2022

M.Sc.

4th Semester Examination

APPLIED MATHEMATICS WITH OCEANOLOGY AND COMPUTER PROGRAMMING

PAPER—MTM-402

Full Marks : 50

Time : 2 Hours

The figures in the margin indicate full marks.

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

MTM-402 (UNIT-1)
FUZZY MATHEMATICS WITH APPLICATIONS

1. Answer any *two* questions : 2×2

(a) How uncertainty can be handled in science and engineering ?

(b) Define trapezoidal and Gaussian fuzzy number.

(c) Find α-cut of triangular fuzzy number $\overline{A} = (2, 8, 12)$ for α = 0.4 & 0.6.

(d) What do you meant by symmetric and non-symmetric fuzzy LPP ?

2. Answer any *two* questions : 2×4

(a) Illustrate Zadeh's Extension principle. Use it, show that 7 – 4 = 3.

(b) Show that fuzzy sets do not satisfy laws of contradiction and excluded middle.

(c) Define convex fuzzy set. Show that union of two fuzzy numbers is not convex in general.

(d) Graphically explain how a triangular fuzzy number $\overline{A} = (1, 5, 13)$ can be expressed in the form $\overline{A} = \cup \{\alpha A_\alpha : 0 < \alpha \leq 1\}$, where U denotes the standard fuzzy union, αA_α is a special fuzzy set define as $\mu_{\alpha A_\alpha}(x) = \alpha \wedge \chi_{A_\alpha}(x)$ and χ is a characteristic function of a crisp set.

3. Answer any *one* question : 1×8

(a) (i) Let $\tilde{A} = (5, 7, 10)$ and $\tilde{B} = (0, 3, 9, 13)$ be two fuzzy numbers, then find $\tilde{A} + 2\tilde{B}$ and $\tilde{A} - \tilde{B}$.

(ii) Evaluate :
$15(1, 5, 11) - 10(0, 2, 7, 11) + 6[-3, 10] + 25$. 6+2

(b) Illustrate the Bellman and Zadeh's principle for fuzzy LPP. Explain Zimmermann's method to convert the fuzzy LPP to crisp LPP. 2+6

[Internal assessment – 05]

MTM–402 (UNIT–2) SOFT COMPUTING

1. Answer any *two* questions : 2×2

(a) Write the features of soft computing.

(b) Differentiate between BNN and ANN.

(c) What is the necessity of mutation in Genetic Algorithm ?

(d) Find the max-min composition of the following fuzzy relations :

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

2. Answer any *two* questions : 2×4

(a) Let X = {1, 2, 3, 4} and Y = {a, b, c} be two universes of discourses. Also, let

$\tilde{A} = \{(1, 0.2), (2, 0.5), (3, 0.7), (4, 1.0)\}$,

$\tilde{B} = \{(1, 0.3), (2, 0.4), (3, 0.8), (4, 0.7)\}$ and

$\tilde{C} = \{(a, 0.1), (b, 0.6), (c, 0.9)\}$. Determine the fuzzy relation of the following fuzzy rule "IF x is $\tilde{A}$ AND x is $\tilde{B}$ THEN y is $\tilde{C}$".

(b) Explain different ANN learning procedures.

(c) Write mathematical formula of fuzzy logic connectives.

(d) Write the hebbian and perceptron learning rules. Find the weights and threshold values that should classify the following input/output pairs.

x_1	x_2	$f(x_1, x_2)$
0	0	0
0	1	0
1	0	1
1	1	1

3. Answer any *one* question : 1×8

(a) Maximize $f(x) = |2x + 1|$; $0 \leq x \leq 10$ 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.

(b) Write the procedure of perception neural network for single output class. Using it find the weights required to perform the following classifications {[(1, 1), 1], [(−1, 1), −1], [(1, −1), 1], [(−1, −1), −1]}.

[Internal assessment – 05]

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