Curious Costs - Jayam Modi

The government of cryptLand has banned the use of online maps in the country due to fear
of tracking by various enemy agencies. So now, it has to come up with a new indigenous
navigation system. As a part of this, it needs a subroutine that can tell the least cost
to travel from one city to another in cryptLand.

There are **N** cities in cryptLand and they are connected by **M** unidirectional roads and
metro. The cost to travel between some cities directly (without any intermediate stops)
is known beforehand. While travelling on roads, the citizens have to pay money to the government.
Since metros are public transport and newly started, the government
gives you money for travelling through them.

The government has to first check if the travel network is valid or not. The entire network is invalid even if a single pair of cities exist such that it is not possible to find the unique shortest cost of travelling between the cities.

If the network is **valid**, then the citizens of cryptLand give a large number of queries to the government to ensure the optimality of designed algorithm. The government must answer these queries really quickly.

Fulfil your duty as the minister of algorithms and answer the queries of people!

Input

The first line contains two integers **N** and **M**, the number of cities and the number of unidirectional roads/metro lines.

The next **M** lines each contain three integers **U V W** . **W** is the cost of travelling from city **U** to city **V**. If **W** is positive, then there is a road from city **U** to city **V**. If **W** is negative, then there is a metro link from city **U** to city **V** . Note that it is not necessary that there is a direct link from **V** to **U** since the roads and metros are unidirectional. This link is unique i.e. there is no other direct link from **U** to **V**. Also, **U** and **V** are distinct.

The next line contains an integer **Q** denoting the number of queries asked by the citizens.

The next **Q** lines contain one query each. Each query is of the form **X Y** which means that you must report the **unique shortest cost** to travel from **X** to **Y** using any number of intermediate cities.

Output

If the travel network is invalid, then just print **"Not Possible"** (without quotes).

If it is valid, then output 1 line for each query **X Y**.
If there does not exist a way to reach from **X** to **Y**, then print **"No Route"** (without quotes) for this query. Otherwise, print the unique shortest cost to travel from **X** to **Y**.

Constraints

1 <= **N** <= 2000

1 <= **M** <= min (10000 , **n(n-1)**)

1 <= **U, V, X, Y** <= **N**

1 <= **Q** <= min (10^5, **n(n-1)**)

-2,00,000 <= **W** <= 2,00,000

Jittery Jumps – Abhinav Sharma

The country virtualBit is organized as an **N** x **N** grid. The cells are numbered from 1 to **N**, south to north, west to east. Each cell in the grid represents one of its cities. The transportation system in virtualBit is pretty crazy and inconvenient. From a cell (i, j), there are four routes:

route-0 - North route that leads to (min(**N**, i + **D_{i,j}**), j)

route-1 - East route that leads to (i, min(**N**, j + **D_{i,j}**))

route-2 - South route that leads to (max(1, i - **D_{i,j}**), j)

route-3 - West route that leads to (i, max(1, j - **D_{i,j}**))

The government of virtualBit wants to improve the transportation system. To achieve this task, they need the answer to **M** queries. In each query, a person starts from some cell in the grid and takes **S** steps. Initially the person has a non-negative number **F**. In each step, he takes the **F**%4 route from the current cell. After taking a route from cell (i, j) the number **F** changes as **F** = **F** * **B_{i,j}** +**C_{i,j}**

Given starting cell (**T_i**,**T_j**), and non-negative numbers **F** and **S**, you need to answer where the person will end up.

Input:

The first line contains **N**.

Each of the next **N** lines contain **N** numbers. The jth number of ith next line is **D_{i,j}**.

Each of the next **N** lines contain **N** numbers. The jth number of ith next line is **B_{i,j}**.

Each of the next **N** lines contain N numbers. The jth number of ith next line is **C_{i,j}**.

The next line contains **M** , the number of queries.

Each of the next **M** lines contain (**T_i**,**T_j**) the coordinates of the starting cell, **F** and **S**.

Output:

For each query, print two numbers that are the coordinates of the cell where the person will end up, given the initial conditions.

Constraints:

1 <= **N** <= 500

0 <= **S** <= 10^18

1 <= **M** <= 10^5

0 <= **D_{i,j}** <= 500

0 <= **B_{i,j}**, **C_{i,j}** <= 10^5

1 <= **T_i**, **T_j** <= N

0 <= **F** <= 10^5

Turbulent Teamwork – Abhinav Sharma

The government of virtualBit has **N** ministers. The importance and type of the i<super>th</super> minister is **A_i** and **P_i**. The ministers have decided that the best way to solve the issues quickly is to divide themselves into two groups. The two groups should satisfy the following:

1. The difference in total importance of ministers must be less than or equal to **B**.

2. The ministers work efficiently when they have another minister from the same group to brain-storm ideas with. So, ministers of the same type form pairs. The total number of ministers in both groups that do not belong to any pair should be less than or equal to **Q**.

Your task is to find the total number of ways in which the two groups can be formed.

Input

The first line contains **T**, the number of test-cases.

T test cases follow.

The first line of each test case contains **N**, **B** and **Q**.

The second line of each test case contains N numbers. The ith number is **A_i**

The third line of each test case contains N numbers. The ith number is **P_i**

Output

Output a single line containing the number of ways in which the groups can be made.

Since the answer can be very large, output the number of ways modulo **1000000007 (10^9+7)**

Constraints

1 <= **T** <= 10

1 <= **N** <= 100

0 <= **A_i** <= 100

1 <= **P_i** <= 5

0 <= **B** <= 10^4

0 <= **Q <= **N****

Bizzare Bookkeeping – Arvind M

As a security officer, you maintain a system that makes a log on people's entry and exit into the government headquarters of virtualBit. The system writes **I** (in) if a person enters and **O** (out) if a person exits. A log is group of such entries (Eg. **IOIIOOIO**) taken at the end of a day.

But due to some technical faults, some of the log entries in a log flipped (**I** for **O** and **O** for **I**). You don't want this faulty log to go outside. So you decided to change the log entries (to make it look like there was no fault). Find the minimum number of flips required to make it look like a valid log entry. Assume that no person stayed in the headquarters at the end of the day.

Examples

1. "IIOOIO" (valid log entry since 2 people entered, 2 exited, 1 entered and 1 exited).

2. "IOOI" (clearly invalid log entry since one person entered but 2 people exited).

NOTE: It is ensured that the test cases provided always have the solution. The length of log is always **even**.

Input

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

Each test case contains a string **S** denoting the faulty log at the end of a particular day.

Output

Output the minimum number of flips required to make the log valid.

Constraints

1 <= **T** <= 10000

1 <= **length(S)** <= 10^6

The total length of all strings in a single test file does not exceed **5 * 10^7**

****length(S) is even****

Wacky Workouts – Arvind M

The government of virtualBit believes that the health of its citizens is the highest priority. It has devised an **N**-day health plan. During these **N** days, the citizens are encouraged to go to the gym for workouts.

A person may or may not go to the gym on any day. The people of virtualBit are a lazy lot, and they don't want to go to the gym for more than one consecutive day. Given the number of days **N**, print the number of ways the **N**-day plan can be completed. Note that it is possible to not go to the gym on any day and still complete the plan.

Input

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

Each test case contains a number **N** denoting the number of days.

Output

Each test case contains a single number denoting the number of ways by which the **N**-day plan may be completed.

Output your answer modulo 10^9+7.

Constraints

1 <= **T** <= 60000

1 <= **N** <= 10^18

Peculiar Paths – Shubham Goel + Abhinav Sharma

It is vacation time and the citizens of virtualBit are visiting their relatives. There are **N** cities in virtualBit.
There are some roads connecting these cities in such a way that there is one and only one **unique path** between any pair of these cities. Each city sells only one type of gift with a fixed price **V_i**.

There are **Q** citizens who wish to visit their relatives. The ith citizen stays in city **A_i** and wants to visit his relative who lives in city **B_i**. They want to purchase some gifts for the children of their relatives. These gifts should be bought only from the cities that lie on the path from **A_i** to **B_i** (including the starting and ending points).

The children are very picky by nature. They love prime numbers and hence will only accept those gifts, whose cost is a **prime number**. Also, the children will only accept gifts that cost **atleast** **L_i** . But they also understand the financial constraints of their relatives and hence will **not accept** any gift that costs **more than** **R_i**.

Each citizen wants to know the number of cities from which he can buy gifts for the children of his relative. Please help him in finding the answer.

Input

The first line of the input contains two numbers **N** and **Q**, the number of cities and number of citizens respectively.

The next line contains **N** numbers. The ith number is the cost of gift being sold at city **i**.

The next **N**-1 lines contain two integers **X** and **Y** indicating that there is a bidirectional road between cities **X** and **Y**.

Each of the next **Q** lines contain a query of the form: **A B L R**.

Output

For ith query, print the number of cities from which the ith citizen can buy gifts while obeying the constraints on the cost of gifts.

Constraints

1<=**N**,**Q**<=10⁵

1<=**V_i**<=10⁶

1<=**X**, **Y**<=**N**

1<=**A**, **B**<=**N**

1<=**L**, **R**<=10⁶