JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- 2025

PhD-I Semester (Mathematics)

COURSE CODE (CREDITS): 18P1WGE101 MAX. MARKS: 25

COURSE NAME: RM (Module-3)

COURSE INSTRUCTORS: BKP MAX. TIME: 2 Hours

Note: *(a) All questions are compulsory.*

(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

<table>
<tr><th>Q.No</th><th>Question</th><th>CO</th><th>Marks</th></tr>
<tr><td>Q1</td><td>To compare two sensors based upon their detection levels and gain setting, following table gives gain settings and sensor detection level with a standard item being monitored provides typical membership values to represent the detection level for each of the sensors:
<table>
<tr><th>Gain Setting</th><th>Sensor 1 (S_1) detection level</th><th>Sensor 2 (S_2) detection level</th></tr>
<tr><td>0</td><td>0</td><td>0</td></tr>
<tr><td>20</td><td>0.5</td><td>0.35</td></tr>
<tr><td>40</td><td>0.65</td><td>0.5</td></tr>
<tr><td>60</td><td>0.85</td><td>0.75</td></tr>
<tr><td>80</td><td>1</td><td>0.9</td></tr>
<tr><td>100</td><td>1</td><td>1</td></tr>
</table>
The universe of discourse is $X = \{0, 20, 40, 60, 80, 100\}$. Find the membership function for the two sensors S_1 and S_2. Also find the fuzzy sets $S_1 \cap S_2$, $S_1 \cup S_2$, $\overline{S_1 \cap S_2}$ and $\overline{S_1 \cup S_2}$ using standard operations.</td><td></td><td>5</td></tr>
<tr><td>Q2</td><td>Let $X = \{1, 2, 3, 4, 5\}$ and fuzzy set $A = \{(1, 0.7), (2, 0.3), (3, 0.5), (4, 0.9), (5, 0.6)\}$, Find the strong α cut set for $\alpha = 0.3,\ 0.5$ and 0.9. Also find the level set of A.</td><td></td><td>5</td></tr>
<tr><td>Q3</td><td>Consider two fuzzy sets, A and B, with membership functions defined as follows:
$A = \{(x_1, 0.7), (x_2, 0.3), (x_3, 0.4)\}$
$B = \{(y_1, 0.3), (y_2, 0.6), (y_3, 0.8)\}$
Define the fuzzy relation on the given fuzzy sets.</td><td></td><td>5</td></tr>
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Q4	Consider a population of chromosomes in a genetic algorithm, where each chromosome represents a solution to a problem. The fitness values of the chromosomes are as follows: Chromosome 1: Fitness = 75; Chromosome 2: Fitness = 82; Chromosome 3: Fitness = 69; Chromosome 4: Fitness = 88; Chromosome 5: Fitness = 71. If we use tournament selection with a tournament size of 3, which chromosomes would be selected as parents for reproduction? Write the each step of tournament selection.		5
Q5	Draw the flow chart of standard genetic algorithm.		5