ACM ICPC Guangzhou Summer Series June Contest
Time Limit: 5 hours

Judge Setup:
Core 2, 1.6Ghz, 2GB ram.
6/30/2017

Problem A: Amazing Function
Time Limit: 5 seconds

Description

The function **F(n)** is defined as:

$$F(0) = 2^{0.5} + 3^{0.5} + 6^{0.5}$$
$$F(n) = (F(n-1)^2 - 5) / (2 * F(n-1) + 4)$$

Given **N**, find **F(N)**. Note that **N** can be very large!

Input

A number of of inputs (≤**1000**), each start with the number of value of integer **N** ($0 \le N \le 10^{1500}$).

Output

Output **F(N)**, rounded to exactly 10 digits after the decimal.

Sample Input
0
1

Sample Output
5.5957541127
1.7320508076

Problem B: Broken Calculator Keys
Time Limit: 5 seconds

Description

The keys on a calculator is bad broken. Only the 5 keys **sin**, **cos**, **tan**, **asin**, **atan** are still functional. Respectively, they stand for *sine*, *cosine*, *tangent*, *arc-sine*, and *arc-tangent*. Initially the calculator's display shows **0**. Compute the minimum number of key presses, such that the decimal equivalent of the fraction **p/q** will appear on the calculator! Please assume that the calculator has infinite precision, and that it uses radians for trig functions.

Input

A number of of inputs (≤**40000**), each with **p** and **q** (0 ≤ **p** ≤ 1000 and 1 ≤ **q** ≤ 1000).

Output

Output the answer for each input, one on each line.

Sample Input

0 1
1 1
1 2

Sample Output

0
1
7

Problem C: Cats and Vets
Time Limit: 5 seconds

Description

Let there be **M** vets (veterinarians) and **N** cats, where each cat has a different disease. Let all possible combinations of examinations of cats by vets take place. What is the minimum number of gloves needed so that no vet is exposed to any of the cat's disease and no cat is exposed to a disease that the cat does not already have (where it is assumed that each vet wears a glove on his right hand only)? In this problem, the gloves can be turned inside out and even placed on top of one another if necessary without any limits on the number of gloves worn together, but no decontamination of gloves is permitted. Note that if a side of the glove touches either another side of a contaminated side of a glove or a cat, then that side of the glove become contaminated.

Input

A number of of inputs (≤**10000**), each with **M** and **N.**
(**M**>0 and **N** > 0, and each fit in 64 bit unsigned integer).

Output

Output the answer for each input, one on each line.

Sample Input
1 1
1 2

Sample Output
1
2

Problem D: Delicious Binary Strings
Time Limit: 5 seconds

Description

Given a binary string $a_0a_1...a_{n-1}$, a *delicious* string $b_0b_1...b_{n-1}$ is defined to be another binary string with length **m** between 1 and **n**, such that for any number **p** with 0 ≤ **p** ≤ **n-m**, the quantity below is even.

$$\sum_{k=0}^{m-1} a_{p+k} \wedge b_k$$

Herer ^ means **XOR**. For this problem, calculate the total number of different *delicious* strings modulo **1000000007**.

Input

A number of binary strings (≤**600**), **S**, where the length of **S** is between 1 and 50000.

Output

Output the answer for each input, one on each line.

Sample Input
10110
11100

Sample Output
24
23

Problem E: Elegant Pillars
Time Limit: 5 seconds

Description

Assuming that there are **N** pillars, and we need to put onto the pillars, a bunch of balls, i.e., numbered 1, 2, 3, 4, 5, …, in increasing order such that on the same pillar, the sum of the numbers of any 2 adjacent balls is a square number. Calculate the maximum number of balls that can be placed on the **N** pillars. You may put the ball on any pillar, but no balls can be skipped. The process stops once you cannot not place a ball. For example, on 2 pillars, A and B, you can place 1 on pillar A, 2 on pillar B. Then 3 will have to go on pillar A (1+3=4 is a square), and finally 4 cannot be placed (as 4+4=8, and 2+4=6 are neither squares), and we are done (ending up with 3 placed balls).

Input

A number of of inputs (≤**1000**), each with **N (**0 **<** **N** **<** 1000000000**).**

Output

For each input, output the total number of balls on one line.

Sample Input
1
2

Sample Output
1
3

Problem F: Faster Networks
Time Limit: 5 seconds

Description

A general network system can be described as an undirected graph. Each node on the graph is a server, and the data lines connecting the servers are treated as an edge on the graph. The edge weight is the length of the data line. The communication distance between the two servers is defined as the shortest path length between their corresponding nodes. Now, consider a network system where the graph structure is a tree. You are the administrator of the network system and are required to add a data line of a given length to the system. Data lines can be connected to any two servers. Your task is to find the minimum distance between two servers where the communication distance is farthest in all legitimate scenarios (all ways of adding the data line).

Input

The input contains multiple sets of data. For each set of data, the first row of input contains two positive integers **N (0<N≤100000)**, where **N** is the number of servers and **L** is the length of the newly added data line. This is followed by **N-1** lines, each with three positive integers **a, b, l**, which means there is a data line with length **l** connected to the servers **a** and **b**. The server number is indexed from 1, …, **N**. Both **l**, and **L** fit in 32 bit signed integer. The last input set is just 2 0's on one line (denoting end of all inputs), and should be ignored (no output for this).

Output

For each set of data, output on one line the minimum distance between two servers where the communication distance is farthest in all legitimate scenarios.

Sample Input

```
3 1
1 2 1
1 3 1
7 1
1 2 1
2 3 1
3 4 1
4 5 1
5 6 1
6 7 1
0 0
```

Sample Output

```
1
3
```

Problem G: Graph Colorings
Time Limit: 5 seconds

Description

Given a full bipartite graph, such that the number of vertices on both sides of the graph is exactly the same. We want to color each edge into three colors: red, blue, or green, such any two red edges do not share the same vertex, while any two blue edges do not share the same. Calculate the number of such colorings!

Input

A number of of inputs (≤**1000**), each with **N (**0 ≤ **N** ≤ 10000000**),** which is the number of vertices on each side of the graph (a total of 2***N** vertices).

Output

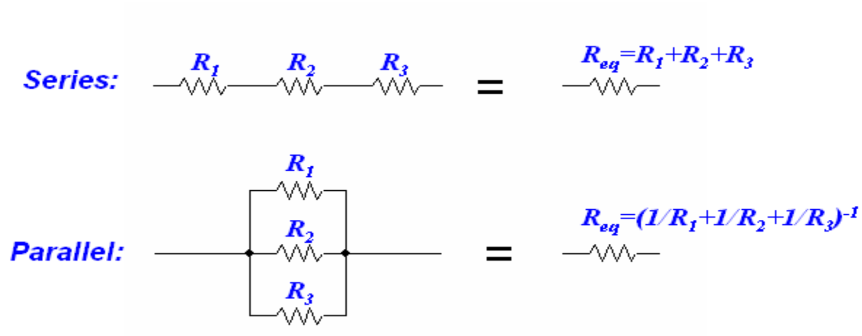
For each input, output the answer on one line, modulo **1000000007**.

Sample Input
1
2

Sample Output
3
35

Problem H: Hobbit's Resistor Graphs
Time Limit: 5 seconds

Description



Hobbit has only learnt the parallel and series method of calculating resistance across an electric network graph where there is a single resister on every edge of the undirected graph **G**. Given an undirected graph **G**, and 2 vertices **u** and **v**, if it is possible to calculate the resistance between **u** and **v** using only these 2 rules shown above, then the graph **G** is called series-parallel decomposible (sp-decomposible for short) with resect to (**u**, **v**). In other words, **G** may be turned into just the 2 node graph of **u**, **v** connected by one edge, by a sequence of the following operations: (a) Replacement of a pair of parallel edges with a single edge that connects their common endpoints; (b) Replacement of a pair of edges incident to a vertex of degree 2 other than **u** or **v** with a single edge.

Input

The input contains multiple sets of data.   The first line of each set contains 2 positive integers **n** (1≤ **n** ≤ 100000), and **m** (1≤ **m** ≤ 100000), which represent the number of nodes and the number of edges/resistors in the resistor network. Then, a total of m lines follows with each resister edge (**u**, **v**), such that (1 ≤ **u**, **v** ≤ **n**, **u** ≠ **v**).

Output

For each set of data, output on one line the number of unique pairs (**u**, **v**) with **u** < **v**, such that **G** is sp-decomposible with respect to (**u**, **v**).

Sample Input

```
6 6
1 2
1 3
1 4
2 3
2 4
5 6
```

Sample Output

```
6
```

Problem I: Incredible Sums
Time Limit: 5 seconds

Description

Given an array of integers a_0, a_1, ..., a_n, Compute:

$$\left(\sum_{1 \leq i < j < k < l \leq n} a_i a_j a_k a_l\right) \bmod (10^9 + 7)$$

Input

A number of of inputs (≤**200**), each with **N (**0 ≤ **N** ≤ 100000**),** followed by an array of N integers, each integer a_i ($0 \leq a_i \leq 1000000000$), on the next line.

Output

For each input, output the answer on one line.

Sample Input

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

Sample Output

```
0
24
```

Problem J: Just Pentagon Perimeter
Time Limit: 5 seconds

Description

Given a set of points in the plane, find the convex pentagon with largest perimeter such that each vertex of the pentagon is a unique point in the point set! Note that convex means no line segment between two points on the boundary of the pentagon ever goes outside the pentagon.

Input

A number of of inputs (≤**100**), each with **N (**$1 \le$ **N** $\le$ **8500),** followed by **N** points with (**x,y**) integer. Each integer fit in 32 bits signed. Note there are no duplicate points.

Output

Output the perimeter rounded to 2 decimal places on each line for each input set. If no such pentagon exists, print -1.

Sample Input

```
1
0 0
6
0 0
0 2
1 2
1 3
2 0
2 2
```

Sample Output

```
-1
8.83
```

Problem K: Katrina's Shadow
Time Limit: 5 seconds

Description

Katrina is a giant flying monster, in the shape of a convex polyhedron. It's dark, so she has lit a powerful point light source (strictly on the outside of Katrina by margin of at least 0.1). This casts a shadow on the ground. Calculate the size of the shadow!

Input

Multiple inputs. In each input, the first three lines has three real numbers each, with each line representing a point in 3D coordinates (**x,y,z**), where -1000 ≤ **x**,**y**,**z** ≤ 1000. These three points together determine a plane, the plane is the ground. Safely assume that the three points of the coordinates are different and not collinear. The next line of three real numbers is the point source.
Followed by an integer **n** (1 ≤ **n** ≤ 100) representing the number of convex polyhedral vertices.
Followed by **n** rows, each row of three real numbers, representing a vertex of the convex polyhedron.

Output

For each input, output the answer on one line rounded to 2 digits after the decimal.

Sample Input

```
0 0 0
0 1 0
1 0 0
0 0 2
8
0 0 1
0 1 1
1 0 1
1 1 1
0 0 0
0 1 0
1 0 0
1 1 0
```

Sample Output

```
4.00
```

Problem L: Laser Avoidance
Time Limit: 5 seconds

Description

You start at point (**0,0**) and must reach point (**p**, **q**) on a flat field. Unfortunately there is a number of lasers you have to avoid. Each laser starts at a point (**x**, **y**) and shoots out an infinite one directional ray at radian angle **θ** from the **x**-axis. Given the position of the lasers, find the shortest path you can take without getting hit by a laser.

Input

A number of inputs (<**100**). The first row is the three integer **n**, the total number of lasers, and the end point (**p**, **q**). The next **n** line, each has two integers **x**, **y** and a real number **θ**, describing the laser as defined above as position of laser and the angle with respect to the x-axis.
Note that $0 \le n, p, |q|, |x|, |y| \le 1000000$, $\theta \in [-\pi, \pi)$.

Output

For each input, output the answer with 5 digits after decimal.

Sample Input

```
3 5 5
2 1 1
3 1 2
4 1 -1.5
3 5 0
5 2 1
5 2 2
5 2 -1.5
```

Sample Output

```
7.63441
5.00000
```