9th IIUC Inter-University Programming Contest

IIUPC2012

Problemset

Allah grant me the serenity
To accept the problems that I cannot solve
The persistence to solve the problems that I can
And the wisdom to know the difference

Organized by: Computer Club
International Islamic University Chittagong

Problem A: Brother & Sisters!

Taman is excited to announce that he has learnt bitwise **AND** operation. His Big Sister Titly has given him a sequence of non-negative integers $x_1, x_2 \ldots x_n$ as key. To test that whether Taman knows bitwise **AND** operation or not, Taman is asked to find maximum value among all (**a AND** x_i) where $1 \le i \le N$. But their youngest sister Tamanna is not happy with this. She adds another condition that for a given sequence, Taman has to answer **Q** queries instead of just one. Can you help poor Taman?

Note:
Expression ***x* AND *y*** means applying the operation of bitwise **AND** to numbers ***x*** and ***y***. This operation exists in all modern programming languages, for example, in language C++ and Java it is marked as "**&**".

Input

First line of input will contain the number of test cases, $T \le 5$. Then **T** test cases follow. First line of each test case contains two integers **N** ($1 \le N \le 10000$) and **Q** ($1 \le N \le 30000$) separated by a single space. Next line contains **N** integers $x_1, x_2 \ldots x_n$ separated by a single space ($0 \le x_i < 10^9$). Each of next **Q** lines describes a query which consists of a single integer **a** ($0 \le a < 230$).

Output

For each query output a single integer, the maximum value of (**a AND** x_i) where $1 \le i \le N$.

Sample Input	Output for Sample Input
1 3 3 1 2 3 10 11 12	2 3 0
Problem Setter: Muhammed Hedayet	
Alternate Solution: Kazi Rakibul Hossain	

Problem B: RMQ Overkill

Range minimum query problems are getting more and more common everyday. I used to consider them as hard problems some years ago, but not anymore. So I decided to make this harder for everyone. Today you are given a sequence (with **0**-based indexing) of non-negative integers which contains no more than **10000** elements and where each integer is less than **10**. For each possible query (**i** , **j**) where (**0 ≤ i ≤ j <10000**) [**N** is the size of the sequence], you have to find the minimum integer in that range, and add the minimums for all those queries together. When you are done that, mod the sum with **1000000007** and print.

Input

There will be multiple cases (no more than **120**). You must read for cases until **EOF**.
For each case :
First line, an integer **N** (**1 ≤ N ≤ 10000**), the size of the array.
Second line, a string of **N** characters where i-th character denotes the i-th element of the sequence.

Output

For each case, one line containing an integer, **R**, the result described above.

Sample Input	Output for Sample Input
3 143 3 413 3 121	13 11 7
Problem Setter: Pratyai Mazumder	
Alternate Solution: Mohammad Hafiz Uddin	

Output Explanation

First case : all possible queries and there results are, (**0**,**0**)=>**1**, (**0**,**1**)=>**1**, (**0**,**2**)=>**1**, (**1**,**1**)=>**4**, (**1**,**2**)=>**3**, (**2**,**2**)=>**3** . So, **R = 1 + 1 + 1 + 4 + 3 +3 = 13**.

Second case : all possible queries and there results are, (**0**,**0**)=>**4**, (**0**,**1**)=>**1**, (**0**,**2**)=>**1**, (**1**,**1**)=>**1 ,** (**1**,**2**)=>**1**, (**2**,**2**)=>**3 .** So, **R = 11.**

Third case : all possible queries and there results are, (**0**,**0**)=>**1**, (**0**,**1**)=>**1**, (**0**,**2**)=>**1**, (**1**,**1**)=>**2**, (**1**,**2**)=>**1**, (**2**,**2**)=>**1**. So, **R = 7.**

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Problem C: Sohel Sir's Assignment

Sohel sir gave an assignment in CSE-315 course instead of a class test. The assignment was to make questions and provide corresponding answers from the chapters 2, 3, 4, 5. Each student is assigned chapter no **y** according to the formula :

$$y = (Roll \ \% \ 4) + 2$$

I.e. he has to make questions and answers from chapter **y**. According to this rule, Roll **4** was supposed to make questions and answers from chapter **2** as **(4%4) + 2 = 2** and Roll **35** was assigned to chapter **5** as **(35%4) +2 = 5**. In the meantime, roll **35** had already made the questions & answers from chapter **5** and Roll **4** got the complete assignment of roll **35** .So to copy that assignment Roll **4** wanted to change the divisor 4 of the formula to some number **m** such that his assignment changes to chapter **5 ,** that is **(4%m) + 2 = 5**. But he failed to find such number. Now, your problem is similar to the above problem.

Given two number **x** and **y** you have to find a positive number **m** such that **(x%m) + 2 = y**.
If multiple **m** is possible, choose the minimum one .If no answer is found print **Impossible**.

Input

First line of input will contain the number of test cases, **T ≤ 125.** Then there follows **T** lines, each containing two integers **x** ($\mathbf{0 \le x \le 10^{12}}$) and **y** ($\mathbf{2 \le y \le x+2}$).

Output

For each case, print **m**, if **m** is found. Otherwise print "**Impossible**" (without quotes).See the samples given below for exact formatting.

Sample Input	Output for Sample Input
4 4 5 35 5 4 2 11 5	Impossible 4 1 4
Problem Setter: Mohammad Hafiz Uddin	
Alternate Solution: Radi Muhammad Reza	

Problem D: VOID

All of you who are related to gaming know the name of Call Of Duty Legends of Bangladesh. Yes, I am talking about VOID. They are so pro that they have two teams and both of the teams go to final and become champion and runner up. They have such strong brotherhood that sometimes they toss the coin to decide who will be the champion. Although, They are now ranked 9th among all the teams, but they say,"the ranking is a lie. No ranking system can judge VOID ".All of the members have to have a nick name for VOID. Current members are VOID LeapOfFaith, VOID wrath, VOID kopal, VOID aragorn, and VOID faltu. Now their leader is VOID LeapOfFaith. He does not like others names because they have only one word name. He thinks that names should be consists of many words like VOID IAmLegend, VOID LoveIsADangerousDisadvantage etc. Now he wants to change name of all the members according to new rule. But the members are not very good at giving long names .So he decides to make some list of cool words and make the entire member to choose name in following way.

There are **N** lists of word. **i**-th list have $\mathbf{W_i}$ **(1 ≤ i ≤ N)** number of word. All the words will be **distinct**. Rules are:

1. A member can only choose one word from one list or not choose from that list.
2. A member will choose serially beginning from list **1** to **N**.
3. The name must be consisting of at least 2 words.

Like there are three lists of word.

List1	**List2**	**List3**
Call	Of	Duty
Age		Empires

Here, $\mathbf{W_1 = 2}$, $\mathbf{W_2 = 1}$, $\mathbf{W_3 = 2}$.

There are 12 possible names :

1. **Call Of Duty**
2. **Call Of**
3. **Call Duty**
4. **Call Of Empires**
5. **Call Empires**
6. **Age Of Duty**
7. **Age Of**
8. **Age Duty**
9. **Age Of Empires**
10. **Age Empires**
11. **Of Duty**
12. **Of Empires**

Now, you are given the number of words in the lists. You have to determine how many names can be formed in the previous way. Since that can be a big number give that **modulo 1000000007.**

Input

First line of input will contain the number of test cases, $\mathbf{T \leq 20}$. Each test case is described by exactly two lines. The first line contains an integer $\mathbf{N}$ ($\mathbf{2 \leq N \leq 5000}$). The second line contains $\mathbf{N}$ space-separated integers $\mathbf{W_i}$ ($\mathbf{1 \leq W_i \leq 10^9}$).

Output

For each test case output exactly one line containing a single integer, how many names can be formed **modulo 1000000007.**

Sample Input	Output for Sample Input
3 3 2 1 2 3 2 2 2 3 3 2 3	12 20 39
Problem Setter: F. A.Rezaur Rahman Chowdhury	
Special Thanks: Prasanjit Barua Linkin	

Problem E: Sin Cos Problem

Given **A** and **B**, you have to determine the maximum value of the function :

$$F(\theta) = A*\sin\theta + B*\cos\theta$$

Input

First line of input will contain the number of test cases, **T ≤ 2000.** Then there follows **T** lines, each containing two integers **A** and **B** separated by a single space. **A** and **B** will fit in a signed 32bit integer.

Output

For each case, print one line containing two single space separated real values rounded to two decimal places. The first one is the **lowest non-negative** value of **θ** (**θ** is in **Radian**) for which the **F(θ)** gives maximum value and the second one is the maximum value.

Sample Input	Output for the Sample Input
4 **1 1** **-1 1** **1 -1** **-1 -1**	**0.79 1.41** **5.50 1.41** **2.36 1.41** **3.93 1.41**
Note : Pi is considered to be **acos(-1).**	
Problem Setter: Muhammad Ridowan	
Alternate Solution: Zobayer Hasan	

Problem F: Simply Loopy

Given an integer **n**, print what the following function (written in C++) will return :

```
long long unsigned lol(int n)
{
    long long unsigned ret = 0 , i , j , k , l , m , M = 7477777 ;

    for( i = 1 ; i ≤ n ; i++ )
        for( j = 1 ; j ≤ n ; j++ )
            for( k = 1 ; k ≤ n ; k++ )
                for( l = 1 ; l ≤ n ; l++ )
                    for( m=1 ; m ≤ n ; m++ )
                        if( i + j + k + l + m == n )
                            ret = (ret + i*i + j*j + k*k + l*l +  m*m)%M ;

    return ret ;
}
```

Input

First line of input will contain the number of test cases, **T ≤ 600**. Then there follows **T** lines, each containing an integer **n** (**1 ≤ n ≤ 10^5**).

Output

For each case, print the case number starting from **1** and the value returned by the function **'lol(n)'** . See the sample output for exact formatting.

Sample Input	Output for Sample Input
3 5 6 7	**Case 1: 5** **Case 2: 40** **Case 3: 175**

Note: A straight forward implementation of the given function may take millions of years, even for the fastest computers!

Problem Setter: Momontho Mashak Monmoy

Alternate Solution: Muhammad Ridowan, Md. Shiplu Hawlader

Problem G: Hajj-e-Akbar

Labayk Allahuma Labayk. Labayk La shareeka laka Labayk. Innal hamda wannimata laka wal mulk. La shareeka Lak

(Here I am at your service, oh Lord, here I am - here I am. No partner do you have. Here I am. Truly, the praise and the favor are yours, and the dominion. No partner do you have.)

These are the words chanted by some two million people from world heading, as if pulled by a magnet, to one single spot on Earth. As has happened every year for 14 centuries, Muslim pilgrims gather in Makkah to perform rituals based on those conducted by the Prophet Muhammad during his last visit to the city.

Performing these rituals, known as the Hajj, is the fifth pillar of Islam and the most significant manifestation of Islamic faith and unity. Undertaking the Hajj at least once is a duty for Muslims who are physically and financially able to make the journey to Makkah. The emphasis on financial ability is meant to ensure that a Muslim takes care of his family first. The requirement that a Muslim be healthy and physically capable of undertaking the pilgrimage is intended to exempt those who cannot endure the rigors of extended travel.

The pilgrimage is the religious high point of a Muslim's life and an event that every Muslim dreams of undertaking. Umrah, the lesser pilgrimage, can be undertaken at any time of the year; Hajj, however, is performed during a five-day period from the ninth through the thirteenth of Dhu Al-Hijjah, the twelfth month of the Muslim lunar calendar.

It is generally presumed that the Hajj performed on Friday is called “Hajj-e-Akbar” and it is a superior kind of Hajj as compared with the Hajj performed on other days of the week.

But, the correct meaning of the term, as explained by a large number of the commentators of the Holy Quran is that the Umrah, which can be performed at any time throughout the year, was generally called “Hajj-e-Asghar” (the minor Hajj). In order to distinguish hajj from Umrah the former was named “Hajj-e-Akbar” (the greater hajj). Therefore, each and every hajj is Hajj-e-Akbar, no matter whether it is performed on Friday or on any other day. The word “Akbar” (greater) is used only to distinguish it from Umrah which is a minor Hajj.

Input

There will be several lines in the input terminated with a line containing a single *. This last line should not be processed. Each of the lines will contain either Hajj or Umrah.

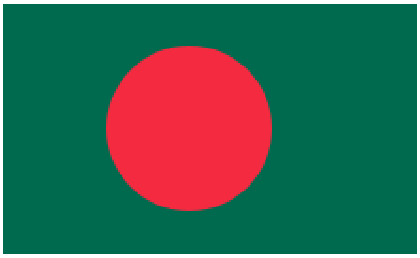
Output

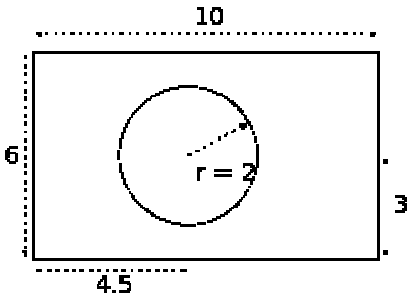
For each line of the input, output either “Hajj-e-Akbar” or “Hajj-e-Asghar” in separate lines without quotations. For exact format refer to the sample.

Sample Input	Output for Sample Input
Hajj Umrah Hajj Umrah *	Case 1: Hajj-e-Akbar Case 2: Hajj-e-Asghar Case 3: Hajj-e-Akbar Case 4: Hajj-e-Asghar
Problem Setter: Mohammed Shamsul Alam	
Special Thanks: Tanveer Ahsan	

Problem H: 10:6:2

The national flag of Bangladesh is bottle green in color and rectangular in size with the **length (L)** to **width** ratio of **10:6**. It bears a red circle on the background of green. It maintains the **length (L)** to **radius** ratio of **5:1** (If the **length** is **10** then **width** should be **6** and **radius** should be **2**). The color in the background represents the greenery of Bangladesh while the red circle symbolizes the rising sun and the sacrifice of lives in our freedom fight.





Input

First line of input will contain the number of test cases, **T ≤ 100.** Then there follows **T** lines, each containing a positive integer **L≤1000,** representing length of the flag.

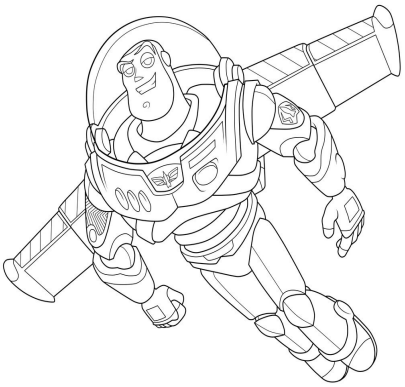
Output

For each test case output is a line with two space separated real numbers containing exactly two digits after decimal point. Two numbers represent the area of red and green portion respectively.

Sample Input	Output for Sample Input
1 10	12.57 47.43
Note: Pi is considered to be **acos(-1).**	
Problem Setter: Kaysar Abdullah	

Problem I: To Infinity and Beyond

You probably don't know toys walk, play and talk when we are not around. And there are toys who can perform intergalactic missions! But lets forget about alien planets now, the toy-land on earth is in danger, "Zurg" the evil emperor from outer world is planning to capture it. But as always when toyland is in trouble the great space ranger "Buzz Lightyear" of star command comes for the rescue!



Toyland consists of several cities and bidirectional roads. The Toyland chief wants to take following steps to save Toyland:

1. First divide the cities of Toyland into multiple regions. Two cities MUST be included in same region if there is at least **one simple cyclic route** connecting both cities. One city can be included in multiple regions. Size of each region should be **maximal**; that means extra city can't be added in a region. Here simple cyclic route means no vertex should appear more than one time in the route.

2. There are limited numbers of "Buzz" toys available. After creating the regions, one "Buzz" toy will be sent to each of them to save that region from Zurg!

Toys need energy to work. Each city can supply energy to infinite number of toys but the amount of energy a city provides daily to a single toy is limited otherwise toys may waste energy. **A toy is assigned to a single region but it can get energy from any city within its region.**

For a single toy, the total daily energy supply is the sum of the energy supply of all the cities within its region.

Each "Buzz" may need different amount of energy to work. If a region provides too less energy than additional energy need to be provided anyhow and it is considered as a loss. But if the region provides more energy than required, "Buzz" wastes it by playing with laser and flying all around. So:

Daily Loss in region X =
| Daily Energy required by "Buzz" assigned in that region - Daily Energy supplied by region X |

Exactly one "Buzz" must be assigned in each region, if there are more toy than needed, they'll keep them for emergency. The chief wants to **minimize the maximum wastage among all the regions** and he needs your help desperately.

Help the toyland to survive, expand your mind To Infinity and Beyond and find the answer.

Input

First line of input will contain the number of test cases **T ≤ 600.** For each case, first line will consist of number of cities **N** (**1 ≤ N ≤ 100**), roads **E** and number of Buzz toys available **B** (**1 ≤ B ≤ 50**). In next line there are **N** integers less than **1000**, **i-th** integer denotes energy supply in city **i**. In next line there are **B** integers less than **1000**, **j-th** integer denotes energy required by Buzz **j**. Next there are **E** lines each consisting two integer **u** and **v** denoting there is a bidirectional road between **u** and **v** (**u!=v**). **There is at most one road between two cities**. All inputs are non-negative.

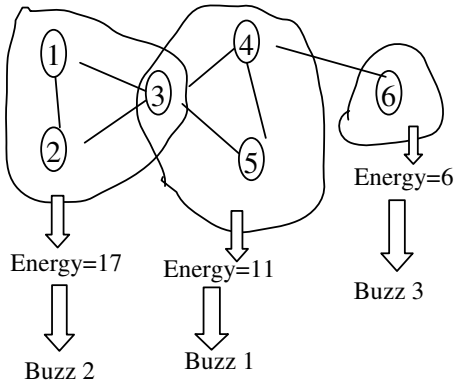
Output

For each test case first print number of regions. Then, if number of regions is more than number of buzz available, output "**No**"; otherwise print the maximum wastage amount among all the regions. Print case number for every case, see sample output for details.

Sample Input	Output for Sample Input
2 6 7 3 5 4 8 1 2 6 10 14 9 1 2 2 3 3 1 3 4 4 5 3 5 5 6 4 3 1 5 4 8 1 10 1 2 2 3 3 1	Buzz Mission 1: 3 3 Buzz Mission 2: 2 No
Note: Large input File, use faster I/O.	
Problem Setter: Shafaet Ashraf	
Alternate Solution: Shiplu Hawladar	

Output Explanation

Regions and optimal assignment in **1st** case:



Problem J: Yell Classico

The *Old Yellers*, the contestants of the old days of IIUC are going to have a football match with the current contestants. As the *yellers* are going to be the host of the match, it will be called 'Yell Classico'. As the yellers are always busy in yelling, oops, I mean programming, they have appointed you as the manager of their team. Now, as a manager of the *Yeller* team, you have to select **11** players for the match from **N** players.

All the **N** players will stand in a line just before the match. Your task will be to select **11** players from them in such a way that, the player standing in front is as tall as possible. If there are more than one such team formations, do it in a way where the 2^{nd} player is as tall as possible. If still there is a tie, choose the formation having tallest player in the 3^{rd} position and so on. **(Which means, until you can break the tie or reach the 11^{th} position, keep looking in the next position).**

Note that,

1. You don't have enough time to change the order in which players are standing.
2. If you have tie even after reaching the 11^{th} position, select from any of the tied formations.

Players are quite same in their playing abilities, you don't need to bother about that.

Input

First line of input will contain the number of test cases, **$T \leq 100$.**
For each test case, there are two lines.
The first line contain **N** (number of players, **$1 \leq N \leq 2000$**).
The second one is a line of **N** integers separated by spaces. The ith integer of this line will specify the height of the ith player. (Heights will not be greater than **10^9**).

Output

For each test case output "**Case X:** ", (**X** is the case number, starting from **1**). Then print the heights of the **11** selected players separated by spaces. If it's not possible to select exactly **11** players, then send the spectators home by printing "**go home!**" (Without quotations). See the sample output for exact formatting.

Sample Input	Output for Sample Input
4 15 2 10 8 5 1 5 9 9 3 5 6 6 2 2 8 11 2 6 3 8 7 2 5 3 4 3 3 4 2 7 9 6 12 6 2 3 8 7 2 5 3 4 3 3 10	Case 1: 10 8 9 9 3 5 6 6 2 2 8 Case 2: 2 6 3 8 7 2 5 3 4 3 3 Case 3: go home! Case 4: 6 3 8 7 2 5 3 4 3 3 10
Problem Setter: Bidhan Roy	
Alternate Solution: Hasnain Heickal Jami	

Output Explanation

In the last test case, there are **12** ways you can choose the team.

1. 2 3 8 7 2 5 3 4 3 5 10
2. 6 3 8 7 2 5 3 4 3 5 10
3. 6 2 8 7 2 5 3 4 3 5 10
4. 6 2 3 7 2 5 3 4 3 5 10
5. 6 2 3 8 2 5 3 4 3 5 10
6. 6 2 3 8 7 5 3 4 3 5 10
7. 6 2 3 8 7 2 3 4 3 5 10
8. 6 2 3 8 7 2 5 4 3 5 10
9. 6 2 3 8 7 2 5 3 3 5 10
10. 6 2 3 8 7 2 5 3 4 5 10
11. 6 2 3 8 7 2 5 3 4 3 10
12. 6 2 3 8 7 2 5 3 4 3 5

From them, you can not select the **1st** team-formation because it has a player with height **2** in front, but other formations have a taller player of height **6** in front.

Now, there is a tie, because, all the other formations have a player of same height (**6**) in front. So, now you will have to look for the formation which has the tallest player in next (**2nd**) position. For this case, it is the second one (having a player of height **3**) and there is no tie for this position. So, the team-formation you will select is 6 3 8 7 2 5 3 4 3 5 10.