CSCI 4560/6560 Evolutionary Computation

Assignment Number 4: Due Thursday 11/29/2001 **(in class)**

1. **[10 points] Review question:**

   Consider a genetic algorithm using a binary representation with bit strings of length 5. Consider the following two fitness functions:

   - F1(x)=the number of ones in bit string x
   - F2(x)=the number of ones or zeros in bit string x whichever is larger

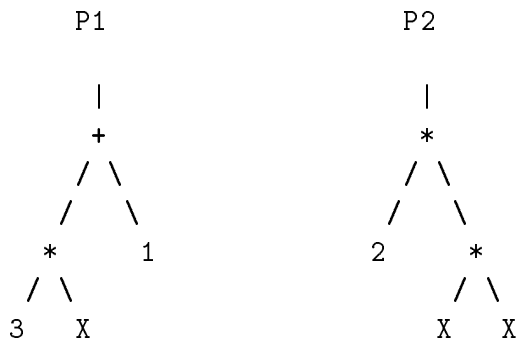
   (a) What is the average fitness of schema 11*** under F1?

   (b) What is the average fitness of schema 11*** under F2?

   (c) What is the average fitness of schema 00*** under F1?

   (d) What is the average fitness of schema 00*** under F2?

2. **[10 points]** Consider the following two genetic programming individuals:



   Assume the the fitness is based on the following set of I/O pairs:

X	F(X)
1	2
2	5
3	10
4	15

   (a) If the fitness (to be maximized) is taken to be the number of pairs an individual computes correctly for all the I/O pairs, compute the fitness for P1 and P2.

   (b) If the fitness (to be minimized) is taken to be the sum of the square errors for all the I/O pairs, compute the fitness for P1 and P2.

   (c) Give 4 examples of individuals that may result from the crossover of P1 and P2.

3. **[10 points]**

   The exclusive OR function (XOR) takes two binary inputs X1 and X2 and produces one binary output which is 1 if X1 and X2 are different and 0 otherwise.

(a) Give a decision tree which correctly computes the XOR function for any values of X1 and X2.

(b) Give a classifier system in the format used by the GIL program which correctly computes the XOR function for any values of X1 and X2 (i.e. matches the value pairs that result in a 1 and does not match the others).

4. **[10 points]**

Based on your studies in this course, identify at least 5 examples in which adaptive techniques were used to improve an evolutionary computation method.