GURU NANAK INSTITUTE OF TECHNOLOGY

An Autonomous Institute under MAKAUT

2022

SOFT COMPUTING

IT604C

TIME ALLOTTED: 3HR **FULL MARKS:70**

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable

GROUP – A
(Multiple Choice Type Questions)

Answer any ***ten*** from the following, choosing the correct alternative of each question: 10×1=10

1.		Marks	CO No.
(i)	Which of the following is known as Fuzzy Inference? a) Generalized Modus Ponens b) Generalized Modus Tollens c) Both (a) and (b) d) None of the above	1	CO1
(ii)	Which of the following is an 'absolute' fuzzy quantifier? a) Most b) nearly 100 c) Few d) None of the above	1	CO1
(iii)	Identification of an object, e.g., a chair, a tree, or a human being, from the visual image of our surroundings is an act of a) Pattern classification b) Pattern association c) Both (a) and (b) d) None of the above	1	CO2
(iv)	The interconnections of perception are a) Unidirectional b) Bidirectional c) Both (a) and (b) d) None of the above	1	CO1
(v)	A Perceptron cannot realize the XOR function because the input patterns are a) Not bipolar b) Not linearly separable c) Discrete d) None of the above	1	CO3
(vi)	Which of the following parts of a biological neuron is modeled by the weighted interconnections between the input and output units of an artificial neural model?	1	CO2

a) Dendrite

b) Axon

c) Soma

d) Synapse

(vii)	Which of the following properties does not hold good for the Cartesian product of sets?	1	CO2

a) Commutativity

b) Associativity

c) Both (a) and (b)

d) None of the above

(viii)	An output of a fuzzy inference system is a	1	CO3

a) A crisp value

b) A linguistic variable

c) A fuzzy set

d) None of the above

(ix)	Which of the following is involved in a reasoning process using Generalized Modus Ponens?	1	CO2

a) Fuzzy propositions

b) A set of clauses

c) Universal quantifier

d) None of the above

(x)	Genetic Algorithms are inspired by	1	CO3

a) Statistical mechanics

b) Big bang theory

c) Natural evolution

d) None of the above

(xi)	Which of the following selection techniques never selects the worst-fi t chromosome of a population?	1	CO4

a) Roulette wheel

b) Tournament selection

c) Both (a) and (b)

d) None of the above

(xii)	Which of the following genetic operators is based on the Darwinian principle of Survival of the fittest?	1	CO2

a) Selection

b) Crossover

c) Mutation

d) None of the above

GROUP – B
(Short Answer Type Questions)

Answer any *three* from the following: 3×5=15

			Marks	CO No.
2.	(a)	Define Soft Computing?	1	CO1
	(b)	How does soft computing differ from probability?	2	CO1
	(c)	What is the difference between soft computing and hard computing	2	CO1
3.		Discuss different activation functions used in training an artificial neural network.	5	CO2
4.	(a)	Can the XOR problem be solved using Perceptron?	1	CO2
	(b)	Justify your answer?	2	CO2
	(c)	Define Cross over and Mutation?	2	CO2
5.	(a)	Explain the operation of AND logic using McCulloch and Pitts Neuron Model.	3	CO4
	(b)	Explain the operation of OR logic using McCulloch and Pitts Neuron Model.	2	CO4
6.		Let A={(3,0.5), (5,1), (7,0.6)} and B={(3,1), (5, 0.6)}, Then obtain i) AUB and ii) AxB.	5	CO3

GROUP – C
(Long Answer Type Questions)

Answer any *three* from the following: 3×15=45

			Marks	CO No.
7.	(a)	Define "Artificial Neural Network"	1	CO2
	(b)	How are ANN classified?	2	CO2
	(c)	Consider the fuzzy rule R: If service is good, Then the customer is satisfied. Related universes are service-rating = {a, b, c, d, e}, and satisfaction-grade = {1, 2, 3, 4, 5} where the service-ratings a, b, c, d, e are in descending order and the satisfaction-grades 1, 2, 3, 4, 5 are in the ascending order. The fuzzy sets good-service and satisfied are defined as follows: $\text{Good-service}=\frac{1.0}{a}+\frac{0.8}{b}+\frac{0.6}{c}+\frac{0.4}{d}+\frac{0.2}{e}$ $\text{Satiesfied}=\frac{0.2}{1}+\frac{0.4}{2}+\frac{0.6}{3}+\frac{0.8}{4}+\frac{1.0}{5}$ Find the relation matrix for this rule according to Zadeh's interpretation?	7	CO3
	(d)	Consider two fuzzy sets A=1/2.0+ 0.65/4.0 + 0.5/6.0 + 0.35/8.0 + 0/10.0 and B= 0/2.0+ 0.35/4.0 + 0.5/6.0 + 0.65/8.0 +1/10/0. Show that the above fuzzy sets satisfy the DeMorgan's Law ?	5	CO4

8. (a) Find the max-min composition (T) for the following relations R and S: 8 CO4

$$R = \begin{array}{c} \\ a \\ b \\ c \end{array}\begin{array}{c} \begin{array}{cc} x & y \end{array} \\ \begin{bmatrix} 0.3 & 0.7 \\ 0.9 & 0.4 \\ 0.2 & 0.5 \end{bmatrix} \end{array}$$

$$S = \begin{array}{c} \\ x \\ y \end{array}\begin{array}{c} \begin{array}{ccc} p & q & r \end{array} \\ \begin{bmatrix} 0.4 & 0.1 & 0.8 \\ 0.3 & 0.7 & 0.6 \end{bmatrix} \end{array}$$

(b) Consider the following fuzzy set as follows: 7 CO2

$$expansive - car = \frac{0.2}{a} + \frac{0.6}{b} + \frac{0.7}{c} + \frac{1.0}{d}$$

$$comfortable = \frac{0.1}{1} + \frac{0.2}{2} + \frac{0.5}{3} + \frac{0.8}{4} + \frac{1.0}{5}$$

Apply if-then (Zadeh's interpretation) fuzzy rule to find relation R: *If the car is expansive, Then it is comfortable*

9. (a) Explain the "Roulette-wheel" selection algorithm? 5 CO2

(b) Apply single-point crossover on the following binary string and generate two off springs. 3 CO4

A = 0110100101

B = 0100110010

(c) Apply double-point crossover on the following binary string and generate two off springs. 2 CO4

A = 0110100101

B = 0100110010

(d) For the following binary strings, apply 1's complements mutation operator with a probability of 40%. 5 CO4

A=10001011

B=01001101

C=10101010

D=01100100

10. (a) Two fuzzy sets A and B both defined on x as follows 4 CO3

M(x)	x_1	x_2	x_3	x_4	x_5	x_6
A	0.1	0.6	0.8	0.9	0.7	0.1
B	0.9	0.7	0.5	0.2	0.1	0

Express the following α-cut sets

i. $(A \cup B)_{0.6}$

ii. $(A \cup \overline{A})_{0.7}$

iii. $\overline{(A \cap B)_{0.7}}$

iv. $(\overline{A} \cup \overline{B})_{0.7}$

(b) What is membership function? Explain triangular membership function? 3 CO2

	(c)	Let X= {a,b,c,d} Y= {1,2,3,4} and A={(a,0)(b,0.8),(c,0.6),(d,1)}B={(1,0.2)(2,1),(3,0.8),(4,0)}C = {(1,0)(2,0.4),(3,1),(4,0.8)}. Determine the implication relation- i. "IF x is A THEN y is B"	8	CO3
11.		Write short on any three of the following		
	(a)	Supervised learning	5	CO2
	(b)	Hybrid System	5	CO4
	(c)	Perceptron Model	5	CO3
	(d)	Multilayer Feed Forward ANNs	5	CO4
	(e)	Activation Function	5	CO3