

Pandora's Adventures in Replyland

Reply Code Challenge 2022

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Abstract

In the fantasy world of Replyland, legend says that in ancient times the Gods hid a jar in a cave, on the peak of the highest mountain. No one knew what was in the jar. Some said it contained eternal fortune, others terrible disgrace. Only one man dared to climb the mountain and take the jar: Epimetheus. He was power-hungry and imagined the jar would give him the ability to defeat anyone.

Once back in his village, he gathered everyone in the square and opened the jar. From it a shadow emerged and exploded into thousands of pieces that were scattered across Replyland. The sky thundered and a godly voice bellowed: "You dared to open the jar and free all the evils and sins ever known. Only a true hero can gather all the demons and put them back into the jar". Pandora, Epimetheus' wife, emerged from the crowd and said: "My husband was that foolish to challenge the Gods and open the sacred jar. I will challenge the demons to restore the balance." Everyone knew and respected Pandora: she was a devotee to the magic of light and nature, and a very powerful healer. The godly voice thus declared: "So be it. Your journey starts now."

Your task is to help Pandora face the perils of her mission. Choose the enemies she confronts carefully, and collect as many of the Shadow's fragments as possible...





1 Problem Statement

To fight the demons, Pandora's character consumes a special resource called *stamina*. She starts the quest with a certain amount S_i of stamina, consumes it when battling enemies and recovers it after some time until she reaches a maximum amount of S_{max} . Exceeding stamina will be lost.

The quest involves a total of T turns. In each turn you can decide to face one from a list of D demons. Each demon is defined by:

- S_c : stamina lost by Pandora after defeating the demon
- T_r : number of turns needed to recover stamina after the fight
- S_r : amount of stamina recovered T_r turns after the fight
- N_a : number of turns in which you'll earn fragments for defeating the demon
- List of N_a elements where $\forall a_i, i \in [0, N_a) : a_i \in \mathbb{N}$. Each a_i represents the number of fragments earned in the i -th turn after the fight for performing the ritual to put the fragments back in the jar

You need to provide the list of demons you want to face in the journey.

As Pandora:

- You cannot defeat more than one demon in the same turn
- You can only face a demon if you have enough stamina
- You cannot fight the same demon more than once
- After defeating a demon you will recover some stamina after a certain number of turns have passed
- Your stamina will always be included in the interval $[0, S_{max}]$
- The reward mechanism processes the list of demons you decided to face, in the order you faced them. If you don't have enough stamina to face an enemy, the system will wait until you have enough stamina required to face the demon or the total number of turns have passed.
- In any given turn, you first recover your stamina, then face an enemy, then collect the fragments
- In each turn, if applicable, you recover all the fragments that every defeated demon has granted you
- In each turn, if applicable, you recover all the stamina that every defeated demon has granted you
- You can collect fragments and facing demons for a maximum of T turns. After that, no other demon can be faced nor any fragment can be collected.

Your total score is the sum of fragments you collected at the end of T turns.



2 Input format

The input file is a regular ASCII text file. Each line of the input file is separated by a single “\n” character “UNIX-style”). If a line contains multiple data, each value is separated by a single whitespace character. The first row of the input file will be composed of 4 integer numbers:

- The integer S_i is the amount of stamina the player starts with
- The integer S_{max} is the maximum amount of stamina you can cumulate during the fight
- The integer T is the number of turns available
- The integer D is the number of demons available

Then, D lines follow, each describing one demon. Each demon line contains the following integer data:

- The integer S_c is the amount of stamina points you consume to face the demon; you cannot face a demon if you don't have at least this amount of stamina;
- The integer T_r is the number of turns you have to wait before recovering stamina;
- The integer S_r is the amount of stamina that you recover after T_r turns have passed;
- The integer N_a is the number of turns you'll earn fragments after defeating the demon;
- A sequence of N_a integers $a_i, i \in [0, N_a)$ represents the amount of fragments you'll earn in the i -th subsequent turn after the fight.

3 Output format

The output file must be a regular ASCII text file. Each line of the output file must be separated by a single “\n”. Each line of this file must contain the 0-based index of the demon to face. The demons will be faced in the order provided.

The output file is valid if:

- it contains only numbers and newlines
- for each index $i, i \in [0, D)$
- each index is present in the file only once



4 Scoring rules

Given a list E of N defeated enemies, E_n is the n -th enemy, T_n is the turn in which the n -th enemy is defeated, A_n is the list of fragments for the n -th enemy, of length $\text{len}(A_n)$, and $A_n[i]$ is the i -th reward of the list.

T is the number of turns in the simulation.

Given an enemy E_n , the reward R_n obtained by defeating them is the sum of all the accumulated fragments starting from the turn in which the enemy is defeated, before the end of the simulation:

$$R_n = \sum_{i=0}^{\min(\text{len}(A_n), T-T_n)-1} A_n[i] \quad (1)$$

The total reward R is the sum of all the scores:

$$R = \sum_{i=0}^{N-1} R_i \quad (2)$$

Formally:

$T \rightarrow$ number of turns in the simulation

$E = [E_0, E_1, \dots, E_{n-1}] \rightarrow$ enemy

$T = [T_0, T_1, \dots, T_{n-1}] \rightarrow$ turn in which the E_i enemy is defeated

$A_{E_0} = [A_0, A_1, \dots, A_n] \rightarrow$ reward array for enemy E_0

$A_{E_1} = [A_0, A_1, \dots, A_n] \rightarrow$ reward array for enemy E_1

...

$R_n = \sum_{0 \leq i \leq \min(\text{len}(A_{E_n}), T-T_n)-1} A_{E_n}[i] \rightarrow$ score for enemy N

$R = \sum_{0 \leq i \leq N-1} R_i \rightarrow$ total score

5 Constraints

- All the indices, loops and iterations start from 0
- $T \leq 1.000.000$
- $D \leq 100.000$
- All the stamina values $S \in [0, 100.000]$
- $T_r \in [1, T]$
- $N_a \in [0, 100.000]$
- $a_i \in [0, 10.000]$

6 Example

6.1 Input file example

```
5 20 10 5
16 4 18 13 0 10 5 0 0 7 4 1 1 6 10 2 9
2 1 11 18 0 6 1 7 3 4 7 0 5 7 9 5 6 3 9 9 0 5
```



```

3 1 5 15 0 5 4 5 0 10 1 8 3 8 2 4 7 2 1
7 6 10 13 8 2 5 0 0 4 3 9 6 4 1 6 4
17 5 7 16 5 1 4 5 1 8 9 10 9 7 2 8 9 7 3 10

```

You start with 5 stamina points, and in each moment you can have no more than 20 stamina points. The quest will last 10 turns and you have 5 enemies that you can choose to face.

To face the **red demon**, you consume 16 stamina points. After 4 turns you'll recover 18 stamina points. You'll earn fragments over 13 turns for beating this opponent: 0 fragments in the same turn of the battle, 10 fragments in the following one, 5 fragments two round later, 0 point in the fourth and fifth turn after the battle, 7 fragments in the sixth, 4 fragments in the seventh, 1 fragment in the eighth and ninth, 6 in the tenth, 10 in the eleventh, 2 in the twelfth and 9 in the thirteenth.

6.2 Output file example

```

1
3
2
4
0

```

Because all the indexes are 0-based, you request to face the **teal demon**, then the **violet one**, followed by the **orange demon**, then the **brown one** and finally, the **red one**.

6.3 Scoring

Output = [1, 3, 2, 4, 0]

Red demon = [0, 10, 5, 0, 0, 7, 4, 1, 1, 6, 10, 2, 9]

Teal demon = [0, 6, 1, 7, 3, 4, 7, 0, 5, 7, 9, 5, 6, 3, 9, 9, 0, 5]

Orange demon = [0, 5, 4, 5, 0, 10, 1, 8, 3, 8, 2, 4, 7, 2, 1]

Violet demon = [8, 2, 5, 0, 0, 4, 3, 9, 6, 4, 1, 6, 4]

Brown demon = [5, 1, 4, 5, 1, 8, 9, 10, 9, 7, 2, 8, 9, 7, 3, 10]

$T_{max} = 10$



In the turn	Happens	Reward per turn	Accumulated
0	Pandora faces the Teal demon	0	0
1	Pandora recharges 11 stamina points, then faces the Violet demon	14	14
2	Pandora faces the Orange demon	3	17
3	Pandora recharges 5 stamina points	17	34
4	x	7	41
5	x	9	50
6	x	11	61
7	Pandora recharges 7 stamina points, then faces the Brown demon	18	79
8	x	16	95
9	x	25	120

The **red demon** isn't faced because the maximum number of turns has been reached.