The 39^{th} ACM International Collegiate Programming Contest

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Problem A. GCD pair

The greatest common divisor (gcd) of two or more integers (at least one of which is not zero) is the largest positive integer that divides the numbers without a remainder.

Now I will give you a simple problem about gcd again.

Given a sequence of N integers, $A = \{a_1, a_2, ..., a_N\}$.

For every pair of $< l, r > (1 \leq l \leq r \leq N)$, defined a function $F(l, r) = gcd(a_i)(l \leq i \leq r)$ that is the greatest common divisor of all the integers in the subsequence $\{a_l, a_{l+1}, ..., a_r\}$

Obviously, There are $N(N+1)/2$ pair of $< l, r > (1 \leq l \leq r \leq N)$.

We can get the rank of pair $< l, r >$ through the following code.

```
pair<int,int> get_RANK(int l,int r)
{
    map<int,int>mp;
    int k1 = 1, k2 = 1;
    for(int i = 1;i <= N;i++)
        for(int j = i;j <= N;j++)
        {
            if(i == l && j == r)continue;
            if(F(i,j) < F(l,r))
            {
                if(mp.find(F(i,j)) != mp.end())continue;
                k1++;
                mp[F(i,j)] = 1;
            }
            else if(F(i,j) == F(l,r))
            {
                if(i < l || (i == l && j < r))k2++;
            }
        }
    return make_pair(k1,k2);
}
```

(If you don't know C++, what a sad story! Sorry!)

There are Q queries, you need to answer the following two queries:

- SELECT k_1 k_2: ask for the pair $< l, r >$ which is rank $< k_1, k_2 >$.If there is no such pair output -1.
- RANK l r: ask for the rank $< k_1, k_2 >$ of the pair $< l, r >$

Input

The first line of the input is $T(1 \leq T \leq 10)$, which stands for the number of test cases you need to solve.

The first line of each case contains two integers N,Q $(1 \leq N, Q \leq 10^5)$,denoting the number of integers and queries, respectively.

The second line contains N integers, $a_1, a_2, ..., a_N (1 \le a_i \le 10^5)$.

For the next Q lines, contain instructions "SELECT k_1 k_2" or "RANK l r"

$(1 \le k_1, k_2 \le N(N+1)/2, 1 \le l \le r \le N)$,

Output

For each test case, print a line "Case #t:"(without quotes, t means the index of the test case) at the beginning.

For each query, output the answer.

Sample input and output

Sample Input	Sample Output
1	Case #1:
3 6	3 1
6 2 4	1 1
RANK 1 1	1 4
SELECT 3 1	-1
RANK 2 3	2 2
SELECT 2 2	2 3
SELECT 1 3	
SELECT 1 4	

Problem B. Escape

As a young man, Al was a skilled artist, a potter with a wife and two fine sons. One night, his older son developed a severe stomachache. Thinking it was only some common intestinal isorder, neither Al nor his wife took the condition very seriously . But the boy died suddenly that night.

Knowing the death could have been avoided if he had only realized the seriousness of the situation, he always felt he was guilty. To make matters worse, his wife left him a short time later, leaving him alone with his six-year-old younger son. The hurt and pain of the two situations were more than Al could stand, and he turned to alcohol for help. In time Al became an alcoholic.

As the alcoholism progressed, AL began to lose everything he possessed – his land, house, etc. Finally Al died alone in a small bar. Hearing of Al's death, I thought, "What a totally wasted life! What a complete failure! "

As time went by, I began to revalue my earlier rough judgement . I knew Al's now adult son, Ernie. He is one of the kindest, most caring, most loving men I have ever known. I saw the love between Ernie and his children, thinking that kindness and caring had to come from somewhere .

I hadn't heard Ernie talked much about his father. One day, I worked up my courage to ask him what on earth his father had done so that he became such a special person. Ernie said quietly, "As a child until I left home at 18", Al came into my room every night, gave me a kiss and said, "love you, son."

Tears came to my eyes as I realized what I had been a fool to judge Al as a failure. He had not left any material possessions behind. But he had been a kind loving father, and left behind his best love.

wuyiqi trapped in a maze again. He want to escape from the maze. He face a problem:

put $k_1 + k_2 + ... + k_N$ ***different balls into*** N ***different boxes, the first box must contain*** k_1 ***balls, the second box must contain*** k_2 ***balls, and so on. What is the number of division modulo*** P***(***P ***is a prime.).***.

This problem is too easy. wuyiqi can solve it very fast.

But wuyiqi can not escape from the maze, he must solve a hard problem.

Now there is the problem:
Given the N and P as mentioned above.
wuyiqi should gives the $\{k_1, k_2, ...k_N\}$ make the above problem's answer is zero.
And restriction conditions are $0 \le k_1 \le K_1, 0 \le k_2 \le K_2, ..., 0 \le k_N \le K_N$, of course they are all integers, and at least one of which is not zero.

wuyiqi want you to calculate how many $\{k_1, k_2, ...k_N\}$ meet the conditions.

Input

The first line of the input is $T(1 \le T \le 50)$, which stands for the number of test cases you need to solve.

For each case, there are two lines.

The first line of each case contains two integers N,P $(1 \le N \le 10, 1 \le P \le 20)$,as explained above, and the P is a prime.

The second line contains N integers, $K_1, K_2, ..., K_N (1 \le K_i \le 10^9)$.

Output

For each case, you should output a single line, first output "Case #t: ", where t indicating the case number between 1 and T. Then a single integer follows, indicating the answer module 100000009.

Sample input and output

Sample Input	Sample Output
1 2 3 1 2	Case #1: 1

Note

For the first case, among $\{0, 1\}$,$\{0, 2\}$,$\{1, 0\}$,$\{1, 1\}$,$\{1, 2\}$, there is only $\{1, 2\}$ meet the conditions.

Problem C. Tree

You are given a tree (an acyclic undirected connected graph) with N nodes. The tree nodes are numbered from 1 to N

There are $N-1$ edges numbered from 1 to $N-1$.

Each node has a value and each edge has a value. The initial value is 0.

There are two kind of operation as follows:

- ADD1 u v k: for nodes on the path from u to v, the value of these nodes increase by k.
- ADD2 u v k: for edges on the path from u to v, the value of these edges increase by k

After finished M operation on the tree, please output the value of each node and edge.

Input

The first line of the input is $T(1 \leq T \leq 20)$, which stands for the number of test cases you need to solve.

The first line of each case contains two integers N,M $(1 \leq N, M \leq 10^5)$,denoting the number of nodes and operations, respectively.

The next $N-1$ lines, each lines contains two integers $u, v(1 \leq u, v \leq N)$, denote there is an edge between u,v and its initial value is 0.

For the next M line, contain instructions "ADD1 u v k" or "ADD2 u v k".

$(1 \leq u, v \leq N, -10^5 \leq k \leq 10^5)$

Output

For each test case, print a line "Case #t:"(without quotes, t means the index of the test case) at the beginning.

The second line contains N integer which means the value of each node.

The third line contains $N-1$ integer which means the value of each edge according to the input order.

Sample input and output

Sample Input	Sample Output
2 4 2 1 2 2 3 2 4 ADD1 1 4 1 ADD2 3 4 2 4 2 1 2 2 3 1 4 ADD1 1 4 5 ADD2 3 2 4	Case #1: 1 1 0 1 0 2 2 Case #2: 5 0 0 5 0 4 0

Problem D. Contest

In the ACM International Collegiate Programming Contest, each team consist of three students. And the teams are given 5 hours to solve between 8 and 12 programming problems.

On Mars, there is programming contest, too. Each team consist of N students. The teams are given M hours to solve M programming problems. Each team can use only one computer, but they can't cooperate to solve a problem. At the beginning of the i^{th} hour, they will get the i^{th} programming problem. They must choose a student to solve this problem and others go out to have a rest. The chosen student will spend an hour time to program this problem. At the end of this hour, he must submit his program. This program is then run on test data and can't modify any more.

Now, you have to help a team to find a strategy to maximize the expected number of correctly solved problems.

For each problem, each student has a certain probability that correct solve. If the i^{th} student solve the j^{th} problem, the probability of correct solve is P_{ij}.

At any time, the different between any two students' programming time is not more than 1 hour.

For example, if there are 3 students and there are 5 problems. The strategy $\{1,2,3,1,2\}$, $\{1,3,2,2,3\}$ or $\{2,1,3,3,1\}$ are all legal. But $\{1,1,3,2,3\}$,$\{3,1,3,1,2\}$ and $\{1,2,3,1,1\}$ are all illegal.

You should find a strategy to maximize the expected number of correctly solved problems, if you have know all probability.

Input

The first line of the input is $T (1 \le T \le 20)$, which stands for the number of test cases you need to solve.

The first line of each case contains two integers N,M ($1 \le N \le 10$,$1 \le M \le 1000$),denoting the number of students and programming problem, respectively.

The next N lines, each lines contains M real numbers between 0 and 1 , the j^{th} number in the i^{th} line is P_{ij}.

Output

For each test case, print a line "Case #t: "(without quotes, t means the index of the test case) at the beginning. Then a single real number means the maximal expected number of correctly solved problems if this team follow the best strategy, to five digits after the decimal point. Look at the output for sample input for details.

Sample input and output

Sample Input	Sample Output
1 2 3 0.6 0.3 0.4 0.3 0.7 0.9	Case #1: 2.20000

Problem E. Airport

The country of jiuye composed by N cites. Each city can be viewed as a point in a two-dimensional plane with integer coordinates (x,y). The distance between city i and city j is defined by $d_{ij} = |x_i - x_j| + |y_i - y_j|$. jiuye want to setup airport in K cities among N cities. So he need your help to choose these K cities, to minimize the maximum distance to the nearest airport of each city. That is , if we define $d_i (1 \leq i \leq N)$ as the distance from city i to the nearest city with airport. Your aim is to minimize the value $max\{d_i | 1 \leq i \leq N\}$. You just output the minimum.

Input

The first line of the input is $T (1 \leq T \leq 100)$, which stands for the number of test cases you need to solve.

The first line of each case contains two integers N,K $(1 \leq N \leq 60, 1 \leq K \leq N)$,as mentioned above.

The next N lines, each lines contains two integer x_i and y_i $(-10^9 \leq x_i, y_i \leq 10^9)$, denote the coordinates of city i.

Output

For each test case, print a line "Case #t: "(without quotes, t means the index of the test case) at the beginning. Then a single integer means the minimum.

Sample input and output

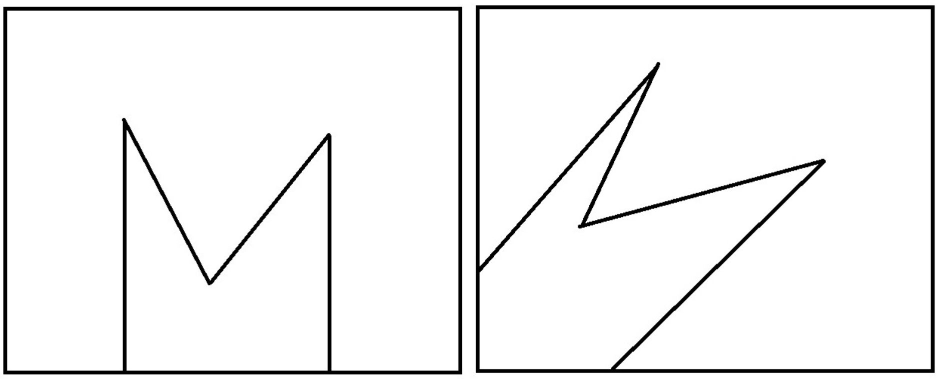
Sample Input	Sample Output
2 3 2 0 0 4 0 5 1 4 2 0 3 1 0 3 0 8 9	Case #1: 2 Case #2: 4

Problem F. Sawtooth

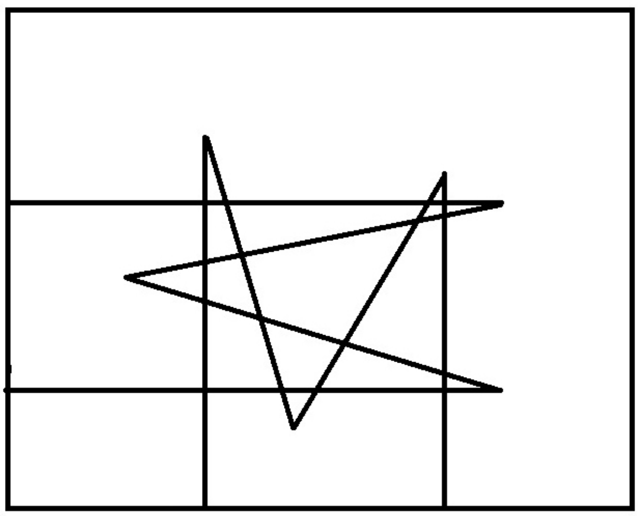
Think about a plane:

- One straight line can divide a plane into two regions.
- Two lines can divide a plane into at most four regions.
- Three lines can divide a plane into at most seven regions.
- And so on...

Now we have some figure constructed with two parallel rays in the same direction, joined by two straight segments. It looks like a character “M”. You are given N such “M”s. What is the maximum number of regions that these “M”s can divide a plane?



Examples of the figure One single “M”divides the plane into two regions



Example of two “M”s dividing a plane

Input

The first line of the input is $T (1 \le T \le 100000)$, which stands for the number of test cases you need to solve.

Each case contains one single non-negative integer, indicating number of "M"s. $(0 \le N \le 10^{12})$

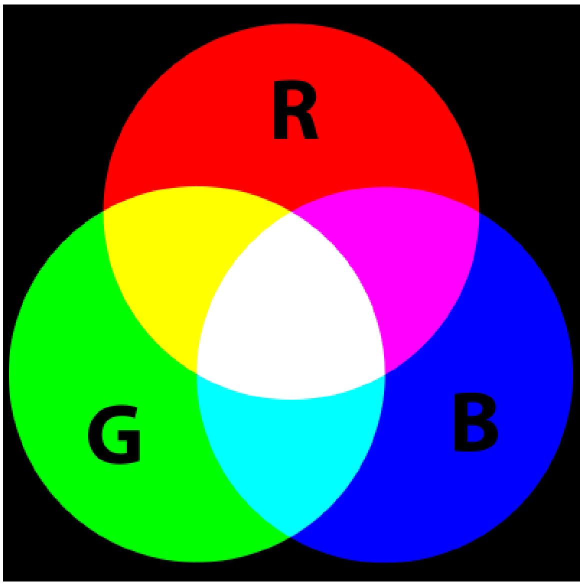
Output

For each test case, print a line "Case #t: "(without quotes, t means the index of the test case) at the beginning. Then an integer that is the maximum number of regions N the "M"figures can divide.

Sample input and output

Sample Input	Sample Output
2 1 2	Case #1: 2 Case #2: 19

Problem G. Colorful Segment



Additive color mixing: adding red to green yields yellow; adding red to blue yields magenta; adding green to blue yields cyan; adding all three primary colors together yields white.

In three dimensional space, there are N segments. Their initial color is black. In the red light, they will turn red. In the green light, they will turn green. In the blue light, they will turn blue. In the red and green light, they will turn yellow. In the red and blue light, they will turn magenta. In the green and blue light, they will turn cyan. In the red, green and blue light, they will turn white.

There are M light sources. They can transmit red, green or blue light. But the light they emitted only illuminate a small area. The $i^{th}(1 \le i \le M)$ light source is located at (x_i, y_i, z_i) and it can illuminate an area of ellipsoidal with equation as follows.

$$\frac{(x-x_i)^2}{a_i^2} + \frac{(y-y_i)^2}{b_i^2} + \frac{(z-z_i)^2}{c_i^2} \le 1$$

Under irradiation of the M light sources, segments will show a different color. You should to calculate the length of the segment in different colors.

Input

The first line of the input is $T(1 \le T \le 100)$, which stands for the number of test cases you need to solve.

The first line of each case contains two integers N,M $(1 \le N, M \le 100)$,denoting the number of segments and light sources, respectively.

For the next N lines, each line describes one segment with six integers $x_1, y_1, z_1, x_2, y_2, z_2$ $(-10000 \le x_1, y_1, z_1, x_2, y_2, z_2 \le 10000)$ which are coordinates of the segment's ending.

Then follows M lines. Each line begins with six integers $x_i, y_i, z_i, a_i, b_i, c_i$ as mentioned above $(-10000 \le x_i, y_i, z_i \le 10000, 1 \le a_i, b_i, c_i \le 10000)$. At the end of the line is a character being 'R','G' or 'B'. 'R' means the light source emits red light. 'G' means the light source emits green light. 'B' means the light source emits blue light.

Output

For each test case, you should output 8 lines, output the length of segment with color black, red, green, blue, yellow, magenta, cyan, white in order. See detailed format from the sample output. Answer will be considered as correct if their absolute error is less than 10^{-5}.

Sample input and output

Sample Input	Sample Output
2 1 2 -5 0 0 5 0 0 0 0 0 2 1 1 R 2 0 0 2 1 1 B 2 3 2 0 0 -2 0 0 0 -3 0 0 5 0 0 0 0 1 2 1 R 0 2 0 1 2 1 G 0 2 0 1 2 1 B	4.00000 2.00000 0.00000 2.00000 0.00000 2.00000 0.00000 0.00000 4.00000 4.00000 0.00000 0.00000 0.00000 0.00000 2.00000 2.00000

Problem H. Guess the Money

Dshawn is a tuhao. He has a lot of money. One day, he gave A dollars to kuangbin and cxlove. kuangbin got B dollars and cxlove got C dollars. Obviously, $A = B + C$.

wuyiqi is very curious, he want to know the A,B and C. But they didn't tell him. Just tell him some information about the three numbers.

Dshawn said that the number A has N_1 digits in its decimal representation (without extra leading zero). Assume the digits of its decimal expansion from the left to the right are $a_0, a_1, ..., a_{N_1-1}$. Dshawn didn't tell wuyiqi all the digits but tell him M_1 digits.

kuangbin said that the number B has N_2 digits in its decimal representation (without extra leading zero). Assume the digits of its decimal expansion from the left to the right are $b_0, b_1, ..., b_{N_2-1}$. kuangbin didn't tell wuyiqi all the digits but tell him M_2 digits.

cxlove said that the number C has N_3 digits in its decimal representation (without extra leading zero). Assume the digits of its decimal expansion from the left to the right are $c_0, c_1, ..., c_{N_3-1}$. cxlove didn't tell wuyiqi all the digits but tell him M_3 digits.

You should find the number of possible $\{A, B, C\}$. It is possible that someone tells lies, so if the information given is inconsistent with any possible $\{A, B, C\}$, you should also detect this.

Input

The first line of the input is $T(1 \le T \le 50)$, which stands for the number of test cases you need to solve.

The first line of each case contains two integers N_1,M_1 $(1 \le N_1 \le 10^7, 0 \le M_1 \le min(N_1, 10^4))$.

For the next M_1 lines, each line contains two integers id and x $(0 \le id < N_1,\ 0 \le x \le 9)$ means $a_{id} = x$.

The next line contains two integers N_2,M_2 $(1 \le N_2 \le 10^7, 0 \le M_2 \le min(N_2, 10^4))$.

For the next M_2 lines, each line contains two integers id and x $(0 \le id < N_2,\ 0 \le x \le 9)$ means $b_{id} = x$.

The next line contains two integers N_3,M_3 $(1 \le N_3 \le 10^7, 0 \le M_3 \le min(N_3, 10^4))$.

For the next M_3 lines, each line contains two integers id and x $(0 \le id < N_3,\ 0 \le x \le 9)$ means $c_{id} = x$.

Output

For each test case, print a line "Case #t: "(without quotes, t means the index of the test case) at the beginning.

If it is impossible, please output "IMPOSSIBLE" else output the answer modulo 20140927.

Sample input and output

Sample Input	Sample Output
3 2 0 1 1 0 9 1 0 1 1 0 5 1 0 1 0 2 0 3 0 2 0	Case #1: 9 Case #2: 6 Case #3: IMPOSSIBLE

Problem I. Divided Land

It's time to fight the local despots and redistribute the land. There is a rectangular piece of land granted from the government, whose length and width are both in binary form. As the mayor, you must segment the land into multiple squares of equal size for the villagers. What are required is there must be no any waste and each single segmented square land has as large area as possible. The width of the segmented square land is also binary.

Input

The first line of the input is $T(1 \leq T \leq 100)$, which stands for the number of test cases you need to solve.

Each case contains two binary number represents the length L and the width W of given land.

$(0 < L, W \leq 2^{1000})$

Output

For each test case, print a line "Case #t: "(without quotes, t means the index of the test case) at the beginning. Then one number means the largest width of land that can be divided from input data. And it will be show in binary. Do not have any useless number or space.

Sample input and output

Sample Input	Sample Output
3 10 100 100 110 10010 1100	Case #1: 10 Case #2: 10 Case #3: 110

Problem J. Fraction

Given a number n, and a geometric progression $a_i = b \cdot q^i, i \geq 0$, what is the fraction of the elements of that progression with decimal notation that has the decimal notation of n as prefix?

More formally, if c_i out of the first i elements of the progression start with n in decimal notation, you need to find the limit $\lim\limits_{i \to \infty} \frac{c_i}{i}$. It is guaranteed that the limit always exists.

For example, $n = 7, b = 1, q = 2$. About 5.799% of all powers of two start with 7. (the smallest one is $2^{46} = 70368744177664$)

Input

The first line of the input is $T (1 \leq T \leq 100)$, which stands for the number of test cases you need to solve.

Each case contains three integers n,b and q. $(1 \leq n, b, q \leq 1000)$

Output

For each test case, print a line "Case #t: "(without quotes, t means the index of the test case) at the beginning. Then output one floating number – the sought fraction. Round your answer to the 5th decimal place.

Sample input and output

Sample Input	Sample Output
2 7 1 2 1 1 1	Case #1: 0.05799 Case #2: 1.00000

Problem K. Yaoge's maximum profit

Yaoge likes to eat chicken chops late at night. Yaoge has eaten too many chicken chops, so that Yaoge knows the pattern in the world of chicken chops. There are N cities in the world numbered from 1 to N. There are some roads between some cities, and there is one and only one simple path between each pair of cities, i.e. the cities are connected like a tree. When Yaoge moves along a path, Yaoge can choose one city to buy ONE chicken chop and sell it in a city after the city Yaoge buy it. So Yaoge can get profit if Yaoge sell the chicken chop with higher price. Yaoge is famous in the world. AFTER Yaoge has completed one travel, the price of the chicken chop in each city on that travel path will be increased by V.

Input

The first line contains an integer $T(0 < T \leq 10)$, the number of test cases you need to solve. For each test case, the first line contains an integer $N(0 < N \leq 50000)$, the number of cities. For each of the next N lines, the i-th line contains an integer $W_i(0 < W_i \leq 10000)$, the price of the chicken chop in city i. Each of the next N–1 lines contains two integers X $Y(1 \leq X, Y \leq N)$, describing a road between city X and city Y. The next line contains an integer $Q(0 \leq Q \leq 50000)$, the number of queries. Each of the next Q lines contains three integer X Y $V(1 \leq X, Y \leq N; 0 < V \leq 10000)$, meaning that Yaoge moves along the path from city X to city Y, and the price of the chicken chop in each city on the path will be increased by V AFTER Yaoge has completed this travel.

Output

For each query, output the maximum profit Yaoge can get. If no positive profit can be earned, output 0 instead.

Sample input and output

Sample Input	Sample Output
1 5 1 2 3 4 5 1 2 2 3 3 4 4 5 5 1 5 1 5 1 1 1 1 2 5 1 1 1 2 1	4 0 0 1 0