BTE 514E Structured Programming

Homework 2

Due 12.11.2023 23:59

Submission through Ninova

Write a program to simulate a worker allocation problem. Let's assume we own an Iron and a Copper mine and 5 workers are working for us. Workers work in the mine, producing Metal Bar of the mines resource. Our company sells an Alloy produced from Iron and Copper. Due to limited storing capacity, we may need to sell Iron Bars or Copper Bars before we produce the Alloy. Our job is to find how to distribute workers into mines yielding maximum estimated the profit that we would get in a year. We would like to create a simulation to determine the best distribution of workers.

- A worker working in the Iron mine would produce an Iron Bar with %20 percent of chance.
- A worker working in the Copper mine would produce a Copper Bar with %50 percent of chance.
- 1 Alloy is produced with 3 Copper Bars and 3 Iron Bars
- We profit 13₺ from 1 Alloy, 1₺ from 1 Iron Bar and 0.5₺ from 1 Copper Bar.
- During the day, workers work in mines to produce Metal Bars.
- We always produce Alloys if we can and sell it immediately.
- Then we store Metal Bars that we have.
- Our storage can save up to 10 Metal Bars for the next day.
- After we sell Alloys, if the total number of Metal Bars exceeds 10 and if we store 5 of any Metal, we sell 5 of them.
- We will be in business for 365 days.
- At the end of the year, we will sell all remaining Metals.

Write following functions to fulfill the task:

- mine(*metal*)
  - returns 1 if miner could produce given *Metal* Bar
  - returns 0 if miner could not produce given *Metal* Bar
  - each *Metal* has different chance to be produced
- simulate(*max_day*, *iron_worker*, *copper_worker*)
  - simulates the given scenario for *max_day* amount of days with *iron_worker* amount of workers working in the Iron mine and *copper_worker* amount of workers working in the Copper mine.
  - returns amount of profit
- estimateProfit(*n*, *max_day*, *iron_worker*, *copper_worker*)
  - simulates the given scenario *n* times scenario for *max_day* amount of days with *iron_worker* amount of workers working in the Iron mine and *copper_worker* amount of workers working in the Copper mine.
  - returns average profit

Estimate profits by calling estimateProfit function for 1000 times, 365 days with all possible worker allocation.

```
print("Iron Worker: 1, Copper Worker: 4, Profit:",estimateProfit(1000,365,1,4))
print("Iron Worker: 2, Copper Worker: 3, Profit:",estimateProfit(1000,365,2,3))
print("Iron Worker: 3, Copper Worker: 2, Profit:",estimateProfit(1000,365,3,2))
print("Iron Worker: 4, Copper Worker: 1, Profit:",estimateProfit(1000,365,4,1))
```

Hints:

- Write functions according to explanation. You can get partial points for each implemented function.
- Use rand or randint function from random module. Experiment with these function before, to understand how to use it for this assignment. Check following links for more:
  https://www.geeksforgeeks.org/python-random-function/
  https://www.geeksforgeeks.org/python-randint-function/

Example input and outputs:

- There will be no input required for this program.
- Example output is given at the bottom. Results may vary since there is randomness in the program. But results for the higher n should be really close to the given output.

```
Iron Worker: 1, Copper Worker: 4, Profit: 640.228
Iron Worker: 2, Copper Worker: 3, Profit: 830.9915
Iron Worker: 3, Copper Worker: 2, Profit: 1019.2
Iron Worker: 4, Copper Worker: 1, Profit: 893.8205
```