2022

APPLIED MATHEMATICS WITH OCEANOLOGY AND COMPUTER PROGRAMMING

[P.G.]

(M.Sc. Fourth SemesterEnd Examination-2022)

PAPER-MTM 402

Full Marks: 50 ***Time: 02 Hrs***

The figures in the right hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

Illustrate the answers wherever necessary

Unit - I

[Fuzzy Mathematics with Applications]

Full Marks: 25

Answer question no 1 and two from the rest

1. Answer any two questions. **2x2= 4**

a)Explain Bellmann – Zadeh's principle.

b)Consider the universal set $X=\{-3,-2,-1,0,1,2,3\}$ and a function defined on X is $f(x)=|x|$. Then find $f(\tilde{A})=\tilde{B}$ where,

$\tilde{A}=\{(-3,0.2),(-2,0.3),(-1,0.4),(0,0.5),(0,0.6),(2,0.7),(3,0.8)\}$

c)Find α -cut of triangular fuzzy number $\tilde{A}=(3,8,12)$ for $\alpha=0.2\,\&\,0.7$

d)Define interval number and fuzzy number.

2. **a)**Let A' be a fuzzy set in X with membership function $\mu_{\tilde{A}}(x)$ Let, A_α be the α -cut of $\tilde{A}$ and $\chi_{A_\alpha}(x)$ be the characteristic function of the crisp set A_α for $\alpha \in (0,1]$. Then for each $x \in X$, show that $\mu_{\tilde{A}}(x) = \sup\{\alpha \wedge \chi_{A_\alpha}(x) : 0 < \alpha \le 1\}$

   b)Let $\tilde{A} = (5,7,11,15)$ and $\tilde{B} = (1,9,13)$ be two fuzzy numbers, then show that $\tilde{A} + \tilde{B} = (6,16,20,28)$ and $2\tilde{A} - \tilde{B} = (-3,5,13,29)$

   2+6

3. **a)**Explain Zadeh extension principle

   b) Consider the universal set $X_1 = \{-2,-1,0,1,2,3\}$, $X_2 = \{-3,-2,-1,0,1,2\}$ Given that $\tilde{A} = \{(-2,0.7),(-1,0.6),(0,0.5),(1,0.4),(2,0.3),(3,0.2)\}$ and $\tilde{B} = \{(-3,0.5),(-2,0.4),(-1,0.5),(0,0.3),(1,0.4),(2,0.2)\}$ are two fuzzy sets defined on X_1 and X_2 respectively and $f(x_1,x_2) = |x_1| + |x_2|$ .Then obtain the fuzzy set $\tilde{C}$ *s.t* $f(\tilde{A},\tilde{B}) = \tilde{C}$

   2+6

4. **a)**Show that fuzzy sets satisfy the distributive law over standard sets operations.

   b)Define Convex Fuzzy Set. Show that intersection of two fuzzy numbers is Convex fuzzy set but union is not in general.

   4+4

Internal Assessment - 5

Unit - II

[Soft Computing]

Full Marks: 25

5. **Answer any two questions :** **2x2= 4**

   a)What are the basic differences between traditional computing and soft computing?.

   b)Define bias and threshold in artificial neural network.

   c) What is the necessity of cross-over in Genetic Algorithm?

   d) Find the max-min composition of the following fuzzyrelations.

$$\tilde{R}_1 : \begin{array}{c} \\ x_1 \\ x_2 \\ x_3 \end{array} \begin{array}{c} \begin{array}{cc} y_1 & y_2 \end{array} \\ \begin{bmatrix} 0.3 & 0.2 \\ 0.1 & 0.7 \\ 1 & 0 \end{bmatrix} \end{array} \text{ and } \tilde{R}_2 : \begin{array}{c} \\ y_1 \\ y_1 \end{array} \begin{array}{c} \begin{array}{cccc} z_1 & z_2 & z_3 & z_4 \end{array} \\ \begin{bmatrix} 0 & 1 & 0.8 & 0.6 \\ 0.5 & 0 & 0.2 & 0.5 \end{bmatrix} \end{array}$$

6. **a)**Determine the weights of a single layer perceptron network for implementing the logical AND gate considering bias b =1

   b)Explain Semantic Equivalence with example

   c) Give a brief note on roulette-wheel selection process in genictic Algorithm.

   d) Realize the logical XOR function using McCulloch-Pitts neuron model.

7. Answer any one question

a)Maximize $f(x) = \sin x, 0 \le x \le \pi$ using binary coded GA (one iteration only) Given that population size N = 6, initial population

$x_1 = 10011, x_2 = 10101, x_3 = 10110, x_4 = 11100, x_5 = 01010, x_6 = 01111$ random numbers for selection : 0.19, 0.63, 0.97, 0.11, 0.70, 0.51; cross-over probability, $p_c = 0.65$; random numbers for cross-over: 0.60, 0.85, 0.57, 0.37, 0.70, 0.32; mutation probability, $p_m = 0.05$; and random numbers for mutation: 0.21, 0.37, 0.02, 0.52, 0.07, 0.97, 0.04, 0.61, 0.17, 0.09, 0.14, 0.82, 0.08, 0.21, 0.37, 0.20, 0.25, 0.72, 0.24, 0.16, 0.47, 0.58, 0.49, 0.01, 0.18, 0.09, 0.82, 0.26, 0.43, 0.08. 8

b) Write the procedure of perceptron neural network for single output class. Using it finds the weights required to perform the following classifications

$\{[(1,1),1],[(-1,1),1],[(1,-1),1],[(-1,-1),-1]\}$ 8

Internal Assessment - 5
