DHANAMANJURI UNIVERSITY

Examination- 2024 (JUNE)

M.Sc 2nd Semester

Name of Programme : M.Sc. Mathematics
Paper Type : Theory
Paper Code : OPE-006
Paper Title : Fuzzy set theory and Mathematicsl Programming
Full Marks : 40
Pass Marks : 16 **Duration: 2 Hours**

The figures in the margin indicate full marks for the questions:

Answer any four of the following questions: **$4 \times 10 = 40$**

1. a) Define the following terms
   i) Universal fuzzy set
   ii) $\alpha-$ cut of a fuzzy set
   iii) Compliment of a fuzzy set
   iv) Power of a fuzzy set
   v) Cardinality of a fuzzy set.

   b) Illustrate the three fuzzy sets that represent the concept of a young, middle and old aged person by a trapezoidal membership function. Also draw the figure to represent the above membership function.

2. Define
   a) union of fuzzy sets
   b) Intersection of fuzzy sets
   c) $\tilde{A}$ and $\tilde{B}$ be two fuzzy sets defined on the universal set X, prove that

$$|\tilde{A}| + |\tilde{B}| = |\tilde{A} \cup \tilde{B}| + |\tilde{A} \cap \tilde{B}|.$$

3. Define LPP and write the canonleal forms of LPP. An oil company has two units A and B which products three different grades of oil super fine, medium and low grade oil. The company has to supply 12,8,24 barrels of super fine, medium and low grade oils respectively per week. It costs the company Rs. 1,000 and Rs. 800 per day to run the units A and B respectively. On a day Unit A products 6,2 and 4 barrels and the unit B produces 2,2 and 12 barrels of super fine, medium and low grade oil per day. The manager has to decide on how many days per week should each unit be operated in order to meet the requirement at minimum cost. Formulate the LPP model, Also solve it by using graphical method.

4. **Answer the following questions:**
   Use the Simplex method to solve the following LPP.

$$\text{Minimise } Z = -2x_1 + 3x_2$$

$$\begin{aligned} \text{Subject to: } & 2x_1 - 5x_2 \leq 7 \\ & 4x_1 + x_2 \leq 8 \\ & 7x_1 + 2x_2 \leq 16 \\ & x_1,\ x_2 \geq 0 \end{aligned}$$

5. Answer the following questions:
   Use Big M method to solve the following LPP:

$$\text{Maximise } Z = 3x_1 - x_2$$

$$\begin{aligned} \text{Subject to } & 2x_1 + x_2 \geq 2 \\ & x_1 + 3x_2 \leq 3 \\ & x_2 \leq 4 \qquad\qquad x_1, x_2 \geq 0 \end{aligned}$$

6. Answer the following questions:
   Use two-phase method to solve the following LPP:

$$\text{Minimise } Z = 3x_1 + 8x_2$$

$$\begin{aligned} \text{Subject to: } & x_1 + x_2 = 200 \\ & x_1 \geq 80 \\ & x_2 \leq 60 \qquad x_1, x_2 \geq 0 \end{aligned}$$

7. Solve the following transportation problem with cost coefficients demands and supplies as given in the following table. Find the optimum solution.

	D_1	D_2	D_3	D_4	Supply
O_1	6	1	9	3	70
O_2	11	5	2	8	55
O_3	10	12	41	7	70
Demand	85	35	50	45	

8. Answer the following question:
   Five different machines can do any of the required five jobs with different profits resulting from each assignment as given below.

Jobs/Machines	Machine A	Machine B	Machine C	Machine D	Machine E
Job1	40	47	50	38	50
Job2	50	34	37	31	46
Job3	50	42	43	40	45
Job4	35	48	50	46	46
Job5	39	72	51	44	49

Find out the maximum profit possible through optimal assignment.

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