Faculty of Engineering
End Sem Examination May-2023
CS3EA03 Soft Computing

Programme: B.Tech.   Branch/Specialisation: CSE / All

Duration: 3 Hrs.   **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

Q.1 i.   What are the issues on which biological networks proves to be   1
          superior than AI networks?
          (a) Robustness & fault tolerance   (b) Flexibility
          (c) Collective computation   (d) All of these

     ii. Signal transmission at synapse is a-   1
          (a) Physical process   (b) Chemical process
          (c) Both (a) & (b)   (d) None of these

     iii. What is purpose of Axon?   1
          (a) Receptors   (b) Transmitter
          (c) Transmission   (d) None of these

     iv. On what parameters can change in weight vector depend?   1
          (a) Learning parameters   (b) Input vector
          (c) Learning signal   (d) All of these

     v.   State whether Hebb's law is supervised learning or of unsupervised   1
          type?
          (a) Supervised   (b) Unsupervised
          (c) Either supervised or unsupervised (d) Can be both (a) & (b)

     vi. What is equilibrium in neural systems?   1
          (a) Deviation in present state, when small perturbations occur
          (b) Settlement of network, when small perturbations occur
          (c) Change in state, when small perturbations occur
          (d) None of these

                                                                P.T.O.

vii. The room temperature is hot. Here the hot (use of linguistic variable is used) can be represented by _____.   **1**
   (a) Fuzzy Set   (b) Crisp Set
   (c) Fuzzy & Crisp Set   (d) None of these

viii. The values of the set membership is represented by _____.   **1**
   (a) Discrete set   (b) Degree of truth
   (c) Probabilities   (d) Both (b) & (c)

ix. Which term is used for describing the judgmental or common-sense part of problem solving?   **1**
   (a) Heuristic   (b) Critical   (c) Value based   (d) Analytical

x. Consider the following: **1**
   I.   Evolution
   II.   Selection
   III.   Reproduction
   IV.   Mutation
   which of the following are found in genetic algorithm?
   (a) II, III and IV only   (b) II and IV only
   (c) I, II and IV only   (d) All of these

Q.2 i. With the help of an example, state the role of bias in determining the net output of an artificial neural network.   **2**

ii. Illustrate the different steps involved in the training algorithm of Perceptrons.   **3**

iii. Explain the different learning mechanisms used in artificial neural networks with the help of necessary diagrams.   **5**

OR iv. With graphical representations, explain the activation functions used in artificial neural networks.   **5**

Q.3 i. State the concept of delta-rule used in adaptive linear neurons.   **2**

ii. How is training algorithm performed in back-propagation neural networks?   **8**

OR iii. Design a Hebb network to realize logical OR function.   **8**

Q.4 i. Implement AND logical function using Perceptrons.   **3**

ii. List and explain the various operations that can be performed in fuzzy relations.   **7**

OR iii. Briefly explain the steps involved in designing a fuzzy logic controller.   **7**

Q.5 i. Describe the phases that are considered in genetic algorithms.   **4**

ii. Let the population of chromosomes in genetic algorithm is represented in terms of binary number. The strength of fitness of a chromosome in decimal form, x, is given by   **6**

$$Sf(x) = \frac{f(x)}{\sum f(x)} \; where \; f(x) = x^2$$

the population is given by P where:
P = {(01101), (11000), (01000), (10011)}
Find the strength of fitness of chromosome (11000).

OR iii. 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 A∩B.   **6**

Q.6   Attempt any two:

i. Justify the statement " In nondeterministic environments, agents can apply AND-OR search to generate contingent plans that reach the goal regardless of which outcomes occur during execution."   **5**

ii. "A Genetic Algorithm is a stochastic hill-climbing search in which a large population of states is maintained" Justify the statement by taking suitable example.   **5**

iii. Explain fuzzy logic controlled genetic algorithms.   **5**

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Marking Scheme

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Q.1	i)	D All of there	1
	ii)	B Chemical process	1
	iii)	C transmission	1
	iv)	D all of there	1
	v)	B unspawned	1
	vi)	B sentiment of N/W ,when small particular portion execution	1
	vii)	A Fuzzy Set	1
	viii)	B Degree of Truth	1
	ix)	A Heuristic	1
	x)	A II selection, II reproduction IV mutation	1
Q.2	i.	Al With example ANN	2
	ii.	Perceptron algo explanation	3
	iii.	ANN Diff techniques / learning	5
OR	iv.	Activation fn & Graphical Representation	5
Q.3	i.	Delta Rule in Adaptive liner norms	2
	ii.	Backpropagation algo diagram	8
OR	iii.	Hebb network + diagram	8
Q.4	i.	Implant AND logical Function perceptron	3
	ii.	Fuzzy operations	7
OR	iii.	Fuzzy logic controllers	7
Q.5	i.	Genetic Algo -Paces	4

ii. 　　　　　　　　　　　　　　　　6

$P = \{(01101), (11000), (01000), (10011)\}$

Also, strength of fitness of a chromosome in decimal form, x is given by:

$$Sf(x) = \frac{f(x)}{\sum f(x)} \ where \ f(x) = x^2$$

So, first convert the population in decimal form, then find f(x).

P	Value in decimal	$f(x) = x^2$
01101	13	169
11000	24	576
01000	8	64
10011	19	361

We have to find the strength of fitness of chromosome 11000.

11000 in decimal = 24, f(24) = 576

$$Sf(x) = \frac{576}{169 + 576 + 64 + 361}$$

Sf(x) = 576/1170

Sf(x) = 0.492

OR iii. The fuzzy intersection of two fuzzy sets A and B on universe of 　6
discourse X: $\mu A \cap B(x) = \min [\mu A(x), \mu B(x)]$, where $x \in X$. But
here in the question, they are asking for complement of A
intersection B and so the answer would be 1-min[A(x),B(x)].
The minimum of 0.2 and 0.1 will be 0.1, and 1-0.1 will be 0.9
The second value is min(0.4,0.3)=0.3 and 1-0.3=0.7
The third value is min(0.8,0.6)=0.6 and 1-0.6=0.4
The fourth value is min(0.5,0.3)=0.3 and 1-0.3=0.7
The last value is min(0.1,0.2)=0.1 and 1-0.1=0.9

The only option which has got the values 0.9,0.7,0.4,0.7 and 0.9,
although the fourth value is given as 0.8 instead of 0.7 is option A.
So the answer is option A.

Q.6

i.	AND OR SERCH	5
ii.	Genetic hill climbing	5
iii.	Fuzz logic + genetics algo	5

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