Soft Computing (CS 5161)

Full Marks: 50   **Time: 1Hour 30 minutes**
<u>Answer any five questions</u>

1. Consider the function $f(x) = 5x^3 + 6x^2 - 2x + 1$.
   a) How many local minima does f(x) have?   [4]
   b) What are the locally minimizing values of x?   [3]
   c) Why GA performs better than local search optimization techniques? [3]

2) a) Write different steps of genetic algorithm.   [4]
   b) Given the following parents, P_1 and P_2, and the template T

P_1	A	B	C	D	E	F	G	H	I	J
P_2	E	F	J	H	B	C	I	A	D	G
T	1	0	1	1	0	0	0	1	0	1

   Assume that C_n, are crossover points where $C_n = 0$ means that the crossover point is at the extreme
   left of the parent. Show how the following crossover operators work with regards to genetic algorithms.
   i) one point crossover (using $C_1 = 4$)
   ii) two point crossover (using $C_2 = 2$ and $C_3 = 8$)   [6]

3a) Cluster the following eight points (with (x, y) representing locations) into three clusters:
   A1(2, 10), A2(2, 5), A3(8, 4), A4(5, 8), A5(7, 5), A6(6, 4), A7(1, 2), A8(4, 9). Initial cluster centers are:
   A1(2, 10), A4(5, 8) and A7(1, 2).The distance function between two points a = (x1, y1) and b = (x2, y2)
   is defined as- P(a, b) = |x2 − x1| + |y2 − y1|
   Use K-Means Algorithm to find the three cluster centers after the second iteration.   [7]
   b) What are the weaknesses of the k-means clustering algorithm?   [3]

4) a) What are differences between supervised learning and unsupervised learning? [4]
   b) Define precision and recall   [2]
   c) What is a training set and how is it used to train neural networks? [4]

5) a) What is defuzzification? Why is it needed? Explain with example [4]
   b) How is the fuzzy set different from classical set?   [3]
   c) Can a fuzzy membership be 'True' and 'False' at the same time?   [3]

6) a) What is ANN? Where we can apply pattern classification method?   [4]
   b) Can perceptron solve the non-linear problem? Explain.   [2]
   c) Write down the back-propagation algorithm.   [4]

7) a) What is a Multi-layer Perceptron(MLP)?   [3]
   b) What is the recurrent neural network?   [4]
   c) What is the difference between Epoch, Batch, and Iteration in Deep Learning? [3]