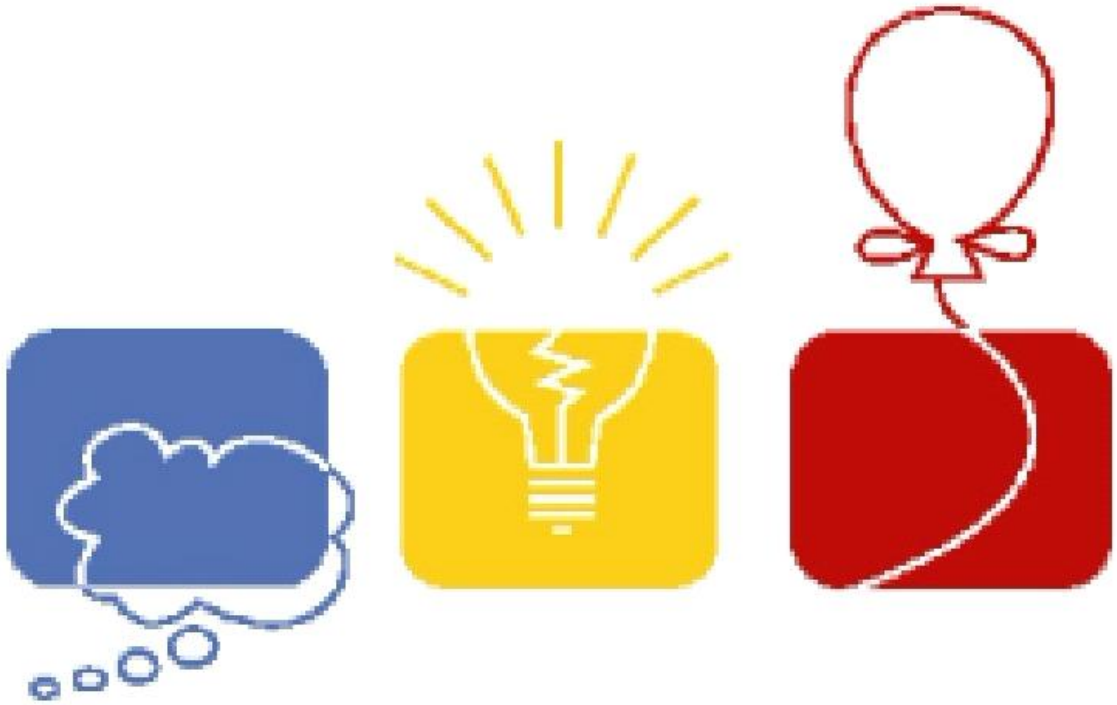

# 2013 ACM South China Normal University Collegiate Programming Contest

# Problem A. LQW's math problem

A number sequence is defined as follows:
$f(1) = f(2) = f(3) = 1$,
$f(t) = (a * f(t-1) + b * f(t-2) + c * f(t-3)) \mod 11$ $(t > 3)$.

For any positive integer k, a is the number of zeros at the end of the decimal form of number $k!$.
For example, $k = 4 \rightarrow k! = 24 \rightarrow a = 0$.

For any positive integer $p$, $g(t) = 2^t \mod 10^p (t \geq 1)$. $b$ is the number of binary digital of the cycle of the sequence g.
For example, $p = 1 \rightarrow g : 2, 4, 8, 6, 2, 4, 8, 6... \rightarrow 4 \rightarrow 100 \rightarrow b = 3$.

For any positive integer $m$, $h(m) = 1 * 2 * 3 + 2 * 3 * 4 + ... + m * (m+1) * (m+2)$, $c$ is the value of $h(m) \mod 2013$.
For example, $m = 1 \rightarrow h(m) = 6 \rightarrow c = 6$.

Given $k$, $p$, $m$ and $n$, you are to calculate the value of $a$, $b$, $c$ and $f(n)$.

## Input

The first line of the input contains an integer $T(1 \leq T \leq 20)$ which means the number of test cases.

Then $T$ lines follow, each line contains 4 integers $k$, $p$, $m$ and $n$ on a single line $(1 \leq k, p, m, n \leq 100,000,000)$.

## Output

For each test case, you should output two lines.

The first line is "Case #:", # means the number of the test case.The second line contains four integers, the value of $a$, $b$, $c$ and $f(n)$.

Output a blank line between two cases.

## Sample input and output

| Sample Input | Sample Output |
|---|---|
| 2<br>4 1 1 4<br>5 2 2 5 | Case 1:<br>0 3 6 9<br><br>Case 2:<br>1 5 30 5 |

# Problem B. A simple tree problem

You are given a tree with n vertices, each edge of it has a length(positive integer less than $10^9$). The n vertices is numbered from 1 to n. We will assume that root of tree always is 1.

We define $dist(u)$ as the min distance between node u and root.
Given an integer $k$, a pair $(u, v)$ of vertices is called valid if and only if $dist(u) + dist(v) \geq k$ ($1 \leq u, v \leq n$, $u \neq v$, $k \leq 10^9$).

Write a program to count how many pairs are valid for a given tree. Noting that we think pair $(u, v)$ is the same as pair $(v, u)$ , so just count once.

## Input

The input contains several test cases.

The first line of each test case contains two integers $n$, $k$ ($2 \leq n \leq 30,000$).
The following $n-1$ lines each contains three integers $u$, $v$, $l$, which means there is an edge between node $u$ and $v$ of length $l$.

## Output

For each test case output the answer on a single line.

## Sample input and output

| Sample Input | Sample Output |
|---|---|
| 5 3358<br>2 1 746<br>4 5 277<br>5 2 3057<br>3 5 1310 | 9 |

# Problem C. Exchange books

Jeflie has a "to read" list, recording the books he intend to read. He is a poor guy, and he wants to read all these books without buying all of them.Luckily, he can exchange a new book with an old one he finished.

There have n books, each one have two properties (level, value). If Jeflie buys $book[i]$, it costs $level[i] * value[i]$. In another way, he can exchange the book[j] by his book[i] only if the $level[i]$ is a divisor of $level[j]$, and it costs $level[j]/level[i] * value[i]$.

Obviously, there exists a best way to read all of the books but cost minimum. Can you help the poor guy to calculate the minimum cost?

## Input

The input consists of multiple cases.

Each case starts with an integer $n$ ($1 \leq n \leq 500$), indicating the number of books Jeflie intends to read.
The second line consists of $level[1], level[2] \ldots level[n]$ ($1 \leq level[i] \leq 10,000$), and the third line consists of $value[1], value[2] \ldots value[n]$ ($1 \leq value[i] \leq 100$).

## Output

For each case, print the minimum cost Jeflie must pay.

## Sample input and output

| Sample Input | Sample Output |
|---|---|
| 5<br>2 3 4 6 8<br>1 1 1 1 1<br>5<br>2 3 4 6 8<br>10 1 1 1 1 | 11<br>31 |

# Problem D. qzhouayi ' s annoyance

As we know, qzhouayi likes PK with other acmers.
One day, he took a walk in school and wanted to find acmers to PK. Unfortunately, he could not find any acmer on the road. So he was very upset and went back to dormitory ac alone.
The next day, he decided to try it again. This time, he thought out a perfect planestimate the number of acmers in each road and find a route which has the most acmers. He was confident of his plan and got up very early.

He divided the school into n areas, from 0 to $n-1$, and there is a road between any two areas. He wanted to find such a route $a1, a2, a3 \ldots ak$:
1) $a_1 = 0$, $a_k = n-1$.
2) $a_1 < a_2 < a_3 < \ldots < a_k$.
3) $f(i,j)$ means the total number of acmers on $road(i,j)$, $f(a_1,a_2) + f(a_2,a_3) + \ldots + f(a_{k-1},a_k)$ is the maximum one.

Please help this poor guy calculate the best route.

## Input

The input file contains several cases.

For each case, the first line contains two integers $n$ and $m$ ($1 \le n \le 10,000, 0 \le m \le 300,000$), representing the number of areas and the roads which have acmers.
The following $m$ lines contain three numbers $x, y, z$ ($0 \le x, y < n, x \ne y, 0 < z \le 1,000$) represent there are z acmers on road(x,y).It is guaranteed that $road(i,j)$ and $road(j,i)$ can not appear at the same time.

n=m=0 indicates the end of input.

## Output

You should print a single line for each test case containing a number indicating the most acmers qzhouayi can meet.

## Sample input and output

| Sample Input | Sample Output |
|---|---|
| 3 0<br>3 2<br>1 2 5<br>0 2 10<br>0 0 | 0<br>10 |

# Problem E. Atoi

Interviewer:"Given a string, please convert it to an integer."

ZHJ:"Is it 10-based?"

Interviewer:"Yes."

ZHJ:"Are there leading zeros?"

Interviewer:"That is possible."

ZHJ:"Does the string contain spaces?"

Interviewer:"That is possible.And the spaces should be skipped."

ZHJ:"Is there any other characters in the string besides digits and spaces?"

Interviewer:"+ or - may be contained.+ and - will appear before the digits."

ZHJ:"Are there more than one +'s or -'s?"

Interviewer:"Of course that is possible!!! You idiot!!!"

## Input

There will be several test cases.

For each case, the input contains a string containing at most 100 characters.

## Output

For each case, you should output an integer indicating the answer.

It is guaranteed that the result is in the range [-10000000, 10000000].

## Sample input and output

| Sample Input | Sample Output |
|---|---|
| 10<br>+01<br>------1<br>-- - - - ++ + + 3<br>0 | 10<br>1<br>1<br>-3<br>0 |

# Problem F. How To Choose

One day, Bob draws $n$ points on a paper. It is guaranteed that he does not draw three points on a straight line.

Now, he wants you to choose four points to construct a concave quadrangle. Bob thinks that two concave quadrangles are the same if they have the same points.
Can you tell him how many different concave quadrangles you can construct?

## Input

The input file will contain one or more test cases.

For each test case, the first line contain an integer $n$ ($4 \leq n \leq 1,000$), indicating the number of points.
Each of the next $n$ lines contains two integers $x$ and $y$ ($-1,000,000 \leq x, y \leq 1,000,000$), indicating the coordinate of corresponding point.

## Output

For each test case, just output a single integer, the number of concave quadrangles you can construct.

## Sample input and output

| Sample Input | Sample Output |
|---|---|
| 4<br>0 0<br>0 1<br>1 0<br>1 1<br>4<br>0 0<br>1 0<br>0 1<br>-1 -1 | 0<br>1 |

# Problem G. Easy problem

In the following equation, $x$, $y$ and $k$ are positive integers.
$1/x + 1/y = 1/k$

For $k = 4$ there are exactly three distinct solutions:
$1/5 + 1/20 = 1/4$
$1/6 + 1/12 = 1/4$
$1/8 + 1/8 = 1/4$

What is the least value $k$ for which the number of distinct solutions exceeds $n$?

## Input

The input contains several test cases.

The first line of the input is a single integer $T$ which is the number of test cases.Then $T$ test cases follow.
Each test case contains a single positive integer $n$ ($2 \leq n \leq 1,000$).

## Output

For each test case, you should output the least value k.

## Sample input and output

| Sample Input | Sample Output |
|---|---|
| 2<br>2<br>3 | 4<br>6 |

# Problem H. Choose a password

BandBandRock is quite sensitive with numbers (a number is defined as a sequence formed by '0'-'9'). He thinks this list of lucky numbers can bring him luck (for example his lucky list could be 9, 13) and he loves these numbers very much!

One day, BandBandRock is choosing a password for his bank account (a password is a sequence formed by '0'-'9'). He always forms his password with at least one of those lucky numbers as substrings. For example, if the passwords length is set as 3, 913and 113 are both available options but 123 is not.

After choosing a password, BandBandRock is worrying about the security of his account. If a hacker realizes his habit and know his number list, he might make some guess and find out BandBandRock's password!

In order to evaluate how secure his account is, BandBandRock wants to know the amount of possibilities of his password.
For example, if the password can be 2 digits at most, therere 21 possibilities as follow:
(1 possibility) 9
(10 possibilities) 90, 92 ... 99
(9 possibilities) 09, 19 ... 89
(1 possibility) 13

## Input

The input consists of multiple cases, and there're less than 100 cases.

Each case begins with the number $n$ ($0 < n < 6$), and the length of password $L$ ($0 < L < 1,000,000,000$). Then following $n$ lines will be the lucky numbers, each per line.
Its guarantee that the length of every number wont exceed 5. Every number will be different from the others.

Theres always a blank line after each input case.

## Output

For each case, you should output the answer in a line, which means the amount of the possibility. As the answer may be so large, you should output the answer mod 1000000007.

## Sample input and output

| Sample Input | Sample Output |
|---|---|
| 2 2<br>9<br>13 | 21 |

# Problem I. Zebra Tower

Princess Lucy is a smart and beautiful girl. Always around her,there will be a lot of suitors, what makes her such upset. She likes playing with cubes so much. Actually, she likes to play with anything whatsoever, cubes or tesseracts, as long as they are multicolored.

Recently, she has a problem about the cubes, so she wants to use this question to test those suitors and deter them. She thinks her Prince Charming should be smarter than her, so who can solve this problem best and fastest have the chance to get her interview.

This problem is that each cube is described by two parameters: color $c_i$ and size $s_i$. A Zebra Tower is a tower that consists of cubes of exactly two colors.
Besides, the colors of the cubes in the tower must alternate (colors of adjacent cubes must differ). And the Zebra Tower should have at least two cubes.There are no other limitations.

A Zebra Tower's height is the sum of sizes of all cubes that form the tower. What you shoule do is building the Zebra Tower of the maximum possible height, using the available cubes.

Can you solve this problem best and fastest then get Princess Lucys interview?
Please be programmed to achieve.

## Input

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

Next $n$ lines contain the descriptions of the cubes, one description per line.
A cube description consists of two space-separated integers $c_i$ and $s_i$ ($1 \leq c_i, s_i \leq 10^9$) — the i-th cube's color and size, correspondingly.

It is guaranteed that there are at least two cubes of different colors.

## Output

For each test case, you should output two part.
The first is "Case #:", # means the number of the test case, then print the maximum height of the Zebra Tower in one line.

## Sample input and output

| Sample Input | Sample Output |
|---|---|
| 4<br>1 2<br>1 3<br>2 4<br>3 3<br>2<br>1 1<br>2 1 | Case 1: 9<br>Case 2: 2 |

# Problem J. Insertion Sort

At the beginning of learning programming, your teacher must teach you how to sort an array via insertion sort. Then, let's sort an array as ascending order with a operation described below:
Operation: As one time, you can select one element and insert it to the position whatever you want.

Could you tell me the minimum number of operations to finish sorting.

## Input

The input consists of $T$ test cases.

The number of test cases $T$ is given in the first line of the input.
Each test case begins with a line containing an integer $N$, $1 \leq N \leq 500,000$, representing the number of integers in the array. Each of the following $N$ integers that belong to the array.

## Output

The output should contain the minimum number of operations to finish sorting, one per line.

## Sample input and output

| Sample Input | Sample Output |
|---|---|
| 2<br>3<br>1 2 3<br>3<br>1 3 2 | 0<br>1 |