



ଅନୁଦାନ 2010

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## **Question 1:**

Lincoln Burrows is accused of murdering the brother of the Vice-President of the United States and is sentenced to death and incarcerated in the Fox River State Penitentiary. Lincoln's brother, Michael Scofield is convinced that he is innocent and formulates an escape plan. Michael commits an armed robbery in order to get inside Fox River.

Coincidentally, Michael Scofield works in the same firm that designed the prison; thus giving him access to the blueprint of the prison. On the escape route, there is a weak wall that Michael plans to blow off. The layout of the wall is as follows-

There is a point on the wall, called the Origin, with the perpendicular axes, X and Y marked at intervals of 1ft each, originating from it. On the wall there lies a rectangular *Network* of sensors with a sensor at each point (a, b) ('a' and 'b' being both integers) of the coordinate system. No sensor lies on either of the axes and all other integral points have sensors. The total count of the sensors is factorial of 'N'.

A sensor deactivator is placed somewhere on the straight line joining the *Origin* and the furthest sensor from the *Origin*. The system is such that no sensor falls on this diagonal of the rectangle.

Find the number of ways in which such a network of sensors could have been designed.

Scofield gets to know that out of all these possibilities, the dimension of the grid is such that the number of rows of sensors parallel to the X axis is the least possible (but greater than 1). Find this least number of rows of sensor that the grid comprises.

**Input:** You will be provided with a number K.

This will be followed by K input lines each containing a number N.

$3 \leq N \leq 75$ .

**Output:** Corresponding to each number N of the above list, print out the output as follows:

<No of possible ways of forming rectangle><Comma><Smallest no of rows > 1>

**Example:**

Input:

2

5

8

Output:

4,3

8,5

## **Question 2:**

Michael succeeds in his plan of *The Prison Break* and flees from the prison along with Lincoln and some other inmates of the Fox River.

But their escape is still in jeopardy. They need to cross the prison grounds without being spotted or worse, killed. Consider the rectangular ground to be divided into a grid of unit size squares with each square being planted with land mines. They have to move along the vertical and horizontal grid lines so as not to be killed. But they could still easily escape by moving along the grid lines. The prison authorities identified this problem and placed guards in some of the grid squares. These guards face towards any of the two longer sides of the rectangle. The first longer side is named side 0, and the other one is named side 1. Each guard can find out if anyone is moving along the grid lines which lie to his left or to his front. Since these guards have restricted movement because of the surrounding land mines, they cannot chase the inmates but can shoot them. The place where the prisoners enter the ground and the point of exit of the prison grounds are at diagonally opposite corners of the grid system. Consider that all prisoners move as a group along the same path and that the group is accommodated in unit grid. Also if any path is guarded on both sides, then both guards can fire onto the convicts.

Your objective is to help the group find a path from start point unto the destination which when followed by the escapees would lead to the minimum number of casualties and you have to tell the maximum number of convicts that can escape this grid alive.

**Input:** First Line of input file contains a number X, the number of test case. Each test case is separated from others by a blank line.

First Line of each input case contains four numbers separated by spaces:

P M N G where

P : number of prisoners in group

M : number of rows in grid (Rows numbered from 1 to M)

N : number of columns in grid (Columns numbered from 1 to N)

G : number of guards

$M \neq N$  and  $2 \leq M < N \leq 20$

This will be followed by G lines, each containing 4 integers separated by a single space

I J K L where I: row number of the square in which guard stands.

J: column number of the square in which guard stands.

K: side which the guard faces: 0 for side 0 and 1 for side 1.

L: number of prisoners that this guard can kill.

**Output:** A single number S corresponding to maximum number of survivors.

Example:

Input:

1

7 2 3 4

1 2 1 2

1 3 0 1

2 1 0 3

2 2 1 2

Output:

5

**Representative diagram for Question 2:**

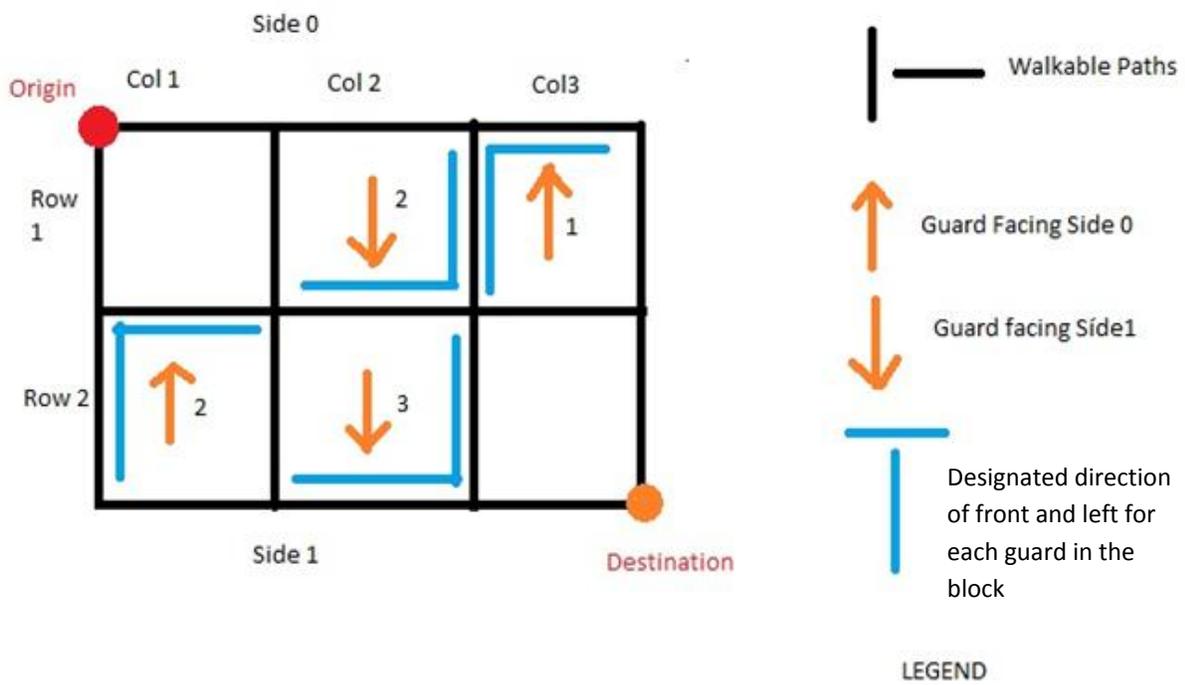


Figure for Question 2

### **Question 3:**

The surviving escapees of Fox River are still on the run, but not without the police hot on their scent. As per Scofield's plan, they reach Joliet, Illinois and plan to reach Oswega where his friend, Nika Volek has arranged a flight to take the convicts straight out of the US.

In Joliet, they find a garage with a number of racing cars and a map of roadways from Joliet and Oswega. Each car can carry a maximum of 2 persons. There are several paths (one way) joining Joliet and Oswega, passing through different cities (numbered arbitrarily). The intermediate cities are connected to some of the cities on the other paths through one-way roads. No road can carry more cars than its number of lanes.

The problem is to find the maximum number of convicts who can escape, by utilizing any path that they may think fit.

There are some specifications:

1. All convicts have to make their way with the cars.
2. The cars can only move parallel to each other on the same road. They can't follow any other car.
3. Once a road takes its maximum capacity, it can't take any more cars.
4. Once a road is taken by any group of cars, the police following this group blocks the way for any other car also.
5. All cars that arrive at a city must leave. No car can stop at a station as the police are still pursuing them.

**Input:** First Line of input file contains a number X, the number of test case. Each test case is separated from others by a blank line.

First line of each input case contains three integers C M N where C is the number of convicts who want to escape; M is the number of intermediary cities and N the number of roads connecting any one city to another.

Thereafter N lines follow, each as:

I J K, where I: starting city number (0 for Joliet, M+1 for Oswega)

J: ending city number

K: number of lanes in the road.

**Output:** A single number P corresponding to the maximum number of escapees.

**Example:**

Input:

1

15 5 8

0 1 3

0 2 1

1 3 3

2 3 5

3 6 2

2 4 4

4 5 2

5 6 3

Output:

6

**HAPPY CODING!!!**

**Do come back for  
C.O.D.E.R.  
season 2  
on  
6<sup>th</sup> March**