JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- 2023

B.Tech-VIII Semester (CSE/IT/ECE/CE)

COURSE CODE (CREDITS): 21B1WMA831 (3) MAX. MARKS: 35

COURSE NAME: Soft Computing & Optimization Algorithms

COURSE INSTRUCTORS: Dr. B. K. Pathak MAX. TIME: 2 Hours

Note: *All questions are compulsory. Marks are indicated against each question in square brackets.*

---

1. Consider two fuzzy sets, A and B, with membership functions defined as follows:
   A = {(0, 0.2), (1, 0.8), (2, 1.0), (3, 0.6), (4, 0.4)}
   B = {(0, 0.4), (1, 0.6), (2, 0.9), (3, 0.2), (4, 0.1)} [CO-2] [5 Marks]
   (a) Find the standard complement, union and intersection.
   (b) Also check whether De Morgan's Law holds or not.
   (c) If we set the alpha cut at 0.5, what is the result of the fuzzy union and fuzzy intersection between sets A and B?
   Note: The membership function is defined as (element, membership degree).

2. 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)} [CO-3] [5 Marks]
   Define the fuzzy relation on the given fuzzy sets.

3. Suppose you are designing a fuzzy membership function to determine the level of "humidity" based on a set of data points. You decide to use a trapezoidal membership function with the following parameters: [CO-3] [5 Marks]
   - Minimum humidity for "low": 20%
   - Moderate low humidity: 30%
   - Moderate high humidity: 40%
   - Maximum humidity for "high": 50%

   (a). Write the equation for the trapezoidal membership function.
   (b). If the current humidity level is 25%, what is the degree of membership for "low"?
   (c). If the current humidity level is 35%, what is the degree of membership for "low"?
   (d). If the current humidity level is 45%, what is the degree of membership for "high"?

4. 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.
   [CO-3] [5 Marks]

5. A roulette wheel for genetic algorithm has the following values assigned to different sections: [CO-4] [7 Marks]
   a. Section A_1: 25% probability of being selected
   b. Section A_2: 15% probability of being selected
   c. Section A_3: 20% probability of being selected
   d. Section A_4: 40% probability of being selected

   If we need to select 10 parents for reproduction using this roulette wheel.
   (a) What is the probability of selecting section A_1 exactly once in 10 spins of the roulette wheel?
   (b) What is the probability of selecting section A_2 at least twice in 10 spins of the roulette wheel?
   (c) What is the expected number of times section A_3 will be selected in 10 spins of the roulette wheel?
   (d) If we spin the roulette wheel 10 times, how many parents will be selected from Section A_4 ?

6. Describe hard computing and soft computing, and what are their characteristics? [CO-1] [4 Marks]

7. Draw the flow chart of standard genetic algorithm. [CO-4] [4 Marks]