Lëtzebuerger Informatiksolympiad 2024

Semi-Finals

Task descriptions

Instructions

- The allowed programming languages are Python 3, Java and C/C++.
- All the programs must be realized in the form of a console application. For instructions how to realize a console application in the allowed programming languages, please refer to the remarks on the site `www.infosolympiad.lu` under the heading *The tasks*.
- Under the input of the program is meant either the direct entry of data from the keyboard or the redirection from a text file in console mode. Under output of the program is meant either the direct display of data to the screen or the redirection to a text file in console mode.
- The formats of the input and output data shown in the execution examples must absolutely be respected.
- For testing, submitting and evaluating a program, the source file with a file extension `py`, `java` or `c/cpp` must be uploaded to the automated online judge CMS (Contest Management System), accessible via the homepage `www.infosolympiad.lu` or directly via the URL `http://158.64.46.20:81`. Please use your personal login (username and password) to access your account on the CMS. The filename of the single source file should be the same than the task name. Please refer to the CMS for technical details on how to test and submit a program.
- Please refer to the CMS for technical details like time limits and memory limits as well as compilation commands.
- You have the right to ask questions via the CMS, but the answers will not teach you how to use a programming language nor tell you how to solve the tasks by using a specific algorithm. The questions should be in relation with the CMS or should treat clarification issues concerning the task descriptions.

Recipes

Description

Your friend wants to start a restaurant, but she keeps getting confused by the preferences and allergies of the customers. She has a very long list of recipes R (of length N). A recipe is a string of characters, where each character represents one ingredient. (For example `"asdfa"` would represent a recipe with ingredients `a`, `s`, `d` and `f`.)
She asks you to help her, by writing a program, which given a string of allergens A of (length M) and preferences P (of length K), returns a list of recipes which must include at least one the preferred ingredients and don't include any of the allergens.
The output recipes should be listed in order of appearance in the input.

Task

Given a list of recipes R (of length N), a string of allergens A (of length M), and a string of preferences P (of length K), return the number of recipes satisfying following conditions, followed by those recipes (a list of strings) :

1. All strings in your output have to be in R.
2. None of the recipes contain any allergens, i.e. no string contains any characters in A.
3. All of the recipes contain at least one of the preferences, i.e. all strings contain at least one character in P. (If there are no preferences i.e. $K = 0$ then we do not need any characters in P.)

Example

You are given the allergens $A =$ `"acda"`, preferences $P =$ `"xyz"`, and the following 6 recipes: `"AzBCD"`, `"luxembourg"`, `"informatics"`, `"olympiad"`, `"axbdxzyd"`, `"europe"`.
The only 2 valid recipes are `"AzBCD"` and `"luxembourg"` and should be outputted in that order.

- `"AzBCD"` is valid, since `z` is included in the preferences string, but no allergen is included. (Note capital letters are different from lowercase letters.) Similarly `"luxembourg"` includes `x` and no allergens.
- `"informatics"`, `"olympiad"`, `"axbdxzyd"` are all not ok, since they all include the letter `a` from the allergens string.
- `"europe"` is not ok since it does not include any letter in P.

Constraints

- $1 \leq N \leq 10^4$
- $1 \leq$ length of $R[i] \leq 10^3$
- $0 \leq M, K \leq 10^6$

Input and output of program

Input data

The first line contains N, M, K.
The following line contains a single string A (the allergens) of length M.
The following line contains a single string P (the preferences) of length K.
The following N lines each contain one string. The N lines are the N recipes in R.

Remark: All strings can be lower or uppercase letters, i.e. "a" is different from "A".

Output data

A single integer L, representing the length of the recipes list satisfying the conditions. The following L rows should represent the L recipes (each recipe should be separated by a new line).

Execution example

Input

```
6 4 3
acda
xyz
AzBCD
luxembourg
informatics
olympiad
axbdxzyd
europe
```

Output

```
2
AzBCD
luxembourg
```

Distribution of points

Subtask	Points	Constraints/Description
1	10	$N, M, K < 100$, length of $R[i] < 100$
2	5	$M = 0$ (no allergens)
3	5	$K = 0$ (no preferences)
4	10	No additional constraints

Technical constraints

Task name	recipes
Input file	standard input
Output file	standard input
Time limit	1 second
Memory limit	256 megabytes

Hiking

Description

Lea likes to go hiking alone through the woods, but she dislikes feeling exhausted during the hike. She therefore needs to plan her routes in advance. She found a really long one way hike through the giant forest of Lioland, and found multiple hotels along that route, she could start her hike at one hotel and stop at another.
Can you help Lea finding the best possible hike ?

Task

Given the N hotel positions P_i for $1 \leq i \leq N$ (in increasing order) and the maximum distance she could travel D. Find the distance of the longest actual hike she can plan, or if no hike can be found return -1.

Example

Let the hotel positions be $\{3, 14, 28, 31, 35, 81, 94, 100\}$ and the maximum travel distance being $D = 30$. In this case the longest hike she can plan is of distance $d = 28$ from hotel 1 to hotel 4 ($P_1 = 3, P_4 = 31$).
If $D = 80$, the longest hike could be of distance $d = 80$ as well going from hotel 2 to hotel 7.

Constraints

- $0 \leq N \leq 10^6$
- $0 < D, P_i < 10^{12}$

Input and output of program

Input data

The first line contains N and D separated by a whitespace. The second line contains the P_i in increasing order and separated by a whitespace.

Output data

The longest actual hiking distance d or -1 if no hike could be found.

Execution example

Input

```
8 30
3 14 28 31 35 81 94 100
```

Output

```
28
```

Distribution of points

Subtask	Points	Constraints/Description
1	15	$N < 10^4$
2	15	No additional constraints

Technical constraints

Task name	hiking
Input file	standard input
Output file	standard input
Time limit	1 second
Memory limit	256 megabytes

Water Distribution

Description

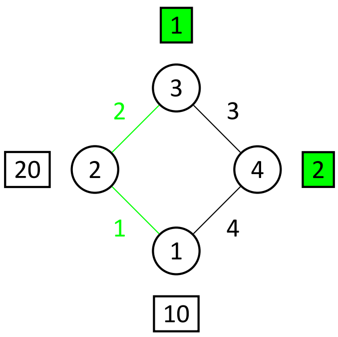
The government of Lioland wants to build a completely autonomous village and therefore needs to collect groundwater as a water supply. The village consists of N different buildings labeled 1 to N. To distribute water, pumping stations need to be build at some buildings and/or pipes between buildings. Each building has water if it has a pumping station or if it is connected by a pipe to a building which already has water. City planners already computed how much it would cost to build pumps at the different buildings (P_j at building j) and how much it would cost to install pipes between M different pairs of buildings (pipe i connects buildings U_i and V_i and costs C_i to build). Building pipes between any other pair of buildings is not possible.
The organizers of the project need your help to find the most cost effective solution to provide water to each building.

Task

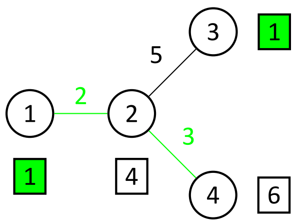
Given the different installation costs, compute the cost of the cheapest way to distribute water to each building.

Example

Consider the following arrangement of buildings and costs. The numbers in rectangles represent the cost of building a pumping station near that building. The numbers near the edges represent the cost to build that specific pipe.



The most cost-effective solution has been highlighted in green and costs 6.
Here is a second example with a different arrangement.



In this case, the optimal cost is 7 when using the pumps and pipes colored in green.

Constraints

- $0 < N \leq 5 \cdot 10^4$
- $N - 1 \leq M \leq (N-1)(N-2)/2$
- $0 < U_i, V_i \leq N$
- $0 < P_j, C_i \leq 10^3$

Input and output of program

Input data

The first line contains N and M.
The second line contains N numbers describing the different P_j.
The next M lines each contain U_i V_i C_i for each pipe.

Output data

The minimum cost.

Execution example

Here are the two inputs/outputs corresponding to the examples given above.

Input

```
4 4
10 20 1 2
1 2 1
2 3 2
3 4 3
4 1 4
```

Output

```
6
```

Input

```
4 3
1 4 1 6
1 2 2
2 3 5
2 4 3
```

Output

```
7
```

Distribution of points

Subtask	Points	Constraints/Description
1	10	$N < 10$
2	15	$N < 1000$
3	15	No additional constraints

Technical constraints

Task name	water
Input file	standard input
Output file	standard input
Time limit	1 second
Memory limit	256 megabytes