1 Simulating a Town

1.1 Overview

The task is to simulate life in an average Australian country town. The simulation must incorporate the following characteristics:

On average the population increases by 30% each year due to immigration and natural births.

Every 18 years the population is reduced by 40% due to children coming of age and being drafted for football. Year 0 is considered a draft year. The calculation for draft numbers is done after the calculation for population growth.

Each unit of food is enough to feed a single person for an entire year.

People are allocated their food at the start of each year. If for some reason, there isn't enough food for a person they will leave town and go to the city.

Due to many factors, 1/5 of all food must be thrown away at the end of every year before the new food arrives.

Food to feed 80% of the population in the form of meat pies, sausage rolls, and potato cakes arrives at the end of each year after the old food has been thrown away. The food order is placed as the last action for the town for the year. This ensures that the most amount of people are catered for.

Normally the simulation should run for 100 years, however if at the start of a year the town's population is 0, the simulation ends early. The starting characteristics of the town should be read from a file called town_start.txt. The ending state of the town should be saved to a file called town_end.txt.

1.2 The Assignment

1.2.1 Task 1: Reading and writing data

Write a script called task1.py that reads in the town starting data. This data should be stored appropriately named variables.

The starting file will be called town_start.txt and will have the following format:

- Starting food
- Starting population
- Starting year

Your python file should then create a new file called town_end.txt, writing the data you just read. It will have the following format:

- Remaining food
- Remaining population
- Final year

Use the following data to test your code:

	Input	Output
Example 1	100 100 0	100 100 0
Example 2	10 100 0	10 100 0

Table 1: Test data for Task 1. Note it follows the format of Food, Population, and Year.

1.2.2 Task 2: Calculating Food

Write a script called task2.py that calculates the food remaining at the end of a single year's cycle. You do not need to consider changes in population in this script. Use the techniques from Task 1 to again read and write the appropriate files.

	Input	Output
Example 1	100 100 0	80 100 1
Example 2	10 100 0	80 100 1
Example 3	100 10 0	80 10 1
Example 4	1000 10 0	800 10 1
Example 5	155 90 0	124 90 1

Table 2: Test data for Task 2. Note it follows the format of Food, Population, and Year.

1.2.3 Task 3: Calculating Population

Write a script called task3.py that calculates the population at the end of a single year's cycle. Do not include changes to food here, only the changes to the population. You must consider if the year is a multiple of 18 for the sake of drafting new football players.

	Input	Output
Example 1	100 100 0	100 78 1
Example 2	10 100 0	10 7 1
Example 3	100 10 0	100 7 1
Example 4	1000 10 0	1000 7 1
Example 5	155 90 0	155 70 1

Table 3: Test data for Task 3. Note it follows the format of Food, Population, and Year.

1.2.4 Task 4: Performing the Simulation

Using the techniques demonstrated in the previous tasks, create the full simulation of the town in a script called task4.py. Your simulation should adhere to the following algorithm which was created using the overview:

1. Food is handed out to the town.
2. People leave if there is no food for them.
3. Food is sorted and rotten food is thrown away.
4. Population grows.
5. Every 18 years, a draft takes place.
6. The food order is placed, and food is delivered for next year.

	Input	Output
Example 1	100 100 0	108 136 100
Example 2	10 100 0	0 0 22
Example 3	100 10 0	0 0 76
Example 4	1000 10 0	156 195 100
Example 5	155 90 0	213 267 100

Table 4: Test data for Task 4. Note it follows the format of Food, Population, and Year.