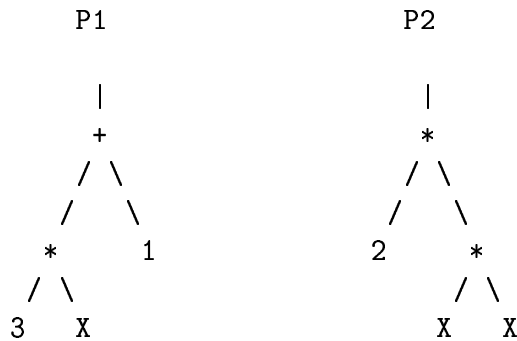


# CSCI 4560/6560 Evolutionary Computation

## Assignment Number 5: Due 11/20/2008 (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	3
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] 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?
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.