

C9-R4 : SOFT COMPUTING

NOTE :

1. Answer question 1 and any FOUR questions from 2 to 7.
2. Parts of the same question should be answered together and in the same sequence.

Time : 3 Hours

Total Marks : 100

1. (a) What is soft computing ? How does it differ from hard computing ?
 (b) Explain the working principle of Genetic Algorithm.
 (c) Consider an optimization problem to be solved using Genetic Algorithm: "Given a set of items, each with a weight and a value, determine the number of each item to include in a collection so that the total weight is less than or equal to a given limit and the total value is as large as possible." What is the suitable encoding strategy to represent candidate solutions ?
 (d) Explain elitism in selection schemes of Genetic algorithms.
 (e) Define a Neuro-Fuzzy system. What are the advantages of modelling such a hybrid system ?
 (f) What is reinforcement learning ? How does it relate with other ML techniques ?
 (g) What are genetic fuzzy systems ? Justify the need of hybridizing genetic algorithm with fuzzy systems. (7x4)

2. (a) What is the guiding principle of soft computing ? Explain the principal constituents of soft computing.
 (b) Explain steepest ascent hill climbing algorithm. Draw the state space diagram for hill climbing showing different types of region. Which are the regions if the algorithm falls into, then it will stuck in local optima ? (8+10)

3. (a) Write a standard procedure to explain the working of Genetic Algorithm.
 (b) Explain Roulette Wheel Selection procedure in Genetic Algorithm. Given are the initial population, their fitness and the random numbers generated for selection process. Apply the Roulette Wheel Selection procedure and find the next population. Discuss the generated solution to point out the limitations of the selection mechanism.

No.	Initial Population	Fitness value F_i	Random No.
1	0000 0000	1	0.259
2	0010 0001	2.1	0.038
3	0001 0101	3.11	0.486
4	0010 1000	4.01	0.428
5	0110 1010	4.66	0.095
6	1110 1000	1.91	0.3
7	1110 1101	1.93	0.616
8	0111 1100	4.55	0.897

(7+11)

4. (a) Define linear regression. Explain the steps of Least Squares linear regression method to find the best fit line for the given N points. Find the best fit line for the points (x, y) given below using Least Squares linear regression. $\{(2, 4), (3, 5), (5, 7), (7, 10), (9, 15)\}$
- (b) Explain cooperative and concurrent Neuro-Fuzzy models and their working with appropriate diagrams. (10+8)
5. (a) What is the difference between derivative free and derivative based optimization ?
- (b) Draw a block diagram of a generic fuzzy inference system. Explain it's working.
- (c) Write in short about the following :
- (i) Neuro-evolutions
- (ii) Fuzzy filtered Neural Network
- (iii) Fuzzy sets vs. Rough sets (6+6+6)
6. (a) What is an adaptive neuro-fuzzy inference system ? Discuss it's strengths. Explain it's architecture that integrates neural learning with fuzzy controller.
- (b) How does the genetic parameters such as crossover rate and mutation rate govern the exploration and exploitation phases of a genetic algorithm ? How to incorporate fuzzy logic controllers within genetic algorithms in order to optimize these parameters ? Explain. (10+8)
7. (a) What is a recurrent neural network ? Explain backpropagation through time technique for training a recurrent neural network. What are it's advantages and disadvantages ?
- (b) What is a Neuro Genetic hybrid system ? Explain it's working and mention it's strengths and limitations. (12+6)

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