Bijoy-71 Programming Contest - organized by DUETCS (Segment 1)

https://toph.co/contests/training/c49gh8g

Toph

Schedule

The contest will run for **3h0m0s**.

The standings will be frozen for the last **45m0s** of the contest.

Authors

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Rules

This contest is formatted as per the official rules of ICPC Regional Programming Contests.

You can use Bash 5.2, Brainf*ck, C# Mono 6.0, C++17 GCC 13.2, C++20 Clang 16.0, C++20 GCC 13.2, C++23 GCC 13.2, C11 GCC 13.2, C17 GCC 13.2, C23 GCC 13.2, Common Lisp SBCL 2.0, D8 11.8, Erlang 22.3, Free Pascal 3.0, Go 1.22, Grep 3.7, Haskell 8.6, Java 1.8, Kotlin 1.9, Kotlin 2.0, Lua 5.4, Node.js 10.16, Perl 5.30, PHP 8.3, PyPy 7.3 (3.10), Python 3.12, Ruby 3.2, Rust 1.57, Swift 5.3, and Whitespace in this contest.

Be fair, be honest. Plagiarism will result in disqualification. Judges' decisions will be final.

Notes

There are 10 challenges in this contest.

Please make sure this booklet contains all of the pages.

If you find any discrepencies between the printed copy and the problem statements in Toph Arena, please rely on the later.

Disclaimer

The contents of this contest have not been reviewed by Toph and do not necessarily represent Toph's views.

A. SIXteen-th December

Bijoy loves playing cricket, and batting is his favorite part. On the occasion of Victory Day, he and his friends organized a cricket tournament. For the batsmen's convenience, he has changed some of the traditional rules of cricket as follows:

1. Each team must consist of exactly sixteen players.
2. There is no limitation on the number of overs. A team can bat as long as they want, and the opposition has to bowl accordingly.
3. The only way to score runs is by hitting a six and getting six runs for a legal delivery. Otherwise, the ball is a dot ball.

You are given the value of A - B, where A is the total runs of one team and B is the total runs of the other in a match. Bijoy wonders whether the match was played according to the rules he changed, particularly the third one. So he asks for your help to check the validity of the runs.

Note that the given run is considered $valid$ if it can be scored by following all the rules changed by Bijoy.

Input

The first line contains a single integer $t(1 \leq t \leq 500)$ – the number of matches in the tournament.

The only line of each test case contains a single integer $n(|n| \leq 10^{1000})$ – the value of A - B.

Output

For each test case, print the case number followed by $Valid$ if the run is valid, or $Invalid$ otherwise.

Samples

Input	Output
2 6 4	Case 1: Valid Case 2: Invalid

B. The Provost's Challenge

Chuppu, a talented student of DUET, resides in a hall at the university. Every morning, he enjoys a refreshing cup of tea. Since every hall has a tea stall, Chuppu makes his tea trips interesting by following a peculiar habit:

He chooses the one that is **farthest** from his current hall and goes there for tea.

The hall provost, the people's favorite Mr. Khawja Sir, observed this routine. Concerned about Chuppu's long tea expeditions, he decided to intervene. His majesty decreed that during the next hall allocation, Chuppu should be placed in a hall such that the **maximum distance** from his hall to any other hall is minimized.

Given the hall layout (a connected graph with no cycles), where the distance between directly connected halls is always 1, your task is to determine the **maximum** distance from Chuppu's new hall to any other hall, assuming he is optimally placed.

Input

The first line will contain only integer $N(1 < N \leq 10000)$ the number of halls.

Next $N - 1$ lines will contain the edges.

Output

Print the answer.

Samples

Input	Output
3 1 2 2 3	1

Input	Output
7 1 2 1 3 1 4 4 5 4 6 2 7	2

C. Her Demand!

Mr. Mukhlech, a programmer, has traveled to the country Bindia with his friend Sokhina, who is also passionate about programming. They arrived on Flight 0741X. While exploring Bindia, Sokhina meets a man who can reverse a linked list recursively, a skill Mr. Mukhlech does not possess. Sokhina expressed her desire for Mr. Mukhlech to learn this skill as well.

To learn how to reverse a linked list, Mr. Mukhlech must travel to City X. There are N highways represented as strings of length M each, and another string of length P represents Mr. Mukhlech's car. While traveling on a highway (from left to right), if the car matches a segment of the highway starting at position i, he earns B_i points.

Your task is to determine whether it is possible for Mr. Mukhlech to achieve at least C points using **any** of the highways to reach City X.

Note that while driving a car on the highway, the uppercase and lowercase letters of highway and car are **not** considered different if the character matches.

Input

The first line contains an integer $T(1 \leq T \leq 1000)$, the number of test cases.

Each test case starts with 3 integers $N, M, C(1 \leq N, M \leq 10^6, 0 \leq C \leq 10^{18})$ that is the number of highways, the length of each highway, and the minimum points to achieve for Mr. Mukhlech.

The next line contains an array of M integers $B_1, B_2, \ldots, B_M$, where B_i represents the points earned if the car matches a segment starting at position$i(0 \leq B_i \leq 10^{18})$.

The next line contains the string representing the car, of length $P(1 \leq P \leq M)$.

The next N lines each contain a string of length M, representing the highways.

The representation of highways and the car consists of uppercase and lowercase English letters only. The summation of $N * M$ over all test cases doesn't exceed 10^6.

Output

For each test case, print "$Case$ #: " followed by the answer to the problem which is "Yes" if Mr. Mukhlech can achieve at least C points using any of the highways, or "No" otherwise. Here, # means the test case number.

Samples

Input	Output
2 2 6 10 1 2 3 4 5 6 abc abcdef ghabca 4 8 12 5 1 0 2 2 7 5 4 xda axdacxda xdayxdaK xdbCLxda xdagdxda	Case 1: No Case 2: Yes

Explanation:

Test Case 2:

The car matches at position 1 and 6 on $4th$ highway achieving a score of $B_1 + B_6 = 5 + 7 = 12$

D. Flag Stand

Today is the great victory day. Just like every year, Mugdha and the students of his school are celebrating the day with so many events. Mugdha's responsibility was to plant a bamboo pole in the corner of the school's playground to hoist the national flag. So, he planted the pole in the correct place, **straight up** from the ground, yesterday.

However, last night, during a storm, the pole was partially broken and left hanging from the standing part. When he reached the playground this morning and saw the broken pole, he felt quite upset. But being very passionate about Mathematics, he began to wonder what angle the broken portion formed with the standing part. Since you are a master in Mathematics, he asks for your help.

You are given the height of the pole before and after it was broken. Your task is to calculate the angle between the broken portion and the standing part and inform Mugdha about it.

Note that the given heights can be in any unit but they are guaranteed to be in the same unit.

Input

The first line contains a single integer $t(1 \leq t \leq 2 * 10^5)$ – the number of test cases.

The only line of each test case contains two integers $H, h(1 \leq h < H \leq 10^{10})$ – the height of the pole before and after it was broken respectively.

Output

For each test case, print the calculated angle in **degrees**.

Your answer will be considered correct if the absolute or relative error from the true answer is at most 10^{-6}.

Samples

Input	Output
2 2 1 3 1	0.00000000 60.00000000

E. Mr. Weirdo

Mr. Weirdo is very much fond of weird messages. He wants you to print the message “This is a weird message!\n” the number of times he asks for. For even more weirdness, you print the message only **one-third** (**rounded up to the nearest integer**) of the times he asked for.

Here, **rounded up to the nearest integer** means $\lceil x \rceil$ - the ceiling value of x. For example, $\lceil 2.4 \rceil = 3$.

Input

The only input line contains a single integer $t (1 \leq t \leq 500)$ – the number of times Mr. Weirdo wants the message to be printed.

Output

For each line of output, print the message “This is a weird message!\n” without quotes.

Samples

Input	Output
1	This is a weird message!\n

F. Moom and Her Bit Set Game

Recently, **Moom** started learning about **bit manipulation**, a fascinating world of ones and zeros. She quickly mastered basic operations like **AND**, **OR**, and **XOR** on arrays. However, these tasks became boring for her. She wanted something more challenging, so she started thinking and came up with a new game.

Moom decided to propose this challenge to **DUETCS (Dynamic Understanding of Efficient Techniques for Competitive Solutions)** for their upcoming **Bijoy-71 Programming Contest**. She believed this problem would be fun and challenging for the participants.

The game is as below:

You are given an array a of n integers. Your task is to choose a subsequence b with m elements and perform the following steps:

Define a new array c, where:

- c_1 **=** b_1 (the first element of the selected subsequence)
- c_i **=** b_i *** (number of set bits in** c_{i-1}**) [for** i **> 1]**

As a participant in this contest, your task is to select the subsequence so that the **number of set bits** in c_m is maximized and help **Moom** prove that her game is a great addition to the event.

A **subsequence** of a given sequence is a sequence that can be derived from the given sequence by deleting some or no elements without changing the order of the remaining elements.

Input

The first line of input contains a single integer n ($1 \leq n \leq 10^5$) — the length of the array a.

The second line of input contains n integers $a_1, a_2, \ldots, a_n$ ($1 \leq a_i \leq 10^9$) — the elements of the array a.

Output

Print one integer — **the number of set bits in** c_m after the operations.

Samples

Input	Output
4 5 11 8 9	4

Explanation:

- Subsequence [5, 11] → `c[2] = 22` → 3 set bits
- Subsequence [11, 9] → `c[2] = 27` → 4 set bits (max)
- Subsequence [5, 11, 9] → `c[3] = 27` → 4 set bits (max)
- Subsequence [5, 8] → `c[2] = 16` → 1 set bit
- Subsequence [8, 9] → `c[2] = 9` → 2 set bits

Answer: 4 set bits (for `c[m]` = 27)

Input	Output
6 1 3 6 7 8 10	4

G. Play With Bits

Naeem Al Imran is the greatest competitive programmer in the history of Dhaka University of Engineering & Technology, Gazipur. He decided to create a black box that reads a number written on a piece of paper as input. After reading the number, the black box updates its memory by performing a bitwise X-OR operation between its current memory and the input number. It then displays the updated memory value on the output screen. Once the process is complete, the paper is returned to you. For example, if the black box's memory is 7 and the number on the paper is 8, the output on the screen will be 15.

You have n papers. Each paper must be used at least once but no more than 2^n times.

Initially, the black box valued at 0. Your task is to find the **maximum** output on the screen using your papers.

Input

The first line contains an integer $n(1 \leq n \leq 17)$ — the number of papers.

The second line contains n space-separated integers $a_1, a_2, \ldots, a_n$ $(1 \leq a_i \leq 5 * 10^9)$ — the ith number is written on ith paper.

Output

Print the maximum value that can be displayed on the output screen after using the papers optimally.

Samples

Input	Output
5 10 13 2 1 6	15

H. Snake Box

Mr. Perseus and S. Islam discovered an extremely large number and decided to play a game with it. The winner of the game would receive the Snake Box as a trophy. The rules of the game are simple:

- On Mr. Perseus' turn, he will take two consecutive digits and replace them with the absolute difference between those digits.
- On S. Islam's turn, he will take two consecutive digits and replace them with the modulo 10 of their sum.

The game ends when the number is reduced to a single digit. If the digit is odd, Mr. Perseus wins; otherwise, S. Islam takes the victory.

S. Islam takes the first turn. Who will be the winner if they play optimally?

Input

The first line contains an integer n $(2 \leq n \leq 2 * 10^5)$ — the number of digits.

The second line contains a number x of n digits.

Output

Print “Mr. Perseus” if Mr. Perseus is the winner; otherwise, “S. Islam” (without quotes).

Samples

Input	Output
3 123	S. Islam
In this case, S. Islam, on the first turn, selected 2 and 3, replacing them with (2 + 3) mod 10 = 5. Then, Mr. Perseus replaced 15 with $\|1 - 5\| = 4$. Selecting 1 and 2 on the first turn would also have been optimal for S. Islam. However, the number was eventually reduced to a single digit, which is even, ensuring S. Islam’s victory.	

I. El Dorado

El Dorado is a mystical land where gold is abundant, and the land is adorned with shimmering cities. There are **n** cities, connected by **m** roads, which form the backbone of this golden kingdom. Due to a recent heavy rainstorm, the roads have been damaged, and travelling between cities has become difficult.

The cities do not have unique names because the citizens believe in simplicity; they are identified only by numbers. Among these cities, a few are designated as **major cities** because they are home to significant gold mines. These major cities are identified by their city numbers being **prime numbers**, which reflects their extraordinary status.

The **government of El Dorado**, known for its eccentric yet effective policies, has decided to repair the damaged roads. However, the government is interested only in repairing or building roads that connect the major cities. Travelers have started complaining about the current state of the roads, but the government has reassured them that the **greatest minds** (yes, including you) have been summoned to solve this problem.

Your task is to determine the **minimum cost** required to connect all the major cities. If no road exists between two major cities, a new road can be built at a flat cost of **c** units. Building new roads in El Dorado is challenging because they must align with the kingdom's aesthetic and environmental guidelines.

Input

The first line contains three integers $n, m, c (1 \leq n \leq 2 * 10^5, 0 \leq m \leq min(3 * 10^5, \frac{n*(n-1)}{2}), 1 \leq c \leq 10^9)$ - number of cities, number of roads and cost to build a new road respectively.

The next m lines describe the roads. Each line contains three integers $u, v (1 \leq u, v \leq n), u \neq v$ - the cities connected by the road, $w (1 \leq w < 10^9)$ - the cost to build a new road.

Output

Output a single integer - the minimum cost required to ensure that all the major cities are connected.

Samples

Input	Output
5 7 9 1 2 4 2 3 6 3 4 2 4 5 3 1 3 5 2 5 10 3 5 8	14

J. 7up

The **Brasil versus Deutschland** football match (also known by its score as 1–7) that took place on 8 July 2014 at the Mineirão stadium in Belo Horizonte was the first of two semi-final matches of the 2014 FIFA World Cup. It was a match of historic loss for Brasil.

Sayeed is a die hard fan of Brasil. But due to his misfortune, he witnessed the 1–7 match. So he considers a Brasil match to be unlucky if the opponent team's score is 7.

You are given the the score of the opponent team of n Brasil matches. Your task is to identify the unlucky one or report if there isn't any.

Input

The first line contains a single integer $t(1 \leq t \leq 100)$ – the number of test cases.

The first line of each test case contains a single integer $n(1 \leq n \leq 1000)$ – the number of Brasil matches.

The second line of each test case contains n integers $a_1, a_1, a_2, \ldots, a_n(0 \leq a_i \leq 7)$ – the score of the opponent team.

Output

For each test case, print the case number and the answer – the match number of the unlucky one. If there are multiple unlucky matches, print the number of the earliest one. Print -1 if there isn't any.

Samples

Input	Output
2 6 0 1 2 3 4 5 8 6 0 2 5 4 7 3 1	Case 1: -1 Case 2: 6

Note

Please don't print any extra trailing spaces after the output and ensure the last line does not end with a newline character.