AI (6033) -- Fall 2013

Project 3 – Option A

Genetic Programming

Due at 11:59pm Dec 6

Each student should submit P3-GP.py

This project will require you to write a program to find an underlying mathematical function based on data using a genetic programming approach.

Your program should accept a single command-line parameter, the filename of a CSV datafile containing two columns of data, x,y with many sample rows.

Your goal is for your program to read this datafile and output a *simple* mathematical formula as a string that fits the datapoints as best as possible, such as:

f(x) = 5 * x + 2

Parenthesis can be added anywhere to clarify order of operations. To write the program, use a genetic programming approach where you use a genetic algorithm to explore the state space of possible mathematical formulas. The possible formula conform to the following BNF grammar:

```
<expression> ::= <expression> + <expression>
<expression> ::= <expression> - <expression>
<expression> ::= <expression> * <expression>
<expression> ::= <expression / <expression>
<expression> ::= floor( 100 *sin(<expression>) )    (in degrees)
<expression> ::= <expression> ^ <expression>
<expression> :: = [-510 .. 510] ∪ x    (integers in the rage, including the variable x)
```

The maximum depth (think of a formula as a tree using the above grammar) of your expression is 4. All computation is done using C ints, integer division, and do not overflow. See the included CSV text files for example mappings.

Your grade will consist of the following:

1. 30% - Submitting code.
2. 30% - Finding the formula of 2 of the example mappings in 2 minutes each within 100 RMS error.
3. 30% - Finding the formula for all example mappings in 2 minutes each within 500 RMS error.

4. 10% – Being able to find the formula for any mapping (similar to examples) in 2 minutes within 500 RMS error.

The formula for the 8 test files are:

1. $f(x) = 2 * x$
2. $f(x) = -5 * x + 7$
3. $f(x) = 35 * x + 2 * x^2$
4. $f(x) = x / 20$
5. $f(x) = (400 * 2) * sin(x)$ // Interpret sin as degrees
6. $f(x) = x^3 - (x + 10)^2$
7. $f(x) = ((4 * 509) + 3) * 4 - x * (x / 3)$
8. $f(x) = 100 * sin(x / 20)$