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Department: CSE

Genetic Algorithms & Applications (CSE 3031)

Exam Type: Mid Term

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Time: 90 minutes **Date: 26/09/2019** **Max. Marks: 30**

Name: **Roll No.**

Instructions:

1. Answer must be in brief and to the point. No query will be handled during exam. Though careful proof reading has been done, even then if you have any doubt/confusion regarding the question you can make your assumptions. You must write your assumptions clearly before you start attempting that question. If instructor thinks that your doubt/confusion/assumption is genuine, then it will be entertained.

2. Use following random numbers in circular fashion starting from left for any problem if required. For example, if a question requires five random numbers and other question requires 3 random numbers then you will use first five random numbers for the first question and you will use 6th, 7th and 8th for the second question available in the given list. Moreover, if there is no random number available for the use in the list (if all random numbers are used from the list and you require more for other questions), then use them in circular fashion.

[.2 .4 .1 .5 .6 .5 .2 .3 .7 .9]

Q.1 **Marks [2.5 +2.5=5]**

a) Assume that you use k-tournament selection with population size 100, what is the probability that the best solution is chosen?

b) Assume that you use 3-tournament selection with population size 50; what is the probability that the third best solution is chosen?

Q. 2 **Marks [(1.5+1.5) + (2+2)+2=9]**

(a) A genetic algorithm is used for evolving a binary string of length n containing only 1s, say if n=3 the string is 111. The initial population is a randomly generated as a set of binary strings of length n.

i. Give a suitable fitness function for this problem.

ii. Will the offspring of parents with a high fitness values generally also have a high fitness value, as per the fitness function of part i? Explain your answer.

(b) Suppose the problem is to evolve a binary string of length n, which is symmetric. If the string positions are numbered from '0', then a symmetric string will have a '1' in position 'i' if and only if there is a 1 in position '(n-1)-i'. For example, 001100 is symmetric since it has a '1' at index 2 and a '1' at index (6-1)-2 = 3. Similarly, 110011 is symmetric, and 011011 is not. The initial population is

a randomly generated set of binary strings of length n, where n is an even number.

i. Give a suitable fitness function for this problem.
ii. Will the offspring of parents with a high fitness values generally also have a high fitness value, given your fitness function? Explain your answer.

(c) If the population size in a genetic algorithm is restricted to 1, what search algorithm does it correspond to? Explain your answer.

Q.3 **Marks [2+3=5]**

a) Discuss Roulette Wheel Selection (RWS) in detail.
b) Six strings have the following fitness values: 3,6,9,12,15, 18 for a maximization problem. Under Roulette Wheel Selection, compute the expected number of copies of each string in the mating pool if a constant population size 6 is maintained.

Q. 4 **Marks [3+3=6]**

Apply Cyclic and Order crossover operators for the pair of following chromosomes to generate two new offspring

Chromosome 1= (4 8 7 3 6 5 1 10 9 2)

Chromosome 2= (3 1 4 2 7 9 10 8 6 5)

Note: Use crossover points as 4 & 8 if required and show steps too.

Q. 5 **Marks [1.5+1.5+2=5]**

a) Discuss the significance of exploitation and exploration in the context of Genetic algorithms.
b) Discuss the significance of crossover and mutation probabilities.
c) State the 0-1 knapsack problem and provide a suitable representation scheme for the use of Genetic Algorithms to solve this problem.