Spring 2019 Spring Programming Contest

Problem 1: Audible Audio

In English, the following sequences of letters usually represent a vowel sound when spoken.

```
a ai au aw ay
e ea ee ei eigh ew ey
i ie igh
o oi oo ou ow oy
u ue
y       (when at the end of a word)
a*e     (when at the end of a word and * is any one or two consonant letters)
e*e     (when at the end of a word and * is any one or two consonant letters)
i*e     (when at the end of a word and * is any one or two consonant letters)
o*e     (when at the end of a word and * is any one or two consonant letters)
u*e     (when at the end of a word and * is any one or two consonant letters)
```

Write a program to count the number of vowels in a spoken word, using the sequences of letters defined above.

The first line will contain the number of words to process.

Each word will appear on a line by itself without spaces or punctuation.

Each data set should produce one line of output indicating the number of vowel sequences in the word.

Sample Input

```
7
LU
toy
aye
rate
fleet
eighty
nonspontaneously
```

Sample Output

```
1
1
1
1
1
2
6
```

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Problem 2: Brushing Boxes

Once upon a time there was a carpenter who made only geometrically-perfect toy boxes without lids because he felt this encouraged imagination. His toy boxes were of all sizes and he carefully painted all surfaces of each one. Being a perfectionist, once he opened a can of paint he never closed it because he felt the finish was not as fine as when fresh paint was used. Each gallon of paint covers exactly $200ft^2$, so he is careful to always determine how many toy boxes to have ready before he begins painting.

Given the length, width and depth of a toy box, determine how many toy boxes of that size must be on hand before opening a gallon of paint.

The first line of input will contain the number of data sets to process.

Each data set consists of the length, width and depth of a toy box, measured in integer inches, and separated by a single space.

Each data set should produce one line of output indicating the number of toy boxes which can be painted with one gallon of paint, as shown below.

Sample Input

```
3
16 24 12
36 24 18
36 23 16
```

Sample Output

```
10
4
5
```

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Problem 3: Cassette Collection

An ancient audiophile has such a large collection of cassette tapes he just keeps them in one, big, literal stack. Whenever he wants to listen to one, he carefully removes the cassette from the stack while ensuring that it doesn't fall over. After listening to it, he places the cassette back on top of the stack.

Since his collection is so large, he has assigned each cassette an identification number. He also tracks of the position of each in the stack; that is, how many cassettes are above it in the stack.

Your task is to implement a program to track of the position of each as the stack changes. In particular, each time he listens to a cassette, your program should print the number of cassettes that were above it *before* it was removed.

The first input line contains a positive integer: the number of test cases, at most 100. The first line of each test case contains two integers m and r ($1 \leq m,r \leq 100000$), the number of cassettes in the stack and the number of locate requests, respectively. The next line of each test case contains r positive integers, each at most m, representing the identification number of a cassette to listen to.

Each test case should produce one line of output containing space separated integers giving the number of cassettes above each cassette just before it is removed from the stack.

For simplicity, assume that the initial stack contains cassettes with identification numbers 1,2,…,m in increasing order, where the cassette labeled 1 is top-most.

Sample Input

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

Sample Output

```
2 1 0
3 0 4
```

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Problem 4: Display Density

Canadian economist Stephen Leacock once said:

> *Advertising may be described as the science of arresting the human intelligence long enough to get money from it.*

A certain periodical uses exclusively monospaced fonts and sells advertisement space using the following formula.

> *ad cost in dollars* = *maximum line length* + 2 × *number of rows*

Advertisers are allowed to format their ads as desired, so the same message will cost different amounts depending on its format, as shown below.

```
Advertising may be described as the science of arresting
the human intelligence long enough to get money from it.
```

56 wide + 2 × 2 rows = $60

```
Advertising may
be described as the
science of arresting
the human intelligence
long enough to get
money from it.
```

22 wide + 2 × 6 rows = $34

Write a program to calculate the minimum cost to run an ad containing a sequence of words separated by spaces. Line breaks may be used as needed but the sequence of words must remain intact. Spaces are not considered important, except to indicate where word breaks occur; all other characters must be preserved.

The first input line will contain the number of ads to process.

Each ad consists of one line containing the sequence of words to appear in the advertisement on a single line. Each line will contain at most 10000 characters.

Each ad should produce one line containing the minimum cost in dollars to run the advertisement.

Sample Input

```
3
Advertising may be described as the science of arresting the human intelligence long enough to get money from it.
Advertising is a ten-billion dollar-a-year misunderstanding with the public.
Advertising is legalized lying.
```

Output Output

```
32
27
18
```

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Problem 5: Existent Edges

A simple undirected graph is an ordered pair $G = (V, E)$ where V is a non-empty set of vertices, and E is a set of unordered pairs (u, v) where u and v are in V and $u \neq v$. If S is a set, define $|S|$ as the size of S. An *incidence matrix* M is a $|V| \times |E|$ matrix where $M(i, j)$ is 1 if edge j is incident to vertex i (edge j is either (i, u) or (u, i)) and 0 otherwise.

Given an $n \times m$ matrix, can it be an incidence matrix of a simple undirected graph $G = (V, E)$ where $|V| = n$ and $|E| = m$?

The first line of input contains an integer t ($1 \leq t \leq 100$), the number of test cases. Each test case begins with a line containing two positive integers, n and m, less than 50. Then n lines containing m values (0's or 1's) such that the j-th number on the i-th line is $M(i, j)$.

For each test case print "Yes" if the incidence matrix given in the input can be an incidence matrix of some simple undirected graph, otherwise print "No".

Sample Input

```
3
3 3
1 1 0
0 1 1
1 0 1
3 1
1
1
0
3 3
1 1 0
1 1 1
1 0 0
```

Sample Output

```
Yes
Yes
No
```

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Problem 6: Fantasy Football

Fantasy football leagues allow football fans to choose players to comprise their "team" and compete against other "coaches" in a virtual world based on the performance of actual athletes. In one variation, players have an overall score which determines their standing in the league. Each week, depending on how the actual athletes perform, the player stands to win up to 10 points.

One measure of the competitiveness within the league is the number of teams who could "move up" in rank each week. A team "moves up" if its rank at the end of a week is higher than its rank at the beginning of the week.

Given a list of current scores, determine how many players could move up this week.

The first input line will contain the number of data sets to process.

Each data set consists of a single line containing the number of scores in the list, followed by the scores. At most 100 teams will be given.

Each data set should produce one line of output containing the number of teams which could "move up" this week.

Sample Input

```
3
3 50 37 55
10 65 76 87 98 109 10 21 32 43 54
10 18 37 72 29 23 31 87 37 45 91
```

Sample Output

```
1
0
7
```

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Problem 7: Greatest Group

The friends of my friends are my friends. -- anonymous

No one knows who first made the statement above, but according to it, if A and B are friends and B and C are friends then A and C are also friends. Your task is to determine how many people belonging to the largest group of friends.

The first line of the input consists of the number of test cases to follow, at most 100.

The first line of each dataset contains N, the number of pairs of people ($0 \leq M \leq 500000$).

Each of the following M lines consists of two numbers, A and B, identifying two friends ($1 \leq A \leq 100000$, $1 \leq B \leq 100000$, $A \neq B$).

The output for each test case should contain (on a line by itself) one number denoting the number of people in the largest group of friends.

Sample Input

```
2
2
1 2
2 3
12
1 2
3 1
3 4
5 4
3 5
4 6
5 2
2 1
7 1
1 2
9 10
8 9
```

Sample Output

```
3
7
```