DSC 430: Python Programming
Assignment 1001: Battle for Crymland

The city of Crymland is plagued by a syndicate run by Mr. Bigg. Initially, Mr. Bigg supervises **7** thieves. The thieves operate as follows:

- Every week each thief independently commits a heist (bank robbery, jewelry theft, etc.). To determine the value of the heist, roll a twenty-sided die to get *d*. The value of the heist is:

$$v = \mathbf{1000} * d^2.$$

- Thieves working for Mr. Bigg keep half of the value of their heist, which is added to their personal wealth. The other half of the heist is given to their supervisor (initially Mr. Bigg).
- If a thief achieves a personal wealth greater than $**1,000,000**, they no longer commit heists. Instead they are promoted to lieutenant. They recruit and manage **7** of their own thieves while still reporting to their supervisor (initially Mr. Bigg). In time, these thieves may accumulate enough personal wealth to become lieutenants themselves. For example:

  Tommy works for Mr. Bigg. Over time, he commits many heists with a total value of 2.4 million dollars. Tommy keeps 1.2m and gives 1.2m to Mr. Bigg. Tommy is promoted to lieutenant. He will no longer commit heists. Instead, he supervises 7 new thieves. One of these new thieves is Ginger. In her first week, Ginger steals $16,000. She keeps $8000 and gives $8000 to her supervisor, Tommy. He keeps $4000 and gives $4000 to his supervisor, Mr. Bigg.

- The hierarchy of lieutenants and thieves can grow infinitely large, but always culminates with Mr. Bigg.

In Crymland, a team of **3** dedicated detectives are trying to take down Mr. Bigg's ruthless crime syndicate. The detectives operate as follows:

- Each week a single detective is randomly assigned to a single heist. If there are more heists than detectives, some heists will not be investigated. If there are more detectives than heists, some detectives will not be assigned a heist.
- Initially, a detective has a **25**% chance to solve the case. Detectives become better with experience. Their chance to solve a case increases by *x*% every time they solve a case, where *x* is the roll on a ten-sided die. Their chance to solve a case can never exceed **75**%.
- When a detective solves a case, the thief is put in jail. The wealth of the thief is seized.
- In order to arrest a lieutenant (and seize their wealth), the detectives require corroborating testimony from **3** jailed criminals who had been directly supervised by the lieutenant. Jailed thieves are always willing to testify. For example:

  Ginger, Roger, Kate and four other thieves work for Tommy. Ginger and Roger have been arrested. Then, when Kate is arrested, the detectives have enough evidence to arrest Tommy. Tommy may then testify against Mr. Bigg. If two other thieves or lieutenants can testify against Mr. Bigg, the detectives can arrest him.

Mr. Bigg did not become the crime boss of Crymland by accident. He is an expert strategist and manipulator. He attempts to corrupt the detectives:

- Whenever a detective first seizes a total of $**1,000,000** from thieves or lieutenants, and every $**1,000,000** thereafter, Mr. Bigg attempts to bribe the detective. The initial bribe equals **10%** of Mr. Bigg's earnings from the week. A bribe has the following probability of being accepted:
    - $10,000 or less, 5%
    - Otherwise, $100,000 or less 10%
    - Otherwise, $1,000,000 or less 25%
    - Otherwise, 50%
- A detective that has been successfully bribed will continue to investigate cases but will purposely fail to solve them.
- A detective that is working for Mr. Bigg has an initial probably of being discovered of **5%**. Each week the probably that the detective is discovered is increased by the roll of a twenty-sided die.
- When a detective is discovered to have been working for Mr. Bigg, he is fired and replaced with a new detective.

The battle for streets of Crymland wages on for a decade.

- Design a simulation to capture the interaction between Mr.Bigg, the thieves, the lieutenants and the detectives.
- The simulation will end after **500** weeks or when Mr. Bigg is arrested, whichever comes first.
- Your simulation should begin by reading parameters in from a parameter file. This file should include all the numbers marked bold above. For example:
    - weeks = 500
    - n_thieves = 7
    - heist_coef = 1000
    - promotion_wealth = 1000000
    - n_detetectives = 3
    - solve_init = 0.25
    - solve_cap = 0.75
    - etc.
- Save to a file the weekly statistics for 1) The total number of actors in Mr. Bigg's criminal syndicate, excluding those jailed, 2) the total number of thieves/lieutenants jailed, 3) the personal wealth of Mr. Bigg, and 4) the total amount of bribes accepted by detectives. This data will be used in Assignment 1002: Crymland Analysis.

Record a three-minute video in which you run the code. Then, present your code. Discuss the design of your simulation focusing on the most important design choices you had to make.

Submission: Submit a single .py file containing all the code to the D2L. Do not zip or archive the file. Your code must include comments at the top including your name, date, video link, and the honor statement, "I have not given or received any unauthorized assistance on this assignment." Each function must include a docstring and be commented appropriately.