CSC 184 – Programming in Python
Project #3 – Breeding Giant Super Rats

Project is due on Wednesday, January 27, at 11:59 PM

For this assignment, you will be writing a program that simulates a genetic algorithm inspired breeding program to produce giant rats for your use as a mad scientist. Mwah ha ha!

The Task:
Your program should not prompt the user for any input. It should make use of the following constants, as defined in the code:
- GOAL_WEIGHT – The goal weight for your rats to achieve. 50,000 is a good value for this.
- NUM_FEMALES – The number of female rats that you keep from generation to generation. Also the number of female rats you begin the simulation with. 20 is a good value for this.
- NUM_MALES – The number of male rats that you keep from generation to generation. Also the number of male rats you begin the simulation with. 20 is a good value for this.
- INIT_MIN_WEIGHT – The initial minimum weight of a starting rat. 200 is a good value for this.
- INIT_MAX_WEIGHT – The initial maximum weight of a starting rat. 600 is a good value for this.
- INIT_MALE_AVERAGE – The average weight of a male starting rat. 350 is a good value for this.
- INIT_FEMALE_AVERAGE – The average weight of a female starting rat. 250 is a good value for this.
- MUTATE_PROB – The probability that a child will mutate. 0.01 is a good value for this.
- MUTATE_MIN – The smallest possible weight multiplier that a mutation can cause. 0.5 is a good value for this.
- MUTATE_MAX – The largest possible weight multiplier that a mutation can cause. 1.2 is a good value for this.
- LITTER_MAX – The largest number of children that a breeding pair can produce in one breeding. 8 is a good value for this. The smallest number of children that a pair can produce is 1.
- GENERATION_LIMIT – The maximum number of generations that your program will simulate. 500 is a good value for this.

The program should simulate the breeding of the rats using a genetic algorithm. Specifically, it should:
- Create an initial population of males and females, randomly selecting their weights using the minimum, maximum, and average values.
- Begin the generation simulation process:
  1. Cull all but the given number of males and females, keeping the largest possible rats.
  2. Print the weight of the largest male and female, along with the generation number.
  3. If the goal weight has been reached, finish the program. If the generation limit has been reached, finish the program.
  4. Have each female breed with a randomly selected male. This will create a litter of children, the number of which should be randomly determined. The weight of the child should be randomly distributed between the mother's and father's weight.
  5. Possibly mutate the child – if a mutation occurs, randomly determine the mutation multiplier using the min and max values given, and multiply the weight by the multiplier.
  6. Once the breeding is finished, integrate the newly created children with the original rats.
  7. Return to step 1.

You can experiment and "play around" with the values of the constants to see what effect they have on the performance of the program.

Administrative Details:
You should submit the program file on Moodle when it is complete.