EEL706: Soft Computing

MAJOR

Answer all questions | Max. Marks: 30; | Time: 2 hrs

Q1. Let the two chromosomes be given by (101011001010) and (110011010101). Use two-point crossover (first point after two digits and the second point after 8 digits) to generate two children. Apply mutation after every 2nd digit in a group of three digits to generate the offspring.

(4)

Q2. Find the peak of the function $f(x) = 3(1-x^2) * \exp\{-(x+1)^2\}$ using PSO. Take $\omega = 1; \alpha = \beta = 2; r_1 = 0.6; r_2 = 0.8; f_{best} = 1000$. Here r1 and r2 represent the random numbers. The number of swarms is 4. The initial values of velocities are taken to be zero. Assume $x(i) = i$ to begin with. Evaluate the solutions for three iterations and give the peak function value at the end of three iterations. (8)

Q3. Given the input-output pairs (10, 0.2), (13, 0.7), (9, 0.4), (5, 0.1), (11, 0.3), (7, 0.01), (14, 0.5), (12, 0.4), (6, 0.2), (9, 0.6), (7, 0.3) and (10, 0.4), find the values of fuzzy curve and find the number of rules from the values of the fuzzy curve. Take b = 20% of the input range using the Gaussian type function.

(8)

Q4. A single-input and single-output Mamdani fuzzy inference system is described as follows:

IF X is *small* THEN Y is *small*.
IF X is *medium* THEN Y is *medium*.
IF X is *large* THEN Y is *large*.

The trapezoid membership functions for input linguistic values *small*, *medium*, and *large* are as follows:
Trap(x, [-20,-15, -6, -3]), Trap(x, [-6,-3, 3,6]), Trap(x, [3, 6,15, 20])

The trapezoid membership functions for output linguistic values *small*, *medium*, and l*arge* are as follows:
Trap(x, [-2.46,-1.46, 1.46, 2.46]), Trap(x, [1.46,2.46,5,7]), Trap(x, [5,7,13,15]).

Suppose the input values are $x = -8$ and 5, calculate the corresponding defuzzified outputs with centroid defuzzification strategy. (10)