Problem 1. Fruit Island

(Time Limit: 2 seconds)

Problem Description

The "Fruit Island" abounds with fruit which is the sweetest in the world, and it is a small island in the Pacific Ocean. In there the official language is "Banana". The islanders are very serious about the grammar of Banana, and a little grammar mistake would make them angry.

Today a businessman wants to buy fruit to ship back his country for sale. He is afraid of using the wrong syntax, which would cause the islanders not to deal with him. Therefore, he wants to invite you to write a program that could check the syntactical correctness of any sentence he used.

Here are the rules:
1. The only characters in the "Banana" are the lower-case letters from "a" through "j" and the upper-case letters "Z", "U", "M", "T", and "R".
2. Every lower-case letter from "a" through "j" is a correct sentence.
3. If x is a correct sentence, then so is xZ.
If x and y are correct sentences, then so are xyU, xyM, xyT, and xyR.

Input Format

Input begins with an integer T $(1 \leq T \leq 10)$, the number of test cases.

Each test input consists of a number of sentences with only the lower-case letters from "a" through "j" and the upper-case letters "Z", "U", "M", "T", and "R". Each sentence is ended by a new-line character with at most 256 characters and at least 1 character.

Output Format

The output consists of the answers of input sentences with YES for each correct sentence and NO for each wrong sentence.

Example

Sample Input:	**Sample Output:**
5 aM cZ abU dZbcTT az	NO YES YES YES NO

Problem 2. Underground Market Street

(Time Limit: 2 seconds)

Problem Description

A city is building an underground market street, where the entrance is located at the middle. For ease of management, all restaurants will be on the left hand side of the entrance, while all other shops will be placed on the right hand side. The power of the market street is provided by a power room at the entrance of the market street, and each shop and restaurant has a switch board at its center. In order to prevent power interference between shops, each shop and restaurant has a separate cable connecting its switch board to the central power room. Thus each shop (or restaurant) requires a cable of length equal to its distance to the power room plus half its width. The distance of a shop (or restaurant) to the power room is the sum of widths of shops (or restaurants) between itself and the power room.

For example, suppose we have 3 shops A, B, and C, and 2 restaurants X and Y, where the width of A, B, C, X, and Y are 10, 6, 4, 8, and 16 meters respectively. The 3 shops A, B, C have to be placed on the right hand side of the entrance, and the 2 restaurants X and Y have to be placed on the left hand side of the entrance. Suppose that we arrange the shops in the order of C, A, B, from left to right, and arrange the restaurants in the order of Y, X from left to right (see Figure 1). Then, the distance of A, B, C, X, and Y to the power room are 4, 14, 0, 0 and 8 meters respectively. The power cable required for A, B, C, X, and Y under this arrangement are 9, 17, 2, 4, and 16 meters respectively. Therefore, for such an arrangement of shops and restaurants, the total length is 9 + 17 + 2 + 4 + 16 = 48.

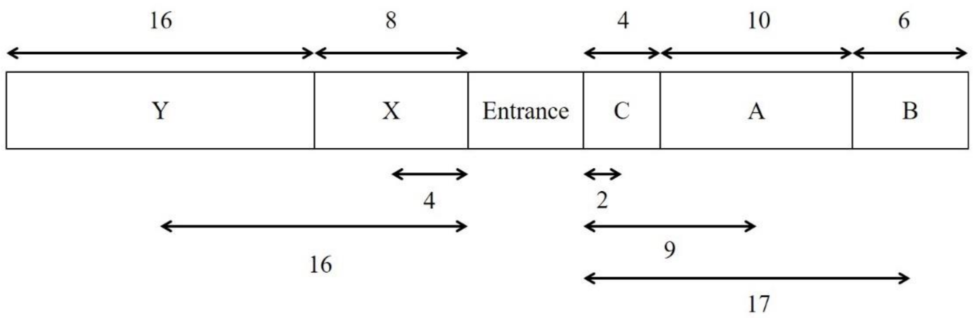

Figure 1.

Given the width of each shop and restaurant, please find an arrangement of the shops and restaurants such that the total length of cable is minimized.

Technical Specification

- The number of shops is a positive integer no more than 50.
- The number of restaurants is a positive integer no more than 50.
- The width of each shop (or restaurant) is a positive even integer no more than 20.

Input Format

The first line is an integer t, $1 \le t \le 15$, indicating the number of test cases. Each test case contains 3 lines. The first line contains two numbers n and m, $1 \le n, m \le 50$, indicating that there are n shops and m restaurants. The second line gives the width of each shop; and the third line gives the width of each restaurant.

Output Format

For each test case, output the minimum required length of cable.

Example

Sample Input:	**Sample Output:**
2 3 2 10 6 4 8 16 4 5 2 20 18 6 4 10 10 16 4	44 139

Problem 3. Rectangles and Lines

(Time Limit: 2 seconds)

Problem Description

There are N rectangles on the plane. A rectangle can be specified by a 4-tuple (x1, y1, x2, y2) such that the rectangle contains all points in the set

$$\{(x, y) \mid x1 \le x \le x2 \text{ and } y1 \le y \le y2\}.$$

For a straight line passing through the origin (0,0), the equation has the form ax-by=0. A line intersects a rectangle if they share at least one point. The goal of this problem is to determine (a, b) such that the straight line ax-by=0 intersects as many rectangles as possible. Since there may be infinite many such straight lines, you should output the one with maximum slope, i.e., a/b.

Technical Specification

- The number of test cases is at most 9.
- For each test case, the number of rectangles N, $1 \le N \le 100000$.
- All coordinates are nonnegative integers at most 30000.

Input Format

The first line of the input file contains an integer indicating the number of test cases. Then, the test cases are given one by one. Each test case starts with a line containing the number N of rectangles in the case. Each of the next N lines specifies a rectangle. A rectangles is given by four integers x1, y1, x2, y2, where $0 \le x1 < x2 \le 30000$ and $0 \le y1 < y2 \le 30000$, and there is a space between two integers.

Output Format

For each test case, output the slope a/b and the maximized number of rectangles in one line, where a and b are nonnegative integers. The slope should be in the irreducible form, that is gcd(a, b)=1. Especially, if the straight line is x=0, the slope should be output as 1/0. Output one space between the slope and the number of rectangles.

Example

Sample Input:	Sample Output:
2 4 5 0 10 5 2 5 5 10 7 10 10 20 0 5 3 12 2 0 0 1 1 0 10 10 20	20/7 3 1/0 2

Problem 4. What The Factorial

(Time Limit: 1 seconds)

Problem Description

HH is good at math. He just learnt the concept of factorial, so he invents an interesting game called WTF (What The Factorial) to practice.

In this game, HH will compute the factorial of n and show it to you. You need to answer the corresponding n very fast. Otherwise, you have to pay n! dollars to him.

In mathematics, the factorial of a non-negative integer n, denoted by n! is the product of all positive integers less than or equal to n.

Technical Specification

- The number of test case $T \leq 50$
- $1 \leq n \leq 50000$

Input Format

The first line contains an integer T indicating the number of the test cases. For each test case, there are a positive integer n! in one line. Note that since HH is smart enough to compute the factorial, the input will always be valid.

Output Format

For each test case, output the corresponding n in one line.

Example

Sample Input:	**Sample Output:**
3 1 120 3628800	1 5 10

Problem 5. Generating Set

(Time Limit: 3 seconds)

Problem Description

Given a set of vectors S from n-dimensional real space, we can generate other vectors from S by using only the addition operation. This is the process of finding the *additive closure* for generating set S. For example, let S = {(1, 2), (3, 1)}. By adding (1, 2) and (3, 1), we get (4, 3). Similarly, by adding (4, 3) and (1, 2), we get (5, 5). Both (4, 3) and (5, 5) are in the additive closure of S. More precisely, the additive closure of S is defined as the set of all vectors that can be calculated in the form

$$\overrightarrow{x_1} + \overrightarrow{x_2} + \cdots + \overrightarrow{x_k}, \text{ where } \overrightarrow{x_i} \in S \text{ for } 1 \le i \le k.$$

We use $\sigma(S)$ to denote the additive closure of S. When we restrict the coordinates in every vector of S to be positive integers, you can see that vectors in $\sigma(S)$ are scattered in the first quadrant when $n = 2$ and the first orthant for general $n \ge 2$. Your job is to compute the m^{th} smallest vector in $\sigma(S)$ using the lexicographic order (a.k.a. the dictionary order) under this restriction. In our previous example, the first 6 vectors are (1, 2), (2, 4), (3, 1), (3, 6), (4, 3), (4, 8), accordingly. Notice that duplicate vectors are considered only once in $\sigma(S)$.

Technical Specification

- There are at most 20 test cases.
- The dimension n is in the range $1 \le n \le 20$.
- The coordinate in each vector is a positive integer less than 100.
- The number of vectors in S is s, where $1 \le s \le 20$.
- The rank index m is no more than 10000.

Input Format

The first line of the input file contains an integer indicating the number of test cases. Then the data for each test case follows. The first line of each test case contains three integers n, s and m, which indicate the dimension, the size of the generating set, and the output rank, respectively. Then in the following s lines, each line specifies a vector of length n.

Output Format

For each test case, please output the m^{th} smallest vector in the additive closure of S in one line, using the lexicographic order. Consecutive coordinates in a vector are separated by a space.

Example

Sample Input:	**Sample Output:**
3 2 2 5 1 1 2 2 2 2 6 1 2 2 1 3 2 7 1 1 1 1 2 3	5 5 4 2 3 4 5