A. Angry Trees

JRY is so rich that he bought too many trees and planted them in his yard. Because of his personal preference, all these trees have the same shape. At first, these trees were small and peaceful, but after growing for several years, they become huge and compete for the limited water and nutrition. Therefore, they become angry, and their common enemy is JRY, because it is JRY who planted them in such a "small" place (although his yard is the biggest in the world).

There are m angry trees, and each angry tree has n nodes and $n-1$ branches. All the angry trees decide to combine together, and they made extra $m-1$ branches so that they can be one. Moreover, they select the first node of the first tree to be the root of the whole huge tree. Now, there is a terribly enormous tree with nm nodes and $nm-1$ branches.

The trees come up with an idea to revenge. When JRY is sleeping, they drag JRY onto one of the nodes, and steal all JRY's money and put it onto one node too (the two nodes can be either same or different). When JRY wakes up, he definitely will go for these money. Every time JRY moves down along a branch (moving towards the root), he will spend 1 unit time, and when he moves up along a branch (moving away from the root), he will spend 2 unit time. Additionally, smart JRY will always move along the shortest path on the tree between him and his money.

One nightmare of the trees is to find the longest time that JRY need to find his money, and they also need to know how many different ways there are to get this longest time (two ways are considered different if and only if JRY's initial position is different or the money's position is different). Can you help them?

Input

The first line of the input is a single integer T, indicating the number of testcases.

For each testcase, the first line is two integers n and m $(1 \le n, m \le 50000)$. Each of the next $n-1$ lines contains two integers x and y, which represent one branch (x, y) in every tree. Each of the following $m-1$ lines contains four integers x, a, y, b, which means there is an additional branch connecting the a-th node of the x-th tree and the b-th node of the y-th tree. It is guaranteed that either every small tree or the whole tree is an acyclic connected undirected graph. Please be aware that the first node (the node numbered 1) of the first tree (the tree numbered 1) is the root of the whole tree.

It is guaranteed that for all the testcases, $\sum n + \sum m \le 1000000$.

Output

For each testcase, print two space-separated integers indicating the longest time JRY need to find his money and the ways of position to reach this upper bound.

Sample Input

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

Sample Output

```
11 2
22 3
```

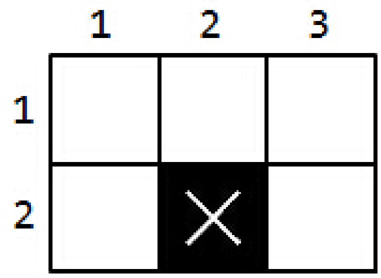
B. Buildings

Your current task is to make a ground plan for a residential building located in HZXJHS. So you must determine a way to split the floor building with walls to make apartments in the shape of a rectangle. Each built wall must be paralled to the building's sides.

The floor is represented in the ground plan as a large rectangle with dimensions $n \times m$, where each apartment is a smaller rectangle with dimensions $a \times b$ located inside. For each apartment, its dimensions can be different from each other. The number a and b must be integers.

Additionally, the apartments must completely cover the floor without one 1×1 square located on (x, y). The apartments must not intersect, but they can touch.

For this example, this is a sample of $n = 2, m = 3, x = 2, y = 2$.



To prevent darkness indoors, the apartments must have windows. Therefore, each apartment must share its at least one side with the edge of the rectangle representing the floor so it is possible to place a window.

Your boss XXY wants to minimize the maximum areas of all apartments, now it's your turn to tell him the answer.

Input

There are at most 10000 testcases.
For each testcase, only four space-separated integers, $n, m, x, y (1 \le n, m \le 10^8, n \times m > 1, 1 \le x \le n, 1 \le y \le m)$.

Output

For each testcase, print only one interger, representing the answer.

Sample Input

```
2 3 2 2
3 3 1 1
```

Sample Output

```
1
2
```

C. Connect the Graph

Once there was a special graph. This graph had n vertices and some edges. Each edge was either white or black. There was no edge connecting one vertex and the vertex itself. There was no two edges connecting the same pair of vertices. It is special because the each vertex is connected to at most two black edges and at most two white edges.

One day, the demon broke this graph by copying all the vertices and in one copy of the graph, the demon only keeps all the black edges, and in the other copy of the graph, the demon keeps all the white edges. Now people only knows there are w_0 vertices which are connected with no white edges, w_1 vertices which are connected with 1 white edges, w_2 vertices which are connected with 2 white edges, b_0 vertices which are connected with no black edges, b_1 vertices which are connected with 1 black edges and b_2 vertices which are connected with 2 black edges.

The precious graph should be fixed to guide people, so some people started to fix it. If multiple initial states satisfy the restriction described above, print any of them.

Input

The first line of the input is a single integer T $(T \leq 700)$, indicating the number of testcases.

Each of the following T lines contains $w_0, w_1, w_2, b_0, b_1, b_2$. It is guaranteed that $1 \leq w_0, w_1, w_2, b_0, b_1, b_2 \leq 2000$ and $b_0 + b_1 + b_2 = w_0 + w_1 + w_2$.

It is also guaranteed that the sum of all the numbers in the input file is less than 300000.

Output

For each testcase, if there is no available solution, print -1. Otherwise, print m in the first line, indicating the total number of edges. Each of the next m lines contains three integers x, y, t, which means there is an edge colored t connecting vertices x and y. $t = 0$ means this edge white, and $t = 1$ means this edge is black. Please be aware that this graph has no self-loop and no multiple edges. Please make sure that $1 \leq x, y \leq b_0 + b_1 + b_2$.

Sample Input

```
2
1 1 1 1 1 1
1 2 2 1 2 2
```

Sample Output

```
-1
6
1 5 0
4 5 0
2 4 0
1 4 1
1 3 1
2 3 1
```

D. Delicious Apples

There are n apple trees planted along a cyclic road, which is L metres long. Your storehouse is built at position 0 on that cyclic road.
The ith tree is planted at position x_i, clockwise from position 0. There are a_i delicious apple(s) on the ith tree.

You only have a basket which can contain at most K apple(s). You are to start from your storehouse, pick all the apples and carry them back to your storehouse using your basket. What is your minimum distance travelled?

$1 \le n, k \le 10^5, a_i \ge 1, a_1 + a_2 + ... + a_n \le 10^5$
$1 \le L \le 10^9$
$0 \le x[i] \le L$

There are less than 20 huge testcases, and less than 500 small testcases.

Input

First line: t, the number of testcases.
Then t testcases follow. In each testcase:
First line contains three integers, L, n, K.
Next n lines, each line contains x_i, a_i.

Output

Output total distance in a line for each testcase.

Sample Input

```
2
10 3 2
2 2
8 2
5 1
10 4 1
2 2
8 2
5 1
0 10000
```

Sample Output

```
18
26
```

E. Eastest Magical Day Seep Group's Summer

As we know, Tsuyuri Kumin likes sleeping in Eastest magical day sleep group's summer. But Rikka wants Kumin to play games with her. So she comes up with one problem:

Here is an undirected graph G with n vertices and m edges. Now you need to delete $m-n$ edges and to make sure that the remain graph is connected. Rikka wants you to tell her the number of ways to choose the edges.

Kumin wants to go to sleep, so she asks you to answer this question. Can you help her?

Input

There are at most 100 testcases，and there are no more 5 testcases with $n \geq 10$.

For each test case, the first line contains two integers n, m $(1 \leq n \leq 16, n \leq m \leq \frac{n(n-1)}{2})$.

Then m lines follows. Each of them contains two integers u_i, v_i, meaning that there is an edge between u_i and v_i. It is guaranteed that the graph doesn't contain self loops or multiple edges.

Output

For each testcase print a single integer - the number of ways to choose the edges. The answer may be very large, so you only need to print the answer modulo 998244353.

Sample Input

```
4 5
1 2
2 3
3 4
4 1
1 3
```

Sample Output

```
5
```

F. Friends

There are n people and m pairs of friends. For every pair of friends, they can choose to become online friends (communicating using online applications) or offline friends (mostly using face-to-face communication). However, everyone in these n people wants to have the same number of online and offline friends (i.e. If one person has x onine friends, he or she must have x offline friends too, but different people can have different number of online or offline friends). Please determine how many ways there are to satisfy their requirements.

Input

The first line of the input is a single integer T $(T = 100)$, indicating the number of testcases.

For each testcase, the first line contains two integers n $(1 \le n \le 8)$ and m $(0 \le m \le \frac{n(n-1)}{2})$, indicating the number of people and the number of pairs of friends, respectively. Each of the next m lines contains two numbers x and y, which mean x and y are friends. It is guaranteed that $x \neq y$ and every friend relationship will appear at most once.

Output

For each testcase, print one number indicating the answer.

Sample Input

```
2
3 3
1 2
2 3
3 1
4 4
1 2
2 3
3 4
4 1
```

Sample Output

```
0
2
```

G. Gorgeous Sequence

There is a sequence a of length n. We use a_i to denote the i-th element in this sequence. You should do the following three types of operations to this sequence.

$0\ x\ y\ t$: For every $x \le i \le y$, we use $min(a_i, t)$ to replace the original a_i's value.
$1\ x\ y$: Print the maximum value of a_i that $x \le i \le y$.
$2\ x\ y$: Print the sum of a_i that $x \le i \le y$.

Input

The first line of the input is a single integer T, indicating the number of testcases.

The first line contains two integers n and m denoting the length of the sequence and the number of operations.

The second line contains n separated integers $a_1, \ldots, a_n$ ($\forall 1 \le i \le n, 0 \le a_i < 2^{31}$).

Each of the following m lines represents one operation ($1 \le x \le y \le n, 0 \le t < 2^{31}$).

It is guaranteed that $T = 100, \sum n \le 1000000, \ \sum m \le 1000000$.

Output

For every operation of type 1 or 2, print one line containing the answer to the corresponding query.

Sample Input

```
1
5 5
1 2 3 4 5
1 1 5
2 1 5
0 3 5 3
1 1 5
2 1 5
```

Sample Output

```
5
15
3
12
```

H. He is Flying

JRY wants to drag racing along a long road. There are n sections on the road, the i-th section has a non-negative integer length s_i. JRY will choose some continuous sections to race (at an unbelievable speed), so there are totally $\frac{n(n+1)}{2}$ different ways for him to ride. If JRY rides across from the i-th section to the j-th section, he would gain $j-i+1$ pleasure. Now JRY wants to know, if he tries all the ways whose length is s, what's the total pleasure he can get. Please be aware that in the problem, the length of one section could be zero, which means that the length is so trivial that we can regard it as 0.

Input

The first line of the input is a single integer T $(T=5)$, indicating the number of testcases.

For each testcase, the first line contains one integer n. The second line contains n non-negative integers, which mean the length of every section. If we denote the total length of all the sections as s, we can guarantee that $0 \leq s \leq 50000$ and $1 \leq n \leq 100000$.

Output

For each testcase, print $s+1$ lines. The single number in the i-th line indicates the total pleasure JRY can get if he races all the ways of length $i-1$.

Sample Input

```
2
3
1 2 3
4
0 1 2 3
```

Sample Output

```
0
1
1
3
0
2
3
1
3
1
6
0
2
7
```

I. I Wanna Become A 24-Point Master

Recently Rikka falls in love with an old but interesting game -- 24 points. She wants to become a master of this game, so she asks Yuta to give her some problems to practice.

Quickly, Rikka solved almost all of the problems but the remained one is really difficult:

In this problem, you need to write a program which can get 24 points with n numbers, which are all equal to n.

Input

There are no more then 100 testcases and there are no more then 5 testcases with $n \geq 100$. Each testcase contains only one integer n $(1 \leq n \leq 10^5)$

Output

For each testcase:

If there is not any way to get 24 points, print a single line with -1.

Otherwise, let A be an array with $2n-1$ numbers and at firsrt $A_i = n$ $(1 \leq i \leq n)$. You need to print $n-1$ lines and the ith line contains one integer a, one char b and then one integer c, where $1 \leq a, c < n+i$ and b is "+","-","*" or "/". This line means that you let A_a and A_c do the operation b and store the answer into A_{n+i}.

If your answer satisfies the following rule, we think your answer is right:

1. $A_{2n-1} = 24$

2. Each position of the array A is used at most one tine.

3. The absolute value of the numerator and denominator of each element in array A is no more than 10^9

Sample Input

```
4
```

Sample Output

```
1 * 2
5 + 3
6 + 4
```

J. JRY is Fighting

Long long ago, there is a hero fighting against the emperor JRY. At the very beginning, the hero has m HPs(health-points). There points represent his health - if ever they fall below or equal to zero, the hero will die. In the following n seconds, he will be hurt by XXY. At the i seconds, his HP will reduce by h_i. If $h_i < 0$, it means his HP will increase by $|h_i|$.

The hero has a magic bottle which can store HPs. At first, the bottle is empty. Each time after the hero got hurt, the bottle can get k more HPs, and the hero can decide whether he will release the HPs in the bottle. If he does, he will gain the HPs in the bottle and the bottle will be empty.

We define the hero's operating sequence as s, representing that he used the magic bottle at the s_i-th seconds. $|s|$ represent the times he used, as well as the length of the sequence.

Now, you should maximize the mininum time interval between two adjacent operation. In other words, let $T = \max\left\{\min\left\{s_i - s_{i-1}\right\}(1 < i \le |s|)\right\}$, you should find the value of T. We can easily find that if $|s| \le 1, T = +\infty$.

You should give him a plan as an operating sequence s which is right for the hero to survive successfully. The hero is so strict that you should find the lexicographically smallest one.

Sequence $u_1, u_2, \cdots, u_n$ is lexicographically smaller than sequence $v_1, v_2, \cdots, v_m$, if

$n < m$ and $u_1 = v_1, u_2 = v_2, \cdots, u_n = v_n$, or

there exists an integer $k(1 \le k \le \min(n, m))$ where $u_1 = v_1, u_2 = v_2, \cdots, u_{k-1} = v_{k-1}$ and $u_k < v_k$ all hold.

Input

There are multiple testcases, the sum of n is less then 10^6.
The first line contains three space-separated integers each, $n(1 \le n \le 500000)$, $m(1 \le m \le 10^6)$, $k(1 \le k \le 100)$.
The second line contains n space-separated integers, $a_i(0 \le |a_i| \le 100)$.

Output

If the hero can't survive, print "Poor Hero!".
If $T = +\infty$, print "Poor JRY!".
Otherwise, print three lines:
The first line, an integer, representing the value of T.
The second line, an integer, $|s|$.
The third line, $|s|$ space-separated intergers, s_i.

Sample Input

```
5 7 3
1 -2 10 2 2
2 33 33
-33 -33
1 1 1
1
```

Sample Output

```
2
2
1 3
Poor JRY!
Poor Hero!
```