CSCI 4560/6560 Evolutionary Computation

Assignment Number 3: Due Monday 10/2/2006 **(in class)**

1. **[20 points]** Consider a genetic algorithm using a vector of integer representation with vectors of length 5. Assume that the initial population was as follows:

Individual	Genotype	Fitness
1	3,4,1,2,5	200
2	1,4,3,2,2	300
3	5,2,5,3,1	400
4	4,2,3,3,3	100

   (a) What is each individual's probability of being selected as parent if deterministic binary tournament selection is used (in which two distinct individuals selected randomly with uniform probability compete in any tournament)?

   (b) What is each individual's probability of being selected as parent if linear rank based selection is used (in which the worst individual in the population has a zero probability of being selected for mating)?

   (c) If we select individuals 1 and 2 as parents for **uniform** crossover (in which each gene is selected from either parent with equal probability), list the genotypes of all possible children that may result.

   (d) If we select individuals 3 and 4 as parents for **1-point** crossover (in which the crossover point is selected with uniform probability), list the genotypes of all possible children that may result.

2. **[10 points]**

   Consider a genetic algorithm using permutation representation with length 5. Consider the following two parents:

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Parent1: E B D C A
Parent2: A B E D C
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   (a) Give two examples of individuals that could result from doing the **scramble** mutation to Parent1. Briefly explain how you got these individuals.

   (b) Give an example of an individual that could result from doing the **PMX** crossover of Parent1 and Parent2. Briefly explain how you got this individual.

3. **[10 points]** A population consists of six individuals with the following fitness function values: 5,10,15,25,50,100.

   (a) Under fitness proportional (roulette wheel) selection, calculate each individual's probability of being selected for mating.

   (b) Recalculate the probabilities if the fitnesses are scaled prior to roulette wheel selection using the Sigma scaling method with c=2.

(c) Repeat part (b) above after changing the fitness of the fittest individual to 10000 instead of 100.

4. **[10 points]** Solve Problem 2 Page 86 in the text book.

5. **[10 points]** Solve Problem 2 Page 97 in the text book.