPL expression for " **Those people who read are not stupid**" is |
| Option A: | ∃x read(x) → ~stupid (x) |
| Option B: | ∀x read(x) → ~stupid (x) |
| Option C: | ∃x read(x) V ~stupid (x) |
| Option D: | ∀x read(x) ∧ ~stupid (x) |
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| 4. | Suppose you are designing a handwritten digit recognition system using MLP. Dataset contains 28*28 pixel images of handwritten digits from 0-9. Choose the correct number of neuron for input and output layer |
| Option A: | Input layer:100 neurons and Output layer:9 neuron. |
| Option B: | Input layer:100 neurons and Output layer:100 neuron |
| Option C: | Input layer:10 neurons and Output layer:2 neuron |
| Option D: | Input layer:784 neurons and Output layer:10 neuron |
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| 5. | Which search method will expand the node that is closest to the goal? |
| Option A: | Best-first search |
| Option B: | Greedy best-first search |
| Option C: | A* search |

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| Option D: | Depth Limited Search |
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| 6. | Which of the following sequence of steps is taken in designing a fuzzy logic machine? |
| Option A: | Fuzzification → Rule evaluation → Defuzzification |
| Option B: | Fuzzification → Defuzzification → Rule evaluation |
| Option C: | Rule evaluation → Defuzzification → Fuzzification |
| Option D: | Rule evaluation → Fuzzification → Defuzzification |
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| 7. | An expert system is ---------- |
| Option A: | a computer that can answer questions like a human expert |
| Option B: | a group of scientists who design computer programs |
| Option C: | a method of producing new words |
| Option D: | a computer that can feel emotions |
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| 8. | Let us implement a single neuron with threshold activation function to simulate working of logical AND gate. Give the correct values of weights and threshold |
| Option A: | w1=1, w2=-1, T=-1 |
| Option B: | w1=-1, w2=-1, T=-1 |
| Option C: | w1=1, w2=1, T=2. |
| Option D: | w1=-1, w2=1,T=-2 |
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| 9. | Give the height h(A) of a fuzzy set A where $\mu A(\chi)$ = {0.2,0.5.,0.6,0.1,0.9} |
| Option A: | 0.5 |
| Option B: | 0.1 |
| Option C: | 1 |
| Option D: | 0.9 |
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| 10. | Give the functionality of layer 2 in ANFIS |
| Option A: | Layer 2 in ANFIS is responsible for fuzzification |
| Option B: | Layer 2 in ANFIS is responsible for determining firing strength of rule |
| Option C: | Layer 2 in ANFIS is responsible for normalization of firing strength of rule |
| Option D: | Layer 2 in ANFIS is responsible for giving summation of all incoming signal |

| **Q2 (20 Marks)** | ***Please delete the instruction shown in front of every sub question*** |
|---|---|
| **A** | **Solve any Two** **5 marks each** |
| i. | Give the PEAS description for an agent which serves as a "**Soccer playing robot**". Describe its environment. |
| ii. | Formulate a "Travelling Salesperson problem" as a problem solving agent in terms of its states, initial state, successor function, goal test and path cost. Illustrate with an example. |

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| iii. | Describe any four commonly used membership functions to define fuzzy sets with neat diagrams |
| **B** | **Solve any One** **10 marks each** |
| i. | Consider the following statements:<br><br>(i) Every child loves Santa.<br>(ii) Everyone who loves Santa loves any reindeer.<br>(iii) Rudolph is a reindeer, and Rudolph has a red nose.<br>(iv) Anything which has-a-red-nose is weird or is a clown.<br>(v) No reindeer is a clown.<br>(vi) Scrooge does not love anything which is weird.<br>Prove the sentence "**Scrooge is not a child**" using Resolution (draw the resolution tree) |
| ii. | Draw and explain the architecture of ANFIS |

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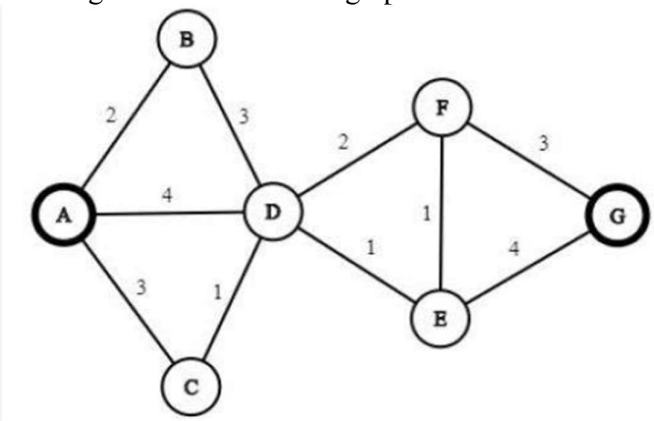
| **Q3 (20 Marks)** | ***Please delete the instruction shown in front of every sub question*** |
| A | **Solve any Two** **5 marks each** |
| i. | Design a suitable planning agent for cleaning the kitchen. Give **any 2** STRIPS style operators that might be used. When designing the operators take into account considerations such as --- Cleaning the stove or refrigerator will get the floor dirty. |
| ii. | Draw the architecture of an expert system. Describe the working of each of the blocks in the architecture. |
| iii. | Design a Mc-Culloh Pitts Model of Neuron to implement the following Boolean function<br>$f(x_1; x_2; x_3; x_4) = (x_1 \text{ AND } x_2) \text{ AND } (!x_3 \text{ AND } !x_4)$ |
| B | **Solve any One** **10 marks each** |
| i. | Figure shows an undirected in which each edge is labelled with a cost of traversing that edge. Node A is the start node and G is the goal node. Additionally we are given a heuristic function h as follows {h(A) = 7, h(B) = 5, h(C) = 6, h(D) = 4, h(E) = 3, h(F) = 3, h(G) = 0}. Apply A* algorithm and find a path from node A to node G. Assume that in case of ties, the search algorithm uses a lexicographic order for tie breaking.<br>  |
| ii. | Design a fuzzy controller for a train approaching or leaving a station. The inputs are distance from the station and speed of the train. The |

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| | output is the amount of brake power used. Use four descriptors for each of the variable. Design a set of rules for control action and appropriate defuzzification. The design should be supported by figures. |

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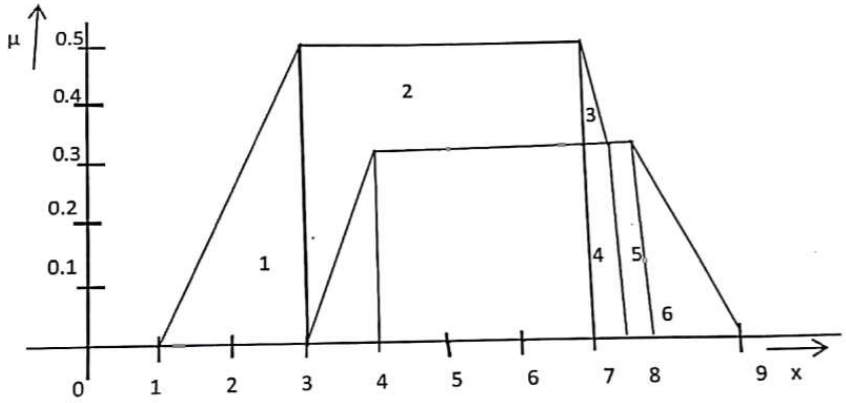
| **Q4. (20 Marks)** | ***Please delete the instruction shown in front of every sub question*** |
| A | **Solve any Two** **5 marks each** |
| i. | Convert the following sentence into CNF<br>**"Every tree in which any aquatic bird sleeps is beside some lake."** |
| ii. | **Apply defuzzification by using CoG method on the following**<br>Ans:<br>For continuous membership function, $x^*$ is defined as :<br>$x^* = \frac{\int x \mu_A(x)\, dx}{\int \mu_A(x)\, dx}$<br>  <br><br>Figure 2 : Fuzzy sets C1 and C2 |
| iii. | What are the frustrations that occur in Hill Climbing Algorithm? |
| B | **Solve any One** **10 marks each** |
| i. | Define the terms chromosome, fitness function, crossover and mutation as used in Genetic algorithms |
| ii. | Solve the following classification problem using the Perceptron learning rule. The input/target for our test problems are<br><br>$(P_1 = [1\ 2]^t, t_1 = 1)$, $(P_2 = [-1\ 2]^t, t_2 = 0)$, $(P_3 = [0\ -1]^t, t_3 = 1)$ .<br>Initial weight vector w (0) = $[1.0,\ 0.8]^t$ and bias b(0)=0. Assume learning rate c=1 and unipolar binary activation function. |