Selection Contest for ACM-HK Programming Contest 2015

The problem set contains 4 problems. Please use standard input/output as your input/output method, instead of file input/output.

Instructions for using the judging system

1. Enter the address in your browser and save the zip file: `http://147.8.177.161/client.zip`.
2. Unzip the file, and execute bin/pc2team.bat.
3. Enter the attached username/password to log in. The password contains capital letters only.
4. When submitting solutions, select your problem, select your programming language, and select your *source code*, and then click "submit". Do NOT use "Test" button.

The contest starts from 7:00 pm, and ends at 9:30 pm. Paper-based notes are allowed, such as printing version of codes or books. Internet access is not allowed. No communication with other contestants.

You can access the real time scoreboard at `http://147.8.177.161/`.

A. Matrix Multiplication

Time Limit: 1 Second(s)

Let us consider an undirected graph $G = (V, E)$ which has N vertices and M edges. Incidence matrix of this graph is an $N \times M$ matrix $A = \{a_{ij}\}$, such that a_{ij} is 1 if i-th vertex is one of the ends of j-th edge and 0 in the other case. Your task is to find the sum of all elements of the matrix $A^T A$ where A^T is A transposed, i.e. an $M \times N$ matrix obtained from A by turning its columns to rows and vice versa.

Input

The first line of the input contains an integer t that denotes the number of test cases ($t \leq 10$). For each test case, the first line contains two integer numbers N and M ($2 \leq N \leq 10000, 1 \leq M \leq 100000$). $2M$ integer numbers follow, forming M pairs, each pair describes one edge of the graph. All edges are different and there are no loops (i.e. edge ends are distinct).

Output

For each test case, output only one line containing the sum requested.

Sample Input

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

Sample Output

```
18
12
```

B. Pairs

Time Limit: 3 Second(s)

Given a sequence of n integers $A_1, A_2, \ldots A_n$ and an integer M, your task is to count the number of pairs (i, j) such that $i < j$ and $A_i + A_j \leq M$.

Input

The first line of the input contains an integer t which denotes the number of test cases ($t \leq 10$). In each test case, the first line contains integers n and M ($2 \leq n \leq 10^5, 0 \leq M \leq 10^9$), separated by a space. The second line contains n space separated integers, which denote $A_1, A_2, \ldots A_n$ ($0 \leq A_i \leq 10^9$).

Output

For each test case, output one line containing the integer that denotes the number of pairs (i, j) that satisfy $i < j$ and $A_i + A_j \leq M$.

Sample Input

```
2
5 6
1 2 3 4 5
5 1
1 1 1 1 1
```

Sample Output

```
6
0
```

C. Range Minimum Query

Time Limit: 3 Second(s)

You are given a sequence of n integers $A_1, A_2, \ldots A_n$. Your task is to perform the following two operations:

1. Update. Given two integers i, j $(1 \leq i \leq j \leq n)$, for $k = i, i+1, \ldots, j$ change $A_k = -A_k$. That is, negate A_k for $k \in [i, j]$.
2. Query. Given two integers i, j $(1 \leq i \leq j \leq n)$, output the minimum of A_k, for $k = i, i+1, \ldots, j$.

Input

The first line of the input contains an integer t $(t \leq 10)$ which denotes the number of test cases. In each test case, the first line contains the integer n $(1 \leq n \leq 10^5)$ and an integer m $(1 \leq m \leq 10^5)$, where n denotes the length of the sequence and m denote the number of operataions to perform. The second line of each test case contains n space separated integers $A_1, A_2 \ldots A_n$ $(-10^9 \leq A_i \leq 10^9)$. Then comes m lines, each of which is of exactly one of the two forms:

1. "U i j". This corresponds to the update operation.
2. "Q i j". This corresponds to the query operation.

Output

For each query operation, print one line containing the answer of the query.

Sample Input

```
2
5 3
1 2 3 4 -5
Q 1 3
U 3 5
Q 1 3
5 4
1 -1 1 -1 1
Q 1 1
Q 1 2
U 1 5
Q 2 4
```

Sample Output

```
1
-3
1
-1
-1
```

D. Turn on the Lights

Time Limit: 5 Second(s)

Suppose you have $n \times m$ lights, and they are placed in n rows and m columns. We use (i, j) to locate the i-th row, j-th column. The state of a light is either "on" or "off".

To control the lights, there are $n \times m$ switches each corresponding to a light. If we switch a light located at (i, j), then the states of light (i, j) together with its four adjacent lights would be changed. The four adjacent lights for light (i, j) are $(i-1, j)$, $(i, j-1)$, $(i+1, j)$ and $(i, j+1)$. However, if the light is on the boundary, there will be less adjacent lights. For example, switching $(1, 1)$ will only affect $(1, 1)$, $(1, 2)$ and $(2, 1)$.

Initially, some of the lights are turned on. Your task is to calculate the minimum number of switch operations we have to perform in order to turn all the lights on.

Input

The first line contains an integer t ($1 \leq t \leq 10$), which donote the number of test cases to follow. In each test case, the first line contains two space separated integers n ($1 \leq n \leq 100$) and m ($1 \leq m \leq 16$). Then comes n lines, and each line contains a 0/1 string of length m. If the j-th character of the i-th string is "1", then the light (i, j) is initially on; otherwise it is initially off.

Output

For each test case, output only one line containing an integer. If there is a way to turn all the lights on, output the minimum number of swtich operations. If there is no way, output -1.

Sample Input

```
2
4 4
0000
0000
0000
0000
4 4
1000
0000
0000
0000
```

Sample Output

```
4
-1
```