ACM Arabella Collegiate Programming Contest 2015

Problem Set

25 / 4 / 2015

A. Relational Operator

[Color: White]

In computer science, a relational operator is a programming language construct or operator that tests or defines some kind of relation between two entities.

Your task is to write a simple program that reads two integers separated by one of the relational operators, and prints true or false, depending on whether the conditional relationship between the two operands holds or not.

Input

The first line of input contains one integer T, the number of test cases ($1 \le T \le 128$).

Each test case is in the form: **x op y**, where **x** and **y** are two integers ($-100 \le x, y \le 100$), and **op** is one of the six operators { !=, ==, <, <=, >, >= }. Note that x, op and y are separated by spaces as shown in the sample input.

Output

For each test case, print “true” or “false” depending on whether the relation holds or not.

Sample Input	Sample Output
3 5 < 9 0 != 0 9 <= 5	true false false

B. Three Angles

[Color: Blue]

Given three angles, determine if it is possible to have a triangle of **positive** area with these angles.

Input

The first line of input contains one integer T, the number of test cases ($1 \le T \le 128$).

Each of the following T lines contains 3 space-separated integers ($0 \le \theta_1, \theta_2, \theta_3 \le 180$). These integers represent the three angles.

Output

For each test case, print "YES" if it is possible to have a triangle of positive area with angles (θ_1, θ_2, θ_3) and print "NO" otherwise.

Sample Input	Sample Output
3 50 60 70 50 65 80 45 90 45	YES NO YES

C. Memory is Full

[Color: Green]

Jamal is trying to install a new app on his smart phone, but he is getting an error message: “Memory is full”.

He loves his already installed apps, so he wants to remove the minimum number of them to be able to install the new app.

Assume that his phone memory is **k** MBs, the new app size is **m** MBs and that there are **n** installed apps. You are given a list of **n** positive integers representing the sizes of the installed apps.

Find the minimum number of apps that should be removed.

Input

The first line of input contains one integer T, the number of test cases ($1 \le T \le 128$).

Each test case begins with three integers: k, m, n ($1 \le m \le k \le 32{,}768$) and ($1 \le n \le 100$). The next line contains n space-separated integers representing the sizes of the installed apps.

Output

For each test case, print the minimum number of apps Jamal has to remove to be able to install the new app.

Sample Input	Sample Output
2 7 7 5 1 2 1 1 1 14 13 5 1 2 2 1 2	5 4

D. Sudoku

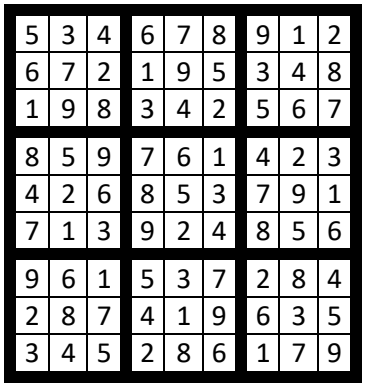
[Color: Orange]

Sudoku is one of the most popular puzzle games of all time.

The goal of Sudoku is to fill a 9×9 grid with numbers so that each row, column and 3×3 box contain all of the digits between 1 and 9.

The nine 3×3 boxes are marked with thick lines.

Samer is developing a nice Sudoku App, he needs your help in writing a program to check whether player's solution is valid or not.



5	3	4	6	7	8	9	1	2
6	7	2	1	9	5	3	4	8
1	9	8	3	4	2	5	6	7
8	5	9	7	6	1	4	2	3
4	2	6	8	5	3	7	9	1
7	1	3	9	2	4	8	5	6
9	6	1	5	3	7	2	8	4
2	8	7	4	1	9	6	3	5
3	4	5	2	8	6	1	7	9

Input

The first line of input contains one integer T, the number of test cases ($1 \le T \le 128$).

Each test case consists of a 9×9 grid; each cell contains a digit between 1 and 9, inclusive. Test cases are separated with a blank line.

Output

For each test case, print "Valid" if the solution is correct, otherwise, print "Invalid".

Sample Input	Sample Output
2 534678912 672195348 198342567 859761423 426853791 713924856 961537284 287419635 345286179 634678912 572195348 198342567 859761423 426853791 713924856 961537284 287419635 345286179	Valid Invalid

E. Time Limit Exceeded?

[Color: Red]

Given n integer numbers, count the number of ways in which we can choose two elements such that their absolute difference is less than 32.

In a more formal way, count the number of pairs (i, j) ($1 \le i < j \le n$) such that $|V[i] - V[j]| < 32$. $|X|$ is the absolute value of X.

Input

The first line of input contains one integer T, the number of test cases ($1 \le T \le 128$).

Each test case begins with an integer n ($1 \le n \le 10{,}000$). The next line contains n integers ($1 \le V[i] \le 10{,}000$).

Output

For each test case, print the number of pairs on a single line.

Sample Input	Sample Output
2 4 1 16 32 64 5 1 100 110 100 1	3 4

F. Palindrome

[Color: Pink]

A string is palindrome if it can be read the same way in either direction, for example “maram” is palindrome, while “ammar” is not.

You are given a string of **n** characters, where each character is either a lowercase English letter or a question mark (?). You are also given a set of **m** constraints. Your task is to count the number of ways in which we can replace all question marks with lowercase English letters such that the resulting string is a palindrome that does not violate the given constraints.

The constraints are in the form of pairs of indices of letters that should be the same.

Input

The first line of input contains one integer T, the number of test cases ($1 \le T \le 256$).

Each test case begins with two integers: n representing the string size ($1 \le n \le 50000$) and m representing the number of constraints ($0 \le m \le 10000$).

The next line contains a string of length n. The next m lines, each contains two integers x and y (1 <= x < y <= n), where letters at index x and index y must be the same.

Test cases are separated by a blank line.

Output

For each test case, print the number of ways modulo 1,000,000,007 ($10^9 + 7$)**.**

Sample Input	Sample Output
4 5 1 ma??m 1 5 5 4 ma??m 1 2 1 5 1 3 3 4 7 0 acm?cpc 4 1 ???? 1 4	26 0 0 676

G. Training Camp

[Color: Yellow]

Montaser is planning to train very hard for ACM JCPC 2015; he has prepared a list with n topics to study in the next n days, one topic every day.

Montaser knows that some topics depend on other topics, so he asked coach Fegla and got a list of m constraints on the order in which he should study these topics.

Also, coach Fegla told him that when he studies topic x on the k^{th} day ($1 \le k \le n$), his level will increase by k^*Wx, where Wx is a weight for topic x, representing how hard it is.

Given the list of topics, the weight of each topic, and the list of constrains, can you tell Montaser what is the maximum level he can reach in these n days? He is currently at level 0 ☹.

Input

The first line of input contains one integer T representing the number of test cases ($1 \le T \le 128$).

The first line of each test case contains two integers: n and m ($1 \le n \le 18$).

The next n lines, each contains the title of one of the topics followed by a space, then an integer W that represents the weight of this topic ($1 \le W \le 100$).

The next m lines are of the form: Topic 1 --> Topic 2, which means that Topic 1 must be studied before Topic 2.

Titles contain only English letters and spaces (no more than 40 characters).

Test cases are separated by a blank line.

Output

For each test case, print the maximum level that Montaser can reach.

Sample Input	Sample Output
1 3 2 Implementation 3 Dynamic Programming 10 Greedy 7 Greedy --> Dynamic Programming Implementation --> Dynamic Programming	47

H. Capital City

[Color: Black]

Bahosain has become the president of Byteland, he is doing his best to make people's lives easier. Now, he is working on improving road networks between the cities.

If two cities are strongly connected, people can use BFS (Bahosain's Fast Service) to travel between them in no time. Otherwise, they have to follow one of the shortest paths between them, and of course, they will use BFS when they can!

Two cities are connected if there is a path between them, and they are strongly connected if after removing any single road they will remain connected.

President Bahosain wants to minimize the maximum distance people have to travel from any city to reach the capital city, can you help him in choosing the capital city?

Input

The first line of input contains one integer T, the number of test cases ($1 \le T \le 64$).

The first line of each test case contains two integers n, m ($1 \le n \le 100,000$) ($0 \le m \le 200,000$), the number of cities and the number of roads, respectively.

Each of the following m lines contains three space-separated integers a, b, c ($1 \le a, b \le n$) ($1 \le c \le 100,000$), meaning that there is a road of length c connecting the cities a and b.

Byteland cities are connected since Bahosain became the president.

Test cases are separated with a blank line.

Output

For each test case, print the number of the city and length of the maximum shortest path on a single line. If there is more than one possible city, print the one with the minimum number.

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