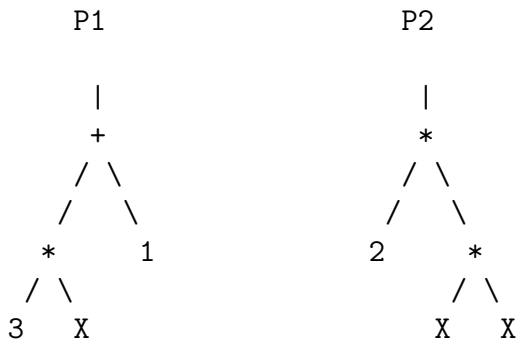
CSCI 4560/6560 Evolutionary Computation

Assignment Number 5: Due 11/12/2013 **(in class)**

1. [**10 points**] Give a classifier in the format used by the GIL program for each of the concepts C1 to C5 described in the classifier system handout on Page 268.

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	4
2	6
3	11
4	16

(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**][**FIN**]

Consider a genetic algorithm using a binary representation with bit strings of length 9. 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 1111***** under F1?

(b) What is the average fitness of schema 1111***** under F2?

(c) Which of the two fitness functions may suffer from genetic drift? Briefly justify your choice.

4. **[10 points]** Consider a genetic algorithm using binary representation with strings of length 5. Assume that the initial population (generation 0) was as follows:

Individual	Genotype	Fitness
1	10001	20
2	11100	10
3	00011	5
4	01110	15

Assume also that a standard generational GA (using 1-point crossover and bit mutation) is used with mutation probability $p_m = 0.01$ and crossover probability $p_c = 1.0$.

(a) Calculate a lower bound for the expected number of representatives of schema 1**** in generation 1.

(b) Calculate a lower bound for the expected number of representatives of schema 0**1* in generation 1.

5. **[10 points][FIN]: Short answers please!**

(a) Why is sharing more suitable for generational rather than steady state GAs?

(b) Why is crowding more suitable for steady state rather than generational GAs?

(c) Explain why diversity maintenance is usually **more** important in multi-objective evolutionary optimization than in single-objective evolutionary optimization.

(d) It is observed that most multi-objective evolutionary optimization methods are generational GAs. Why do you think this happened? Do you think this was a correct decision by the researchers? Briefly justify your answer.