

CodeNection 2023 Preliminary Round Problems

Competition Team of CodeNection 2023

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Codey and CodeNecton

Problem Statement

Codey is joining CodeNecton for the first time and it is loving it! Help Codey express itself by printing the string `I LOVE CODENECTION` n times.

Input Format

The first line contains an integer n , which represents the number of times Codey wants to express love for CodeNecton.

Constraints

$$0 \leq n \leq 10^5$$

Output Format

Output the string `I LOVE CODENECTION` followed by a new line for n times.

Sample Test Case 1

2	<code>I LOVE CODENECTION</code> <code>I LOVE CODENECTION</code>
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When n is 2, the output is the string `I LOVE CODENECTION` printed 2 times, each separated by a new line.

Sample Test Case 2

13	I LOVE CODENECTION I LOVE CODENECTION I LOVE CODENECTION I LOVE CODENECTION I LOVE CODENECTION I LOVE CODENECTION I LOVE CODENECTION I LOVE CODENECTION I LOVE CODENECTION I LOVE CODENECTION I LOVE CODENECTION I LOVE CODENECTION I LOVE CODENECTION I LOVE CODENECTION I LOVE CODENECTION
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When n is 13, the output is the string I LOVE CODENECTION printed 13 times, each separated by a new line

Codey and Hide-and-Seek

Problem Statement

In a world that dances with riddles, Codey has embarked on a grand game of hide-and-seek within a mysterious 2D grid of size $n \times m$. The grid exclusively contains two elements: Codey, represented by the character '#', and empty cells, marked as '.'.

Your mission is to uncover **Codey's hiding spot** by finding the **coordinates** where Codey is lurking. If you succeed, you will happily report back with the coordinates (row and column). However, if Codey is too tricky and you can't find it in the grid, you'll report -1 as your answer.

Input Format

The first line contains two integers, n and m , where n represents the number of rows and m represents the columns in the 2D grid.

The following n lines provide a representation of the 2D grid.

Constraints

$$1 \leq n, m \leq 10^3$$

It is guaranteed that there will only be at most one '#' in the grid.

Output Format

Output Codey's coordinate (row and column) in a single line, separated by a space if Codey is located within the grid. Output -1 if Codey is not found in the grid.

If Codey is not found in the grid, output -1.

Sample Test Case 1

2 3 .#. ...	1 2
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Codey is present in this grid. The coordinates of Codey is printed in the output.

Sample Test Case 2

5 10	-1
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Codey is not present in this grid.

Codey and Math

Problem Statement

Codey is very interested in Math, and it encountered an interesting question during its last mathematics class.

In an infinite sequence numbers: $\dots, -3, -2, -1, 0, 1, 2, 3, \dots$, Codey has been tasked with determining whether it's possible to obtain a **sum equal to n** by adding the numbers from l to r .

Codey wants you to find out if it's possible to achieve this sum. Print the values of l and r if so. If there are multiple answers, print any. Otherwise, print -1 .

Note that this problem uses a custom checker, so make sure your program compiles correctly and prints the output according to the format before submitting.

Input Format

The first line contains an integer n , which represents the sum.

Constraints

$$0 \leq n \leq 10^9$$

Output Format

Output the values of l and r separated by a space where $-10^9 \leq l \leq 0 \leq r \leq 10^9$, that achieve the sum of n . If there are multiple answers, you can output any of them. Output -1 if there is no solution.

Sample Test Case 1

6	0 3
---	-----

When n is equal to 6, and l and r are 0 and 3, respectively, the sum from l to r is $0 + 1 + 2 + 3 = 6$, which is equal to n .

Codey and Textbooks

Problem Statement

Codey, who is enthusiastic when it comes to studies, is eager to purchase n textbooks from the university bookstore. These textbooks are priced in an interesting way:

- The first textbook costs m dollars.
- The second textbook costs $2 \cdot m$ dollars.
- The i -th textbook costs $i \cdot m$ dollars.

Codey has k dollars in his wallet, but it's wondering **how much it needs to borrow** from the E-bee to cover the costs of purchasing n textbooks.

Your task is to calculate and output the amount of money that Codey has to borrow from the E-bee. If it doesn't need to borrow any money, the answer should be 0.

Can you assist Codey in figuring out how much it needs to borrow from E-Bee, if at all?

Input Format

The first line contains three positive integers n, m, k , where n represents the number of textbooks Codey wants, m represents the cost of the first book, and k represents the initial number of ringgit Codey has.

Constraints

$$0 \leq n, m, k \leq 10^5$$

Output Format

Outputs only one integer, the amount of money Codey has to borrow from E-bee. If it doesn't have to borrow money from E-bee, output 0.

Sample Test Case 1

5 2 3	27
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Codey wants 5 textbooks, and the first book costs 2 ringgit. The cost of the books is:

$$(1 \cdot 2) + (2 \cdot 2) + (3 \cdot 2) + (4 \cdot 2) + (5 \cdot 2) = 30$$

Codey has 3 ringgit, therefore Codey needs to borrow 27 ringgit.

Sample Test Case 2

3 2 15	0
--------	---

Codey doesn't have to borrow money from E-bee, because Codey has sufficient money.

Codey and Money

Problem Statement

Codey is planning a trip to Penang, and it needs to gather exactly n ringgits for its exciting journey. However, it only has access to a limited number of ringgit bills, each of which is a power of 10. The ringgit bills that Codey has are defined by an array a with a length of k , where a_i represents the number of 10^{i-1} ringgit bills that Codey possesses.

For example, when $k = 3, a = [3, 2, 1]$, Codey has three 1 ringgit bills, two 10 ringgit bills, and one 100 ringgit bill.

Codey would like you to determine if it's possible to obtain **precisely n ringgits** for its trip using the ringgit bills it has.

Input Format

The first line contains an integer t , which represents the number of test cases.

The following provides the description of each test case:

- The first line contains an integer k , which represents the length of array a .
- The second line contains an integer n , which represents the final amount Codey needs.
- The third line contains k integers a_1, a_2, \dots, a_k , each representing the number of 10^{i-1} ringgit bills.

Constraints

- $1 \leq t \leq 500$
- $1 \leq k \leq 10^5$

- $1 \leq n \leq 10^k$
- $0 \leq a_i \leq 10^5$
- It is guaranteed that the sum of k over all test cases does not exceed $5 \cdot 10^5$

Output Format

Output YES for each test case if it's possible to obtain n ringgits, otherwise output NO.

Sample Test Case 1

1 4 357 7 6 4 11	YES
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Final amount n can be formed using 7 bills of 1 ringgit, 5 bills of 10 ringgit and 3 bills of 100 ringgit.

Sample Test Case 2

2 2 11 2 3 2 1 0 1	YES NO
--------------------------------------	-----------

In the second test case, even though you have a 10 ringgit bill, you cannot split the bill to form exactly 1 ringgit.

Codey and Team Selection

Problem Statement

Codey is a coach and it is assembling a team for a competitive sports league. It is going to select n players for the team. Each player possesses a skill point represented by a_i . The player selection process consists of n steps, and in each step:

- Let b be the **sorted** array of skill points for **unselected** players. Choose an integer j , where $1 \leq j \leq k$, and k is the current total of unselected players, that player joins the team and gains an additional skill point, s_j . In other words, the total team skill increases by $b_j + s_j$.

Codey wants to strategically select players to **maximize** the overall team skill for the upcoming sports league, while following the constraints of the selection process. Can you help Codey to achieve this?

Input Format

The first line contains a single integer n , which represents the number of players.

The second line contains n integers a_1, a_2, \dots, a_n , each representing the skill points of the i -th player.

The third line contains n integers s_1, s_2, \dots, s_n , each representing the additional skill points gained for selecting the j -th player in the array b .

Constraints

- $1 \leq n \leq 10^5$
- $1 \leq a_i \leq 10^5$

- $1 \leq s_j \leq 10^5$
- $1 \leq a_1 \leq a_2 \leq \dots \leq a_n$

Output Format

Output an integer representing the maximum total team skill.

Sample Test Case

3 1 2 3 3 3 1	15
---------------------	----

We can select the players as such:

1. The current team skill is 0 and $b = [1, 2, 3]$. We choose $j = 1$ and the team skill increases by $b_1 + s_1 = 1 + 3 = 4$.
2. The current team skill is 4 and $b = [2, 3]$. We choose $j = 2$, and the team skill increases by $b_2 + s_2 = 3 + 3 = 6$.
3. The current team skill is 10 and $b = [2]$. We choose $j = 1$, and the team skill increases by $b_1 + s_1 = 2 + 3 = 5$.
4. All players are selected, selection ended. The total team skill is 15.

Codey and Painted Tree

Problem Statement

Codey loves solving challenging problems, and today, Codey faces a unique task.

A tree is a connected and undirected graph without cycles. Codey is given a tree with n nodes and $n - 1$ edges. Initially, every node in the tree is painted **white**. Codey can choose to paint some of the nodes **black**. Codey's goal is to find the number of ways to paint the tree such that, in each of these ways, the number of **unique b -path** is exactly m . Codey is excited to tackle this problem and find a solution.

A b -path is a sequence of nodes v_1, v_2, \dots, v_k where $k \geq 2$ and it follows these rules:

- Each adjacent pair of nodes in the sequence is connected by an edge.
- Each node in the sequence is **distinct**.
- It starts in a node painted **black** and ends in a node painted **black**.

Two b -path are considered **different** if the sets of nodes used in the sequence are different.

Your task is to help Codey solve this problem and output the number of valid ways to paint the tree, considering the restrictions, and then return the answer modulo $10^9 + 7$. Recall that a modulo b is the remainder of a when divided by b .

Input Format

The first line contains two integers, n and m , where n represents the number of nodes in the tree, and m represents the number of b -path.

Then following $n - 1$ lines describe the tree, each of them contains two integers u, v , which represents the endpoints of the corresponding edge.

Constraints

- $1 \leq n \leq 10^5$
- $0 \leq m \leq 10^{18}$

Output Format

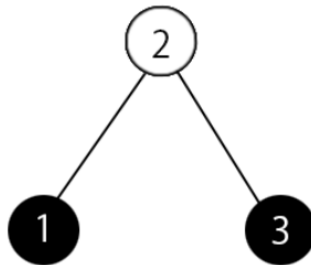
Output the number of ways to paint the tree with m *b-path* modulo 10^9+7 .

Sample Test Case 1

3 1 1 2 2 3	3
-------------------	---

Explanation

One of the ways to paint the tree is as follows:



There is only 1 *b-path* when you paint node 1 and node 3 in black, which can be represented by the sequence of nodes $[1, 2, 3]$. Note that *b-path* $[1, 2, 3]$ is the same as $[3, 2, 1]$ since the set of nodes used in the sequence is the same.

Sample Test Case 2

5 1 1 4 2 5 3 2 4 3	10
---------------------------------	----

Codey and Number Grid

Problem Statement

Codey finds itself in a desolate planet. The planet, shrouded in mystery, is known for its harsh, alien terrain – a place where every decision is a matter of survival. Here, in this strange land, Codey discovers a $n \times m$ (n rows and m columns) grid imprinted with unique numbers that seem to hold the keys to life itself.

Trapped on this planet, Codey faces a huge challenge. Its very survival depends on its ability to decipher this grid. It must uncover k , the **maximum** connected area within the grid that contains every number from **1 to k** . Two cells can only be connected if they share an edge.

As time runs out and the situation becomes more dangerous, Codey needs your help to find k , the largest possible connected area k that meets the condition. Can you assist Codey in determining the value of k to survive this challenge?

Input Format

The first line contains two integers, n and m , where n represents the number of rows and m represents the columns in the 2D grid.

The following lines contain the numbers $a_{i,j}$, which provides a representation of the 2D grid.

Constraints

- $1 \leq n \leq 10^3$
- $1 \leq m \leq 10^3$
- $1 \leq a_{i,j} \leq 10^6$

- Every $a_{i,j}$ is unique

Output Format

Output k , the maximum connected area within the grid that contains every number from 1 to k .

Sample Test Case 1

3 3 1 2 7 9 3 11 8 4 5	5
---------------------------------	---

The representation of the grid and the highlighted maximum area is as follows:

1	2	7
9	3	11
8	4	5

The selected area only consists of number from 1 to 5, hence the output is 5.

Sample Test Case 2

3 3 1 2 3 10 4 11 6 8 5	4
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Codey and Crimes

Problem Statement

Codey, is taking a moment to reflect on a past action it is not proud of.

One night, Codey found itself at a 7-11 convenience store, faced with the desire to purchase n items. Each item took a_i seconds to process, and they were priced at b_i ringgit(s). It was a challenging time for Codey, and its funds were tight, barely enough to afford all n items. Unfortunately, Codey made a regrettable decision that night: it chose to steal.

Here's what it did: For each second the cashier took to process one of their items, Codey managed to steal another item without paying for it. Its goal was to acquire all n items and **save as much money as possible**.

Now, as Codey reflects on their actions, it wants to know the total amount it ultimately ended up paying that night. Can you help Codey recall the cost of its choices?

Input Format

The first line contains an integer n , where n represents the number of items Codey purchased.

The following n lines describe each item, where each of them contains two integers a_i, b_i , which represents the time it takes to process item i , and the price of item i , respectively.

Constraints

- $1 \leq n \leq 2 \cdot 10^3$

- $0 \leq a_i \leq 2 \cdot 10^3$
- $1 \leq b_i \leq 10^9$

Output Format

Output a single integer representing the total amount that Codey ultimately ended up paying at the end of the night.

Sample Test Case 1

3 5 50 2 10 1 20	10
---------------------------	----

Codey bought the second item, which cost him 10 ringgits, and it took 2 seconds to process it. During these 2 seconds, Codey stole all the remaining items.

Sample Test Case 2

5 0 30 0 123 8 30 2 100 1 100	30
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