CSCI 4560/6560 Evolutionary Computation

Assignment Number 3: Due 9/27/2012 **(in class)**

1. **[20 Points][MID]** 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	5,2,5,3,1	10
2	4,2,3,3,3	20
3	3,4,1,2,5	10
4	1,4,3,2,5	30

   (a) What is each individual's probability of being selected as parent if proportional (roulette wheel) selection is used?

   (b) What is each individual's probability of being selected as parent if deterministic binary tournament selection is used (in which two distinct individuals compete in any tournament and ties are broken randomly)?

   (c) If we select individuals 3 and 4 as parents for N point crossover for some value of N, can the genotype of a resulting child be 3,4,3,2,5? how about 1,4,1,2,3? Briefly justify your answer.

2. **[20 Points][MID]** Consider a genetic algorithm doing **unconstrained maximization** using a vector of float representation with vectors of length 5. Assume that the range for each gene is from 0 to 10 inclusive. Assume that the population at some stage was as follows:

Individual	Genotype					Fitness
1	3.1	4.4	1.3	2.2	5.2	20
2	1.3	4.4	3.1	2.2	2.5	30
3	5.4	2.2	5.3	3.3	1.3	40
4	4.5	2.2	3.5	3.3	3.1	10

   (a) If we select individuals 1 and 2 as parents for **whole arithmetic recombination** crossover, give the genotype of one possible child that may result. Very breifly explain how you got it.

   (b) If we select individuals 3 and 4 as parents for **one-point crossover**, give the genotype of one possible child that may result. Very breifly explain how you got it.

   (c) If we select individual 1 for **uniform** mutation and assuming that the first gene is to be mutated, give the genotype of one possible child that may result. Very breifly explain how you got it.

   (d) **For 6560 Students only** What is each individual's probability of being selected as parent if deterministic ternary tournament selection is used (in which three distinct individuals compete in every tournament)?

3. [**20 points**][**MID**] Consider a genetic algorithm using permutation representation with length 10. Consider the following two parents:

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Parent1: A B C D E F G H I J
Parent2: E H I J F A C D G B
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   (a) Give two examples of individuals that could result from doing the **swap** mutation to Parent1.

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

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

4. [**10 points**] Solve Problem 5 Page 68 in the text book.

5. [**10 points**] Solve Problem 3 Page 86 in the text book.