CSE474 - Lab Task 3

1. Read these two chapters carefully:
   https://allendowney.github.io/ModSimPy/chap20.html
   https://allendowney.github.io/ModSimPy/chap21.html

2. Imagine that you are on planet Arrakis, where the average gravitational acceleration is 38% of that of Earth. You have gone there on a spaceship named Sandrider which is 58 meters tall. Assuming there is no air resistance in Arrakis' atmosphere, make a model of how long it would take for a penny to reach the ground from the spaceship's top. The mass, diameter, and density of the penny will be given as input (see this). You need to draw a time-vs-position graph as in Chapter 20 of Downey's book.

3. Unfortunately, you have an enemy on Arrakis, who has built giant factories there and filled the planet with gaseous materials. Now, there is a considerable amount of air resistance there. The terminal velocity of a penny on Arrakis has increased from almost 0 to 40 ms^{-1}. Right now, your industrialist enemy is standing below your spaceship and you can see him from the top. The only things you can drop on him are pennies of various masses, but they are all 20 c.m. in diameter. Make a model of how long it would take for your penny to reach your enemy below. Assume that the enemy is 3 meters tall. You need to draw a time-vs-position graph and a time-vs-velocity graph as in Chapter 21 of Downey's book. Also, draw a mass-vs-force-of-impact graph at the moment of its collision with your enemy's head. This can be calculated using the formula (kinetic energy)/(collision duration). You can assume the collision duration to be 0.1 s.

4. It takes a force of 2,300 Newton on average to crack a human skull. Your enemy, however, is stronger than average humans and it will require 10,000 Newton force to crack his skull. How heavy should your penny be to do this? Find it from the graph above. Mark all points above this critical mass with a different color in the graph.

Submit within 27 November, Saturday, 1:59 PM.
Your code should be well-commented.
The programming language should be Python 3.

CSE474 - Assignment 2

Choose two among the topics below:

1. Physics simulation.
2. Climate change simulation.
3. Ecosystem modeling.
4. Immune system modeling (with vaccination).
5. Stock market simulation.

6.   Network security simulation.

7.   Flight simulation.

8.   Urban model simulation.

9.   Weather forecasting modeling.

10. Robot simulation.

11. Agricultural simulation.

12. Power system simulation.

13. Protein folding prediction.

14. Noise reduction modeling.

15. You may also choose something else entirely, such as a car crash simulation.

For each of your two chosen topics, find a problem you want to investigate. You may, for example, want to simulate the spread of some diseases in the 1980s. Or you may model the rainfall patterns over the last few decades.

Your final project will be based on either one of these two problems. This assignment will be your "Initial Project Proposal". For each problem, write the problem statement first (for example, "Analyzing the Spread Pattern of Spanish Flu in the 1920s"). Mention three resources you will employ to solve this particular problem. One of them must be an existing library that can be accessed online via, for example, GitHub. One of them must be a research article (you can find research articles on scholar.google.com and then download them from libgen.lc or sci-hub.se).

Finally, write in brief about your motivation for wanting to work on this project (in around 150 words). Why do you want to explore this problem? What could be the possible reasons? If you have some dataset in mind that you would like to work with, mention it here too.

So, the format should be:

Project Title 1: "…………"
Resources you will use:
1.   One library that has a repository in GitHub.
2.   One research article.
3.   Any other resource (may be either a library or a research article).
Why you want to work on this project: (in 100 to 150 words).

Project Title 2: "…………"
Resources you will use:
1.   One library that has a repository in GitHub.
2.   One research article.
3.   Any other resource (may be either a library or a research article).
Why you want to work on this project: (in 100 to 150 words).

Submit within 27 November, Saturday, 1:59 PM in a single document file.