Problem J1: What is n, Daddy?

Problem Description
Natalie is learning to count on her fingers. When her Daddy tells her a number n ($1 \leq n \leq 10$), she asks "What is n, Daddy?", by which she means "How many fingers should I hold up on each hand so that the total is n?"

To make matters simple, her Daddy gives her the correct finger representation according to the following rules:

- the number may be represented on one or two hands;
- if the number is represented on two hands, the larger number is given first.

For example, if Natalie asks "What is 4, Daddy?", her Dad may reply:

- 4 is 4.
- 4 is 3 and 1.
- 4 is 2 and 2.

Your job is to make sure that Natalie's Daddy gives the correct number of answers.

Input Specification
The input will be a single integer in the range $1..10$.

Output Specification
The output is the number of ways of producing that number on two hands, subject to the rules outlined above.

Sample Input
```
4
```

Output for Sample Input
```
3
```

Problem J2: Who Has Seen The Wind

Problem Description
Margaret has looked at the wind floating over the prairies for a long time. After these observations, she has created a formula that will describe the altitude of a weather balloon launched from her house. In particular, her equation predicts the altitude A (in metres above the ground) at hour t after launching her balloon is:

$$A = -6t^4 + ht^3 + 2t^2 + t$$

where h is an integer value representing the humidity as a value between 0 and 100 inclusive.

Margaret is curious at what the earliest hour is (if any) that her weather balloon will hit the ground after launch, so long as it is no more than the maximum time, M, that Margaret is willing to wait. You can assume that the weather balloon touches ground when $A \leq 0$.

In order to do this, your program should use the formula to calculate the altitude when $t = 1$, $t = 2$, and so on, until the balloon touches the ground or $t = M$ is reached.

Input Specification
The input is two non-negative integers: h, the humidity factor, followed by M, the maximum number of hours Margaret will wait for the weather balloon to return to ground. You can assume $0 \leq h \leq 100$ and $0 < M < 240$.

Output Specification
The output will be one of the following possibilities:

- `The balloon does not touch ground in the given time.`
- `The balloon first touches ground at hour:`
  `T`

where T is a positive integer value representing the earliest hour when the balloon has altitude less than or equal to zero.

Sample Input 1
```
30
10
```

Output for Sample Input 1
```
The balloon first touches ground at hour:
6
```

Sample Input 2
```
70
10
```

Output for Sample Input 2

```
The balloon does not touch ground in the given time.
```

Problem S3: Absolutely Acidic

Problem Description

You are gathering readings of acidity level in a very long river in order to determine the health of the river. You have placed N sensors ($2 \leq N \leq 2\ 000\ 000$) in the river, and each sensor gives an integer reading R ($1 \leq R \leq 1\ 000$). For the purposes of your research, you would like to know the frequency of each reading, and find the absolute difference between the two most frequent readings.

If there are more than two readings that have the highest frequency, the difference computed should be the *largest* such absolute difference between two readings with this frequency. If there is only one reading with the largest frequency, but more than one reading with the second largest frequency, the difference computed should be the *largest* absolute difference between the most frequently occurring reading and any of the readings which occur with second-highest frequency.

Input Specification

The first line of input will be the integer N ($2 \leq N \leq 2\ 000\ 000$), the number of sensors. The next N lines each contain the reading for that sensor, which is an integer R ($1 \leq R \leq 1\ 000$). You should assume that there are at least two different readings in the input.

Output Specification

Output the positive integer value representing the absolute difference between the two most frequently occurring readings, subject to the tie-breaking rules outlined above.

Sample Input 1

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

Output for Sample Input 1

```
3
```

Sample Input 2

```
4
10
6
1
8
```

Output for Sample Input 2

```
9
```

Problem S4: Animal Farm

Problem Description
You are running a farm which has N ($1 \leq N \leq 100$) animals. You went to the store and bought $M = N$ pre-made pens that will house your animals. Pens satisfy the following conditions:

- pens have between 3 and 8 edges;
- an edge that is specified by two pens connects the two pens;
- an edge that is specified only once connects that pen to the outside;
- there is exactly one animal in each pen and no animals outside the pens, initially.

The animals, however, have a game they like to play called "Escape from the pen." They assign a cost to each edge of the pen, and they determine the minimum cost for all of the animals to meet in the same area by trampling over the edge of various pens. The animals may meet inside a particular pen or outside of all the pens. Also note that once an edge has been trampled, any animal may pass over it without incurring any cost.

You will be given a description of the pens, along with the placement of animals, and you are to figure out what the smallest cost is to move all the animals into the same area.

Input Specification
The first line of input will be the integer M, the number of pens. On the next M lines, there will be a description of each pen, with one description per line. The description is composed of three components, with each component separated by one space, as follows:

- the first component is an integer e_p ($3 \leq e_p \leq 8$), which describes the number of edges for this particular pen p;
- the second component is a sequence of e_p integers describing the corners of each pen, where each integer is less than or equal to 1000;
- the third component is a sequence of e_p integers describing the cost of each edge, where each integer is less than or equal to 5000.

For the corner and edge cost description, the descriptions are given in cyclical order. For example, the following description of a pen

3 1 2 3 7 4 6

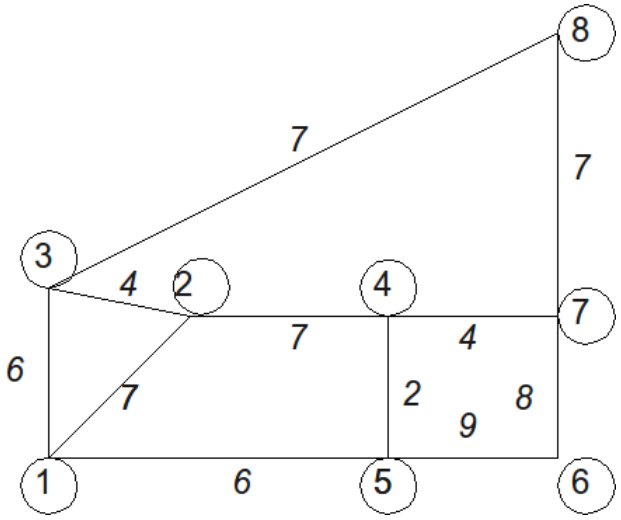
means that there are three corners, and thus, three edges, where the edge $(1, 2)$ has cost 7, the edge $(2, 3)$ has cost 4 and the edge $(3, 1)$ has cost 6. Note: at least 20% of the marks for this question have $N \leq 10$ and no pen will have more than four edges in these cases.

Output Specification
On one line, output the minimal cost that will allow all the animals to gather in one pen or outside all of the pens.

Sample Input
```
4
3 1 2 3 7 4 6
4 1 2 4 5 7 7 2 6
4 4 7 6 5 4 8 9 2
5 3 2 4 7 8 4 7 4 7 7
```

Output for Sample Input
```
10
```

Explanation of Output for Sample Input
The diagram below explains the input data:



where the circled numbers are the corners, and the numbers in *italics* are the edge costs. Notice that if the edges $(2, 3)$, $(4, 5)$ and $(4, 7)$ are removed, all the animals can meet in the pen which has five sides.