

Problem A. 连杀

Input file: standard input
Output file: standard output
Time limit: 2 seconds
Memory limit: 512 megabytes

小寨和咖啡组队打PUBG(PLAYERUNKNOWN'S BATTLEGROUNDS), 已经成功挺进了决赛圈。此时战场上还有 n 个敌人, 每个敌人的位置可以用直角坐标系上的坐标来表示。

小寨和咖啡有着很好的枪法, 但是他们急缺子弹。假设他们无法捡到子弹, 但是移动速度足够快以至于在最后的绝杀过程中 n 个敌人的位置不会发生移动。

假设子弹的轨迹是一条平直的直线, 并且他们的枪很强, 发出的子弹能够消灭掉任何处在子弹的路径上的敌人。请问他们至少需要多少子弹, 才能消灭所有的敌人, 获得最终的胜利?

Input

第一行包含一个数字 $n(1 \leq n \leq 15)$, 表示有 n 个敌人。

接下来 n 行, 每行两个数字 $x, y(-10^9 \leq x, y \leq 10^9)$, 表示一个敌人的坐标。

Output

输出一个整数, 表示需要的最少的子弹数目。

Example

standard input	standard output
10 0 0 1 1 2 2 3 3 4 4 5 5 6 6 7 7 8 8 9 9	1

Problem B. Error

Input file: standard input
Output file: standard output
Time limit: 2 seconds
Memory limit: 512 megabytes

When doing integer multiplication modulo a composite number $M = \prod p_i^{t_i}$, we can accelerate the process by doing it separately for each coprime component $p_i^{t_i}$ of number M , and then combine the results to obtain the final answer with Cantor's Remainder Theorem (CRT).

Miserably, when the code was running, errors occurred in the calculation for one of the coprime components. That is, for some i , the result it got was incorrect modulo $p_i^{t_i}$, therefore after combination, the answer was wrong.

Given the two numbers A, B to multiply, along with the wrong answer C' and the modulo number M , you need to find the component on which the program failed.

Input

The first line contains a single number $T (1 \leq T \leq 10^6)$, the number of test cases.

T lines follow, each line contains 4 numbers $A, B, C', M (0 \leq A, B, C' < M \leq 10^{18})$, denoting a query.

Output

Print T lines. Each line contains a single number $p_i^{t_i}$, the component the program failed on.

Example

standard input	standard output
1 2 3 1 10	2

Note

$$\begin{aligned} M &= 10 = 2^1 \times 5^1 \\ (2 \times 3) \bmod 2^1 &= 0 \neq 1 \\ (2 \times 3) \bmod 5^1 &= 1 \end{aligned}$$

Therefore, the answer is 2^1 .

Problem C. Ending

Input file: `standard input`
Output file: `standard output`
Time limit: 1 second
Memory limit: 512 megabytes

Zag is playing an interesting game during COVID-19 quarantine. The game has n different events, and players start from event 1.

Except for the ending event (numbered n), each event has several follow-up events. While being in a specific event, you can advance to one of its follow-up events with a given probability. If you successfully advance to one of the follow-up events, you can never go backward. Or, if you have unluckily failed to advance, you can try to move to other follow-up events. If you have tried all follow-ups and still failed, your game is over.

Zag asked Coffee, the game developer, to tell him all events and their follow-ups, along with probability to successfully advance, so that you can help him decide his best chance of getting to the ending event.

Input

First line contains two integers n, m ($2 \leq n \leq 5 \times 10^4, 1 \leq m \leq 10^5$), the number of events and the number of follow up relations.

Then m lines follow, each of which consists of three numbers x, y, p ($1 \leq x, y \leq n, 0 \leq p \leq 100$), denoting that you may advance from event x to event y with probability $p\%$.

It is guaranteed that you can not return to a passed event through the follow-up relations.

Output

Print a single decimal number, the maximum probability of reaching the ending event. Your answer is considered correct if the absolute or relative error doesn't exceed 10^{-6} .

Example

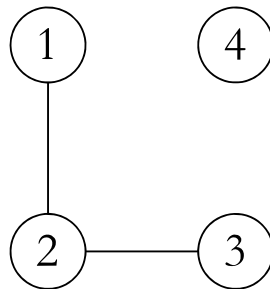
standard input	standard output
4 4 1 2 50 1 3 50 2 4 30 3 4 70	0.425000

Problem D. 删点

Input file: standard input
Output file: standard output
Time limit: 3 seconds
Memory limit: 512 megabytes

小寨得到了一个包含 n 个点的无向图。他要选取一个点的集合（可以为空），将其中的点依次删掉。对于选出的这个集合，他还需要选取一个合适的删点顺序，使得删的过程中，任何点在被删掉的时刻依然与至少一个未被删掉的点相连（请参考样例）。

删着删着，他发现，不是所有的集合都能找到一个满足条件的删点顺序。比如，对于下图：



对于集合 $\{4\}$, $\{1, 4\}$, $\{2, 4\}$, $\{3, 4\}$ 都不能找出满足条件的方案，因为无论如何，在删除4的时候，它都不与任何点相连——事实上，4在任何时刻都不与其它点相连。

他希望知道，有多少个不同的集合可以找到一种满足条件的删点顺序。由于方案数可能很大，请输出答案对998244353取模后的结果。

题目保证不会出现自环。

Input

第一行两个数字 n, m ($1 \leq n, m \leq 10^6$)，表示有 n 个点和 m 条边。

接下来 m 行，每行两个数字 x, y ($1 \leq x, y \leq n, x \neq y$)，表示 x 和 y 之间有一条边相连。

Output

输出存在符合条件删点顺序的集合个数。

Example

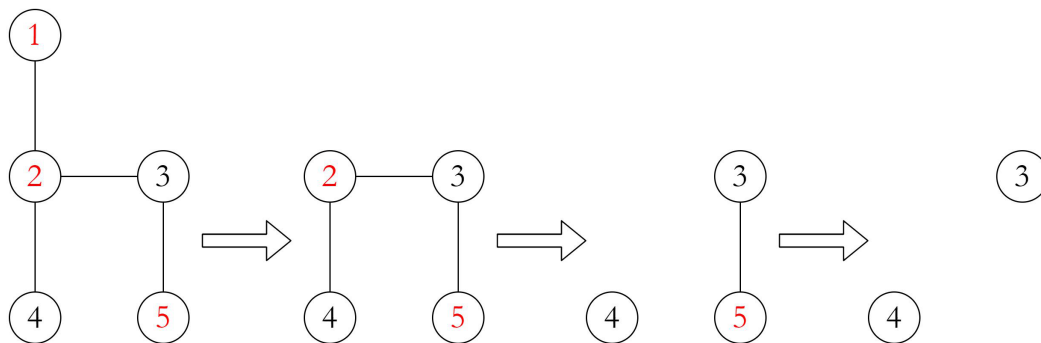
standard input	standard output
5 4 1 2 2 3 2 4 3 5	31

Note

下面是满足条件的31种方案：

$\emptyset, \{1\}, \{1, 2\}, \{2, 4\}, \{1, 2, 3\}, \{1, 4, 5\}, \{1, 2, 3, 4\}$
 $\{2\}, \{1, 3\}, \{2, 5\}, \{1, 2, 4\}, \{2, 3, 4\}, \{1, 2, 3, 5\}$
 $\{3\}, \{1, 4\}, \{3, 4\}, \{1, 2, 5\}, \{2, 3, 5\}, \{1, 2, 4, 5\}$
 $\{4\}, \{1, 5\}, \{3, 5\}, \{1, 3, 4\}, \{2, 4, 5\}, \{1, 3, 4, 5\}$
 $\{5\}, \{2, 3\}, \{4, 5\}, \{1, 3, 5\}, \{3, 4, 5\}, \{2, 3, 4, 5\}$

以 $\{1, 2, 5\}$ 为例，按照 $1 - 2 - 5$ 的顺序删除即可满足要求，如下图所示：



唯一一个找不到满足条件删除顺序的集合是 $\{1, 2, 3, 4, 5\}$ ，因为不管怎么删，最后一个点在删除的时候一定不与任何点相邻。

Problem E. 游戏

Input file: standard input
Output file: standard output
Time limit: 1 second
Memory limit: 512 megabytes

前不久小寨和咖啡沉迷上了一个游戏《少年三国志2》，一段时间之后小寨就玩腻了，于是他自己仿照《少年三国志2》编了一个新的简单小游戏，并邀请咖啡一起来玩这个新游戏。这个游戏规则如下：一共有4种英雄，他们都有奇怪的名字，分别叫做：Gigi, Nick, Thai, May。在游戏一开始的时候，小寨和咖啡分别会有 n 个英雄，这些英雄必定都是上面4种中的一个。这 $2n$ 个英雄里面的每一个都有一个攻击序列 $\{a_i\}$ ，这个序列是 $1, 2, 3, \dots, n$ 的一个排列，这个英雄会先攻击对方编号为 a_1 的英雄，直到将其淘汰（生命值小于等于0），然后再攻击对方编号为 a_2 的英雄直到将其淘汰，然后攻击 a_3 ，以此类推。也就是说 a_1, a_2, \dots, a_n 中第一个没有被淘汰的敌方英雄为他的**当前攻击对象**。每个英雄都有生命值、攻击力、法力上限这三个基本属性，如下表所示：

英雄名	生命值	攻击力	法力上限
Gigi	900	65	100
Nick	1000	52	80
Thai	1500	41	120
May	750	77	50

在游戏开始后小寨和咖啡轮流进行操作，小寨先操作，直到有一方所有的英雄都被淘汰为止。在每一轮中，每一方的操作都是按照下面的流程进行的：按照编号从小到大依次处理每一个没有被淘汰的我方英雄，这个英雄会先恢复10点法力值（初始值为0），如果法力值达到了上限则这个英雄的这次攻击会**强化**为一次大招（并将法力值清零），否则进行一次普通攻击，作用对象为他的当前攻击对象。普通攻击会对当前攻击对象造成英雄攻击力点伤害（在没有护甲的情况下，效果为敌方英雄扣除我方攻击英雄的攻击力点生命值）。每个英雄的大招如下：

- Gigi：先对当前攻击对象进行一次普通攻击，然后对所有没有被淘汰的己方英雄恢复10点生命值。
- Nick：立即获得120点护盾，**护盾值的上限为200点**。当Nick受到伤害时，会先用护盾值抵扣等额生命值的伤害。比如说当前Nick有100点护盾，此时受到120点伤害，会扣除他全部100点护盾和20点生命。
- Thai：立即获得两次伤害减免效果，也就是说接下来Thai受到的两次伤害（不管伤害量是多少）都会被抵消。这个效果可以叠加，也就是说如果Thai在使用完大招之后没有受到伤害，再次使用大招会累计获得4次伤害减免效果！
- May：对当前攻击对象进行一次普通攻击，**然后**标记当前攻击对象。May对他标记的对象的每次攻击伤害都会提升50点（多次标记效果不叠加）。

如果当前操作方的某个英雄攻击之后，对方的所有英雄都被淘汰掉了，则当前操作方胜利，并且剩余的英雄不再进行操作。

Input

输入数据的第一行仅有一个整数 $T(1 \leq T \leq 300)$ 表示测试数据组数。

对于每组测试数据，第一行包含一个整数 $n(1 \leq n \leq 10)$ ，表示双方的英雄数目。

接下来 $2n$ 行，每行表示一个英雄，其中前 n 行按照编号从1到 n 的顺序给出小寨的英雄，接下来 n 行按照同样顺序给出咖啡的英雄。对于这 $2n$ 行，每一行都有如下格式：

Type a_1, a_2, \dots, a_n

其中Type为Gigi、Nick、Thai、May中的一个，表示英雄的类型。 a_1, a_2, \dots, a_n 为这个英雄的攻击序列。

Output

如果**小寨**获胜（最终咖啡的英雄全部被淘汰），输出一行**YES**，接下来一行依次输出小寨的 n 个英雄的生命值（被淘汰的英雄输出0）。如果**咖啡**获胜，输出一行**NO**，接下来一行依次输出咖啡的 n 个英雄的生命值（被淘汰的英雄输出0）。

Example

standard input	standard output
3	YES
1	36
Gigi 1	NO
Nick 1	135
1	NO
Thai 1	545 53
May 1	
2	
Gigi 1 2	
Thai 2 1	
Nick 1 2	
May 1 2	

Problem G. Not-And

Input file: `standard input`
Output file: `standard output`
Time limit: 1 second
Memory limit: 512 megabytes

NAND(Not-And) is a bitwise operation defined as follows: $a \text{ NAND } b := \text{NOT } (a \text{ AND } b)$.

Zag is given an array a which consists of n 32-bit unsigned integers. He asks you to perform two types of operations for him, which are described below in detail.

Input

The first line contains two integers $n, q (1 \leq n, q \leq 10^5)$, length of the array and number of requests.

The second line contains n integers $a_i (0 \leq a_i < 2^{32})$.

Then q lines follow, each of which contains a request of one of the two types:

- 1 1 l r $x (1 \leq l \leq r \leq n, 0 \leq x < 2^{32})$, denoting that you need to calculate and output the answer of $x \text{ NAND } a_l \text{ NAND } a_{l+1} \text{ NAND } \dots \text{ NAND } a_r$.
- 2 2 p $x (1 \leq p \leq n, 0 \leq x < 2^{32})$, denoting that you need to replace the number at position p with the given x .

Output

For every request of the first type, output a line containing the answer.

Example

standard input	standard output
5 5	4294967103
571 342 228 152 192	4294966957
1 1 5 409	4294967103
2 1 414	
1 1 2 100	
2 4 341	
1 2 5 315	

Problem I. Phobia

Input file: `standard input`
Output file: `standard output`
Time limit: 5 seconds
Memory limit: 512 megabytes

People with social phobia hate the moment when meeting some acquaintances on the street. So they will try to avoid any chance of making such things happen.

Though hate sudden encounters, people with social phobia still can't stay at home all the time. In order to keep physical health, they will take walks from time to time. The position of each one's house is known, which can be seen as a point on a number axis. We also learned that everyone will move at a constant speed when they take walks.

Now you are given the positions of their houses and their walking speed, and you are able to choose and order k persons to stay home. Your task is to find out, if the remaining persons start to take walks at the same time, for how long at most they can walk without meeting anyone?

Input

The first line contains two integers n, k ($1 \leq n \leq 10^5, 0 \leq k \leq n$), the total number of persons and the number of persons you can order to stay home.

Then n lines follow, each line contains two integers x, v ($|x|, |v| \leq 10^9$), denoting one person's starting position and walking speed.

It is guaranteed that at the beginning there can only be at most one person at each position of the number axis.

Output

Print one decimal number, the longest time they may walk without meeting anyone. If they may keep walking forever without meeting anyone, print -1. Your answer is considered correct if the relative or absolute error is below 10^{-4} .

Examples

standard input	standard output
2 0 0 1000 1 1000	-1
2 0 0 5 10 -6	0.909090909091
2 1 0 5 10 -6	-1

Problem J. 挤牙膏

Input file: standard input
Output file: standard output
Time limit: 1 second
Memory limit: 512 megabytes

小寨和咖啡比赛挤牙膏。

如果用力度 f 去挤余量为 c 的牙膏管，会挤出 $\min\{c, \lfloor \frac{c \times f}{10^9} \rfloor\}$ 个单位的牙膏（其中符号 $\lfloor x \rfloor$ 表示对 x 向下取整）。

小寨和咖啡共比了 m 轮，给出小寨和咖啡初始的牙膏管余量 c_1, c_2 ，每轮的力度 f_{i1}, f_{i2} ，计算最后谁挤出的牙膏多。如果小寨挤出的多，则小寨胜利，输出Rilly，否则输出Northy。

Input

本题包含多组数据。

第一行包含一个数字 $T(1 \leq T \leq 10^6)$ ，表示数据组数。

对于每组数据，第一行包含三个数字 $m, c_1, c_2(1 \leq m \leq 10^6, 0 \leq c_1, c_2 \leq 10^9)$ 。

接下来 m 行，第 i 行包含两个数字 $f_{i1}, f_{i2}(0 \leq f_{i1}, f_{i2} \leq 10^9)$ ，表示第 i 轮小寨和咖啡挤牙膏的力度。

题目保证 $\sum m \leq 10^6$ 。

Output

对于每组数据，输出一行Zag或Coffee，分别表示小寨和咖啡胜利。

Example

standard input	standard output
1 1 1000000000 100000000 1 100000000	Coffee

Problem K. Fraction

Input file: standard input
Output file: standard output
Time limit: 7.5 seconds
Memory limit: 256 megabytes

Given T queries, for each query you are given two integers n, k , and you need to calculate, what's the k th largest fraction number that has the form of

$$\frac{p}{q} (1 \leq p, q \leq n, \gcd(p, q) = 1)$$

Input

First line an integer $T (1 \leq T \leq 10^2)$, the number of queries.

T lines follow, each line contains two integers $n, k (2 \leq n \leq 10^6)$, indicating a query. It's guaranteed that the answer belongs to $[0, 1)$.

Output

T lines, each line contains a fraction in term of p/q .

Example

standard input	standard output
5	1/1
4 6	1/5
5 1	1/3
9 9	1/1
3 4	3/5
7 11	

Problem L. Subarray Sum

Input file: standard input
Output file: standard output
Time limit: 2 seconds
Memory limit: 256 megabytes

A subarray of an array can be obtained, by erasing some(can be zero) elements in it.

Now you are given an array a containing n integers, and you need to calculate

$$\sum_{b \text{ is a subarray of } a} \sum_{i=1}^{|b|} i \times b_i$$

The answer may be large, so please print the answer mod 998244353.

Input

The first line contains an integer $n(1 \leq n \leq 10^5)$, number of integers in the array.

Then follows a line of n space-separated integers $a_1, a_2, \dots, a_n(0 \leq a_i \leq 10^9)$, denoting the array.

Output

A line, the answer.

Example

standard input	standard output
10 12 23 34 45 56 67 78 89 90 100	1199104

Problem M. Conquest

Input file: `standard input`
Output file: `standard output`
Time limit: 1 second
Memory limit: 256 megabytes

On Island of Deep Dark Fantasy, there are n castles. The castles are connected by bidirectional roads, and there exists exactly one path between each pair of castles.

Initially, inside each castle there is a kingdom. But, as you know, this island is full of deep dark fantasies, and conquests take place all the time.

Each kingdom has its own team of artists, and they are hired to help the king to conquer other castles.

If any castle belonging to kingdom B is conquered by artists from kingdom A , kingdom B will fall, and all castles ruled by kingdom B will become a part of kingdom A .

You are an observer from the World of Wonder. You noticed that conquests on Island of Deep Dark Fantasy can be described as follows: Artists from castle u launch a war in castle x and head towards castle y , conquering all the castles on path.

As you are famous for your research, kings on Island of Deep Dark Fantasy often ask you that if he walks from castle x to y , how many castles along the path are under his rule. You are annoyed by their queries, so you want to write a program to automatically calculate the answer.

Input

The first line contains a integer $n(1 \leq n \leq 2 \times 10^5)$ - the amount of castles on Island of Deep Dark Fantasy.

Each of the following $n - 1$ lines contains two integers $x, y(1 \leq x, y \leq n)$, denoting there is a path from castle x to y .

Then follows a line containing one single integer $q(1 \leq q \leq 2 \times 10^5)$, the number of operations.

The next q lines give you the sequence of operations, each of which contains 4 integers, $op, x, y, z(op \in \{1, 2\}, 1 \leq x, y, z \leq n)$.

$op = 1$ means artists from castle z conquered castles on the path from x to y .

$op = 2$ means you need to find out how many castles on the path from x to y belong to the same kingdom as castle z .

Output

For each $op = 2$ operation, output a line containing a integer, the answer.

Example

standard input	standard output
5 2 1 3 1 4 2 5 3 3 1 4 3 4 1 3 5 5 2 2 5 2	4