

Indian Institute of Engineering Science & Technology, Shibpur
M.TECH (Open Elective), 1st semester Final Examination, November, 2019

Soft Computing (CS- 5161)

Full Marks: 50

Time: 3Hours

Answer any five questions

- 1) a) Describe the steps of the Simulated Annealing (SA) method. [3]
 b) Define 'Local Maxima' for any optimization algorithm. [2]
 c) What are the limitations of 'Hill Climbing' procedure? [3]
 d) How will you measure the performance of any optimization algorithm? [2]

- 2) a) Name and describe the main features of Genetic Algorithms (GA). [3]
 b) Write different steps of GA. [2]
 c) Why GA performs better than local search optimization techniques? [2]
 d) 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

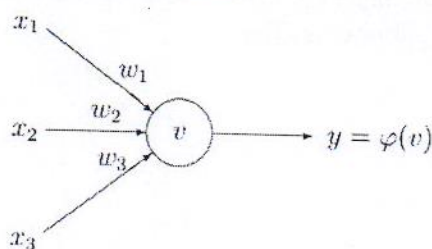
Assume that C_n are crossover points where $C_n = 0$ means that the crossover point is at the extreme left of the parent.

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 $C_3 = 8$)

[3]

- 3) a) Below is a diagram of a single artificial neuron (unit):



The node has three inputs $x = (x_1, x_2, x_3)$ that receive only binary signals (either 0 or 1). How many different input patterns this node can receive? Explain what happens if the node had four inputs? Can you give a formula that computes the number of binary input patterns for a given number of inputs?

[4]

- b) What is a training set and how is it used to train neural networks? [2]
 c) What is an epoch? How will it help in convergence? [2]
 d) How will you measure the performance accuracy of a neural network? [2]
 4) a) What is a fuzzy set? How is it different from a classical set? [2]
 b) What is a membership function of a fuzzy set? [2]
 c) Define Trapezoidal, Gaussian and Triangular membership functions. [2]
 d) Can a fuzzy membership be 'True' and 'False' at the same time? [2]
 e) What is a fuzzy variable? [2]

- 5) a) Explain the method of gradient descent search. [3]
 b) What is ANN? Where we can apply pattern classification method? [3]
 c) Can perceptron solve the non-linear problem? Explain. [1]
 d) Write down the back-propagation algorithm. [3]
- 6) a) Why do we use high crossover probability value and low mutation probability value in a genetic algorithm? [3]
 b) What is defuzzification? Why is it needed? Explain with example. [2]
 c) What is the role of activation function in the neural network? [2]
 d) A neuron with 3 inputs has the weight vector $w=[0.1 \ 0.3 \ -0.2]$. The activation function is binary sigmoidal activation function. If input vector is $[0.8 \ 0.6 \ 0.4]$, then find the output of the neuron. [3]
- 7) a) What do you mean by 'outliers'? [2]
 b) How will you find a solution is 'global optima' or 'local optima'? [1]
 c) Cluster the following points by the k-means clustering method. Let $k=2$. [4]

Subject	x	y
1	1.0	1.0
2	1.5	2.0
3	3.0	4.0
4	5.0	7.0
5	3.5	5.0
6	4.5	5.0
7	3.5	4.5

- d) What are the weaknesses of the k-means clustering algorithm? [1]
 e) Define the workflow of the K-nearest neighbor classifier. [2]