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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

September / October 2023 Supplementary Examinations

Programme: B.E. **Semester: VI**

Branch: Electrical and Electronics Engineering **Duration: 3 hrs.**

Course Code: 19EE6PE3AI **Max Marks: 100**

Course: AI Techniques to Power System **Date: 27.09.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

UNIT - I

1 a) Define agent program and list out the basic elements for selection of agent types. **06**

b) Give a brief history of artificial intelligence. **07**

c) Define soft computing and list out the difference between hard computing and soft computing. **07**

UNIT - II

2 a) Explain the types of neural networks activation functions. **05**

b) Given the flowing input vectors and initial weight vector, determine final weights for hebbian learning of a single neuron network. **10**

$W_1 = [1 \quad -1]^T$,c=1

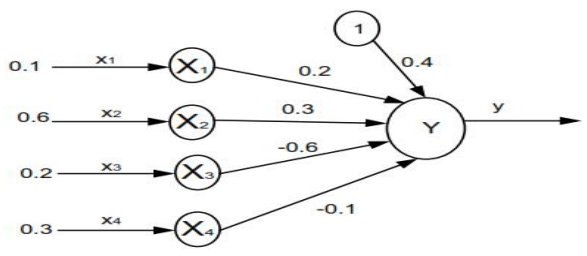
$$X_1 = \begin{bmatrix} 1 \\ -2 \end{bmatrix}, X_2 = \begin{bmatrix} 0 \\ 1 \end{bmatrix}, X_3 = \begin{bmatrix} 2 \\ 3 \end{bmatrix}, X_4 = \begin{bmatrix} 0 \\ -1 \end{bmatrix}$$

Solve for: Bipolar binary activation and bipolar continuous activation (assume λ=1).

c) Differentiate biological neural network and artificial neural network. **05**

OR

3 a) The network shown in the figure. Calculate the output Y for the network using activation function as: (i) binary sigmoid (ii) bipolar sigmoid. **05**



b) Design NOT logic using Mc-Culloch pits neuron model **05**

c) Perform two training steps of the network using delta learning rule for λ=1, c=0.25. Train the network using the following pairs. **10**

$$\left(X_1 = \begin{bmatrix} 2 \\ 0 \\ -1 \end{bmatrix}, d_1 = -1 \right) \left(X_2 = \begin{bmatrix} 1 \\ -2 \\ -1 \end{bmatrix}, d_2 = +1 \right).$$

The initial weights are $W_1 = [1 \quad 0 \quad 1]^T$

UNIT - III

4 a) Explain Fuzzy logic architecture. **05**

b) The discretised membership functions for a transistor and a resistor are given: **05**

$$\mu_T = \left\{ \frac{0}{0} + \frac{0.2}{1} + \frac{0.7}{2} + \frac{0.8}{3} + \frac{0.9}{4} + \frac{1}{5} \right\}$$

$$\mu_R = \left\{ \frac{0}{0} + \frac{0.1}{1} + \frac{0.3}{2} + \frac{0.2}{3} + \frac{0.4}{4} + \frac{0.5}{5} \right\}$$

Find the following

(i)Algebraic sum. (ii) Algebraic product. (iii) Bounded sum. (d) Bounded difference.

c) Consider two fuzzy set given by **05**

$$\underline{A} = \left\{ \frac{1}{2} + \frac{0.2}{3} + \frac{0.5}{4} \right\} \quad \underline{B} = \left\{ \frac{0.9}{2} + \frac{0.4}{3} + \frac{0.8}{4} \right\}$$

Find (i) A∩B (ii) A∪B (iii) $\overline{A}$ (iv) $\overline{A}$ ∪B of the fuzzy sets.

d) Explain increasing, decreasing and triangular fuzzy membership function. **05**

UNIT - IV

5 a) Consider a GA with chromosomes consisting of six genes xi = abcdef and each gene is a number between 0 and 9. Suppose we have the following population of four chromosomes: **07**

x_1 = 4 3 5 2 1 6 x_2 = 1 7 3 9 6 5

x_3 = 2 4 8 0 1 2 x_4 = 9 0 8 1 2 3

and let the fitness function be: f (x) = (a + c + e) − (b + d + f).

1. Sort the chromosomes by their fitness.
2. Do one-point crossover in the middle between the 1st and 2nd fittest, and two-point crossover (points 2, 4) for the 2nd and 3rd.
3. Calculate the fitness of all the offspring.

b) Draw a general structure of genetic algorithm and steps to evolve the population. **07**

c) Write a brief note on selection process of genetic algorithm with block diagram. **06**

OR

6 a) A genetic algorithm uses chromosomes of the form x = abcdefgh with a fixed length of eight genes. Each gene can be any digit between 0 and 9. Let the fitness of individual x be calculated as: **10**

$f(x) = (a + b) - (c + d) + (e + f) - (g + h)$,

and let the initial population consist of four individuals with the following chromosomes:

x_1 = 6 5 4 1 3 5 3 2

x_2 = 8 7 1 2 6 6 0 1

x_3 = 2 3 9 2 1 2 8 5

x_4 = 4 1 8 5 2 0 9 4

a) Evaluate the fitness of each individual, showing all your workings, and arrange them in order with the fittest first and the least fit last.

b) Perform the following crossover operations:

i) Cross the fittest two individuals using one–point crossover at the middle point.

ii) Cross the second and third fittest individuals using a two–point crossover (points b and f).

iii) Cross the first and third fittest individuals (ranked 1st and 3rd) Using a uniform crossover.

c) Suppose the new population consists of the six offspring individuals received by the crossover operations in the above question. Evaluate the fitness of the new population, showing all your workings. Has the overall fitness improved?

b) Discuss the steps involved in evolutionary programming implementation with help of flowchart. **10**

UNIT - V

7 a) Explain the applications of neural networks in load forecasting with example. **10**

b) Design a fuzzy controller to determine the wash time of a washing machine. Assume input is dirt and grease on cloths use three descriptors for each input variable and wash time is output variable identify five descriptor for output variable. Derive the set of rules for controllers action and defuzzify the output obtained. **10**

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