A. Game On the Tree

Given a tree, a connected graph that contains N vertexes and $N-1$ edges, you should control a virtual miner to get maximum values by walking from a vertex A and stopping at a vertex B.

On a tree, as we know, there is only one road between every two vertexes. Here, you are allowed to choose a vertex A (the value of A can not be 0) and a vertex B by yourself. Walking from A and stopping at B, you must collect all the values on the road. Each vertex has a value. Try to get values as large as you can. Remember that the miner you controlled, can never go back to any vertex he has passed.

However, there is a special way to calculate total values. Let's assume that the miner has passed M vertexes from A to B. During the travel, the miner has successively collected M values worths $W_i\ (0 \leq i < M)$. Vertex A has a value worth W_{M-1}. The next vertex on the road has a value worth W_{M-2} ..... At last, vertex B has a value worth W_0. The special rule gives you an integer P. The total value you collect is calculated by the formula $MAX = \sum_{i=0}^{m-1}(W_i \times P^i)$.

It is guaranteed that $Wi\ (0 \leq i < M)$ are less than P. The vertex A and B you choose can be same. But the value of A can not be 0. Output MAX module (10^9+7). Note that you need to make sure MAX as large as possible but NOT make sure the remainder as large as possible. And then, output value of each vertex (stating from vertex A) on the road in the best case.

Input

The first line contains an integer $T(1 \leq T \leq 200)$, indicating the number of test cases. For each case, The first and second line contain two integers $N\ (1 \leq N \leq 10^4)$ and $P\ (2 \leq P \leq 10^9)$, indicating the number of vertexes and the integer P.

Each of the following $N-1$ lines contains two integers a and $b\ (1 \leq a, b \leq N, a \neq b)$, indicating that there is an edge connecting vertex a and vertex b.

The following line contains N integers $W_i\ (0 \leq W_i < P, \sum W_i > 0)$, the value of each vertex. It is guaranteed that at least one of W_i not equal 0.

You can assume that sum of N does not exceed 1.3×10^6.

Output

For each case, the first line outputs "Case #T: MAX"(without quotes). Here, T is the index of test case (starting from 1) and MAX is the maximum value of treasures the miner can collect module (10^9+7).

The second line outputs the value of each vertex from vertex A to vertex B.

Sample Input

```
2

8
2
1 2
2 3
```

```
3 4
4 5
2 6
6 7
7 8
1 0 0 0 0 0 0 0 0

9
1000000000
1 2
2 3
1 4
4 5
1 6
6 7
1 8
8 9
1 2 0 2 0 2 0 2 0
```

Sample Output

```
Case #1: 16
1 0 0 0 0
Case #2: 999999356
2 1 2 0
```

B. Tree Maker

Tree Lover loves trees crazily.

One day he invents an interesting game which is named Tree Maker.

In this game, all trees are **binary trees**.

Initially, there is a tree with **only one** vertex and a cursor on it. Tree Lover can control the cursor to apply 5 operations to build a tree, and their formats are following:

0 : Jump to the parent of the current vertex.

1 : Jump to the left child of the current vertex.

2 : Jump to the right child of the current vertex.

3 x : Generate a tree with x vertices arbitrarily and make it the left subtree of the current vertex.

4 x : Generate a tree with x vertices arbitrarily and make it the right subtree of the current vertex.

When applying an operation, the log system will log down a record of it.

Tree Lover played this game for a whole day yesterday. As a forgetful man, although Tree Lover knew the shape of the tree while playing, after a sleep he forgot it.

All he has now is the logs of operations.

Tree Lover wants to know: how many possible shapes of the tree can have yesterday according to the logs?

Can you answer this question?

Input

The input consists of multiple test cases.

For each test case:

The first line is an integer n (1 <= n <= 500), denoting the lines of logs.

Then follow n lines of logs. The formats of logs are as described above.

The integer x of operation 3 and 4 is positive.

In each case, the number of vertices of the tree will never exceed 500.

You can assume that **the cursor will never jump to a non-existent vertex**.

If the left child of a vertex exists, operation 3 will not be applied on this vertex, and operation 4 is similar.

Output

For each test case, ouput a single line “Case #x: y”, where x is the case number, starting from

1, and y is the answer to Tree Lover's question.

Because the answer can be large, please output the answer mod 1000000007.

Sample Input

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

Sample Output

```
Case #1: 25
Case #2: 5
```

C. Hotaru's problem

Hotaru Ichijou recently is addicated to math problems. Now she is playing with N-sequence. Let's define N-sequence, which is composed with three parts and satisfied with the following condition:
1. the first part is the same as the thrid part,
2. the first part and the second part are symmetrical.
for example, the sequence 2,3,4,4,3,2,2,3,4 is a N-sequence, which the first part 2,3,4 is the same as the thrid part 2,3,4, the first part 2,3,4 and the second part 4,3,2 are symmetrical.

Give you n positive intergers, your task is to find the largest continuous sub-sequence, which is N-sequence.

Input

There are multiple test cases. The first line of input contains an integer T（T<=20）, indicating the number of test cases.

For each test case:

the first line of input contains a positive integer N（1<=N<=100000）, the length of a given sequence

the second line includes N non-negative integers ,each interger is no larger than 10^9 , descripting a sequence.

Output

Each case contains only one line. Each line should start with “Case #i: ”,with i implying the case number, followed by a integer, the largest length of N-sequence.

We guarantee that the sum of all answers is less than 800000.

Sample Input

```
1
10
2 3 4 4 3 2 2 3 4 4
```

Sample Output

```
Case #1: 9
```

D. Segment Game

Lillian is a clever girl so that she has lots of fans and often receives gifts from her fans.

One day Lillian gets some segments from her fans Lawson with lengths of 1,2,3... and she intends to display them by adding them to a number line.At the i-th add operation,she will put the segment with length of i on the number line.Every time she put the segment on the line,she will count how many entire segments on that segment.During the operation ,she may delete some segments on the line.(Segments are mutually independent)

Input

There are multiple test cases.

The first line of each case contains a integer n — the number of operations(1<=n<=$2 * 10^5$, $\sum n$<=$7 * 10^5$)

Next n lines contain the descriptions of the operatons,one operation per line.Each operation contains two integers a , b.

if a is 0,it means add operation that Lilian put a segment on the position b(|b|<10^9) of the line. (For the i-th add operation,she will put the segment on [b,b+i] of the line, with length of i.)

if a is 1,it means delete operation that Lilian will delete the segment which was added at the b-th add operation.

Output

For i-th case,the first line output the test case number.

Then for each add operation,ouput how many entire segments on the segment which Lillian newly adds.

Sample Input

```
3
0 0
0 3
0 1
5
0 1
0 0
1 1
0 1
0 0
```

Sample Output

```
Case #1:
0
0
0
Case #2:
0
1
0
2
```

E. The shortest problem

In this problem, we should solve an interesting game. At first, we have an integer n, then we begin to make some funny change. We sum up every digit of the n, then insert it to the tail of the number n, then let the new number be the interesting number n. repeat it for t times. When n=123 and t=3 then we can get 123->1236->123612->12361215.

Input

Multiple input.

We have two integer n (0<=n<=10^4) , t(0<=t<=10^5) in each row.
When n==-1 and t==-1 mean the end of input.

Output

For each input , if the final number are divisible by 11, output “Yes”, else output ”No”. without quote.

Sample Input

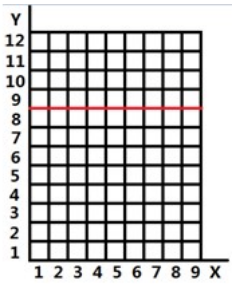
```
35 2
35 1
-1 -1
```

Sample Output

```
Case #1: Yes
Case #2: No
```

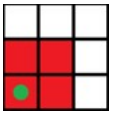
F. Tetris

Tetris
God Wu enjoy coding some trivial games like Tetris.His Tetris is made up by 9 columns and 12 rows.

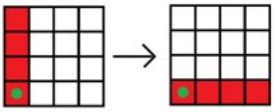


The game will prossess as following steps
1.a random token will appear ,and its special square will be on (4,9);
2.the player can send a signal which means up,left,right and down to control the tokens;(If the operation which means is illegal,the operation will be skipped)
3.the token will fall a unit.(If the fall is illegal,we prossess the 4th step.Otherwise,we prossess the 2nd step)
4.If there is a horizontal line of nine units without gaps,the line will disappear and the tokens above it will fall.If a line will disappear, we will get a score and prossess 4th step again.If there is not a horizontal line of nine units without gaps,we go back to 1st step

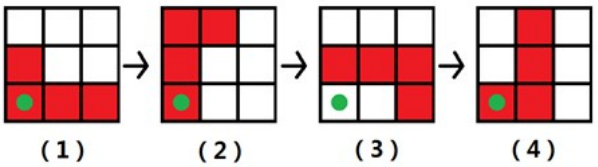
For the sake of debugging, God Wu just created three kinds of Tetris piece. Each type of piece do the same while receiving "left", "right" and "down" operation. specificly:
Left: the entire piece moves left one square with the special square.
Right: the entire piece moves right one square with the special square.
Down: the entire piece moves down one square with the special square.
Up: rotate 90 degree clockwise
The original direction of each square will be same as the first pattern in each picture.
More details see the following pictures
and following is the detail about the "up" operatrion, notice the green square is the special square:
1. O-type



2. I-type



3. J-type



God Wu begins to test the game after finishing coding, and ran a lot of data. However, he find score record is omitted. So he ask you to finish it.

Input

Multiple testcase. The first line is an integer T, refers the case number, followed by T case, each case containing three lines:

The first line is n, refers the number of falling pieces.

Next line is a string s(|s|<=1000), which shows the operation God Wu made from the begining of the Game to the End of the last piece stop moving.

The third line has n integers, the ith integer ai represent the type of the ith piece.(0 is for O-type, 1 is for I-type and 2 is for J-type)

Output

For each test case, output the case number and the score obtained from operation sequence. Format should be "Case X: Y",X is the case number and Y is the score.

Sample Input

```
1
18
waaasspdwsspppwwdddssaaassswdddsswwaasssdddddswwwwwdssaaasssdddsssddasswwaasppddddssaaasssaassswsssddss
1 1 2 2 1 2 0 2 2 1 0 2 0 2 0 2 1 1
```

Sample Output

```
Case 1: 6
```

G. Gray code

The reflected binary code, also known as Gray code after Frank Gray, is a binary numeral system where two successive values differ in only onebit (binary digit). The reflected binary code was originally designed to prevent spurious output from electromechanical switches. Today, Gray codes are widely used to facilitate error correction in digital communications such as digital terrestrial television and some cable TV systems.

Decimal	Binary	Gray	Gray/Decimal
0	000	000	0
1	001	001	1
2	010	011	3
3	011	010	2
4	100	110	6
5	101	111	7
6	110	101	5
7	111	100	4

Now , you are given a binary number of length n including ‘0’ , ’1’ and ‘?’(? means that you can use either 0 or 1 to fill this position) and n integers(a1,a2,….,an) . A certain binary number corresponds to a gray code only. If the ith bit of this gray code is 1,you can get the point ai. Can you tell me how many points you can get at most?

For instance, the binary number “00?0” may be “0000” or “0010”,and the corresponding gray code are “0000” or “0011”.You can choose “0000” getting nothing or “0011” getting the point a3 and a4.

Input

The first line of the input contains the number of test cases T.

Each test case begins with string with ‘0’,’1’ and ‘?’.

The next line contains n (1<=n<=200000) integers (n is the length of the string).

a1 a2 a3 … an (1<=ai<=1000)

Output

For each test case, output “Case #x: ans”, in which x is the case number counted from one,’ans’ is the points you can get at most

Sample Input

```
2
00?0
1 2 4 8
????
1 2 4 8
```

Sample Output

```
Case #1: 12
Case #2: 15
```

H. Convex Polygon

Cute qzy wants to calculate how many convex polygons with M vertices and K acute angles when selecting M vertices in a regular polygon with N vertices(N is odd).But he is busy with girls,so he asks you for help.Can you solve it?

Input

The first line contains a number T, indicating the number of test cases.($T \leq 50000$)

For each case, there are three numbers N($3 \leq N \leq 100000$), M($3 \leq M \leq N$), K($0 \leq K \leq M$), as described previously.

Output

For each case, print the Case #d: answer mod 1000000007 in each line.

Sample Input

```
1
5 4 2
```

Sample Output

```
Case #1: 5
```

I. Root

Given a number $sum(1 \leq sum \leq 100000000)$,we have m queries which contains a pair (x_i, y_i) and would like to know the smallest nonnegative integer k_i satisfying $x_i^{k_i} = y_i \ mod \ p$ when the prime number p $(sum \ mod \ p = 0)$(ps:$0^0 = 1$)

Input

The first line contains a number T, indicating the number of test cases.

For each case, each case contains two integers $sum, m(1 \leq sum \leq 100000000, 1 \leq m \leq 100000)$ in the first line.

The next m lines will contains two intgeers $x_i, y_i(0 \leq x_i, y_i \leq 1000000000)$

Output

For each test case,output "Case #X:" and m lines.(X is the case number)

Each line cotain a integer which is the smallest integer for (x_i, y_i) ,if we can't find such a integer just output "-1" without quote.

Sample Input

```
1
175 2
2 1
2 3
```

Sample Output

```
Case #1:
0
3
```

J. Leader in Tree Land

Tree land has n cities, connected by $n-1$ roads. You can go to any city from any city. In other words, this land is a tree. The city numbered one is the root of this tree.

There are n ministers numbered from 1 to n. You will send them to n cities, one city with one minister.

Since this is a rooted tree, each city is a root of a subtree and there are n subtrees. The leader of a subtree is the minister with maximal number in this subtree. As you can see, one minister can be the leader of several subtrees.

One day all the leaders attend a meet, you find that there are exactly k ministers. You want to know how many ways to send n ministers to each city so that there are k ministers attend the meet.

Give your answer mod 1000000007.

Input

Multiple test cases. In the first line there is an integer T, indicating the number of test cases. For each test case, first line contains two numbers n, k. Next $n-1$ line describe the roads of tree land.

$T = 10, 1 \leq n \leq 1000, 1 \leq k \leq n$

Output

For each test case, output one line. The output format is Case #x: ans, x is the case number,starting from 1.

Sample Input

```
2
3 2
1 2
1 3
10 8
2 1
3 2
4 1
5 3
6 1
7 3
8 7
9 7
10 6
```

Sample Output

```
Case #1: 4
Case #2: 316512
```

K. Mahjong tree

Little sun is an artist. Today he is playing mahjong alone. He suddenly feels that the tree in the yard doesn't look good. So he wants to decorate the tree.（The tree has n vertexs, indexed from 1 to n.）
Thought for a long time, finally he decides to use the mahjong to decorate the tree.
His mahjong is strange because all of the mahjong tiles had a distinct index.（Little sun has only n mahjong tiles, and the mahjong tiles indexed from 1 to n.）
He put the mahjong tiles on the vertexs of the tree.
As is known to all, little sun is an artist. So he want to decorate the tree as beautiful as possible.
His decoration rules are as follows:

(1)Place exact one mahjong tile on each vertex.
(2)The mahjong tiles' index must be continues which are placed on the son vertexs of a vertex.
(3)The mahjong tiles' index must be continues which are placed on the vertexs of any subtrees.

Now he want to know that he can obtain how many different beautiful mahjong tree using these rules, because of the answer can be very large, you need output the answer modulo 1e9 + 7.

Input

The first line of the input is a single integer T, indicates the number of test cases.
For each test case, the first line contains an integers n. (1 <= n <= 100000)
And the next n - 1 lines, each line contains two integers ui and vi, which describes an edge of the tree, and vertex 1 is the root of the tree.

Output

For each test case, output one line. The output format is "Case #x: ans"(without quotes), x is the case number, starting from 1.

Sample Input

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

Sample Output

```
Case #1: 32
Case #2: 16
```