CIS*4780 Assignment 2

Handed out: February 18th

Due date: March 14th, 11:59 pm

Total marks: 20

In this assignment you will gain experience experimenting with and implementing components of genetic algorithms. You are provided with a basic framework where cars drive along a random path and are selected and ranked based on performance with new generations created via 2-pt crossover. There is already some sophistication here, but you will need to extend this according to the instructions.

Everything is self-contained in the main file **genetic_car_sim.py**. This file has some dependencies that you will have to install. Assuming e.g. an Anaconda command prompt the easiest way to do this is using pip install. This relies on Box2D and pygame.

Within the code there are placeholders that show where to implement what is described below marked by a comment of # YOUR CODE HERE. Since there isn't a command line interface, to switch between e.g. methods of crossover you can do this in a hard-coded manner by uncommenting and commenting appropriate lines which are also marked.

Tasks:

0. An example of crossover is given as 2-pt crossover. You will have to implement other types of crossover.
1. [5 pts] Implement 1 point crossover as one method for combining cars
2. [5 pts] Implement uniform crossover as a method for combining cars. In this case, each bit that defines a car is taken from one parent or the other randomly so all bits involve a random choice in contrast to 1 or 2 point crossover.
3. [5 pts] Implement a method for mutation. The specifics of this are up to you. You will likely want to define a mutation rate that controls the likelihood of bits being mutated following crossover.
4. [5 pts] Include a lastname_firstname.txt file that outlines your experiments with the code:
    a. Do any of 1-pt, 2-pt or uniform crossover seem to perform better than the alternatives?
    b. How much does mutation seem to matter, and how sensitive are things to the mutation rate?
    c. Elite selection is included and has a default value of 3. If you alter this value do things tend to improve, get worse etc.?

You should submit:

Your **genetic_car_sim.py** file and your **lastname_firstname.txt** file to the appropriate dropbox on CourseLink.