International Collegiate Programming Contest
Africa and Arab Collegiate Programming
Championship Kickoff 2022
Virtual
May 2022

The International Collegiate Programming Contest
Sponsored by ICPC Foundation

Africa and Arab Collegiate Programming Championship Kickoff 2022

(Contest Problems)

Virtual
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Problem A. Are you excited?

Input file:	standard input
Output file:	standard output
Balloon Color:	White

It is 2022 and here we go again. A new African and Arab Collegiate Programming Championship season is kicking off and a lot of surprises await everyone.

Amira, the ACPC Business Development Consultant, is checking with ACPC partners and friends how they feel about the new season and the Kick Off contest by the following question: "On a scale from 1 to 10 how excited are you about the new season?". Amira knows her friends very well and one of them is Obioma. Amira knows that if Obioma answered with any number larger than 5 then she is excited and with any number other than that then she isn't excieted.

Given the number that Obioma answered the question with, can you tell us if she is excited or not?

Input

You will be given one line containing one integer X ($6 \leq X \leq 10$) which is Obioma's response to Amira's question.

Output

For each test case, print in a single line "yes"if Obioma is excited and "no"if not.

Example

standard input	standard output
10	yes

Problem B. Burning Calories

Input file:	`cals.in`
Output file:	`standard output`
Balloon Color:	`Purple`

Ali wants to exercise and burn **exactly** K calories . He knows that every kilometer he walks, he burns exactly 1 calory.

Ali's neighborhood consist of N houses connected by M roads. The houses are numbered from 1 to N. The length of all roads is an integer number of kilometers. Ali starts at house 1 and he can finish in front of any house. How many routes can Ali take such that he burns exactly K calories.

A route is considered different from another route if the number of roads traversed is different or if at some point, Ali walks a road in a route that he doesn't walk in the other.

Input

The first line contains an integer T, the number of test cases.

The first line of each test case contains three integers N, M, and K the number of houses, the number of roads, and the number of calories Ali wants to burn respectively.

$(2 \leq N \leq 50,\ N-1 \leq M \leq min(N*(N-1)/2, 100),\ 1 \leq K \leq 10^5)$

The next M lines contain three integers, a, b, and c, meaning that there is a road between house a and house b that is c kilometers long.

$(1 \leq a, b \leq N,\ 1 \leq c \leq 10^9\ )$

It is guaranteed that the sum of N over all testcases does not exceed 50.

It is guaranteed that the sum of M over all testcases does not exceed 100.

It is guaranteed that the sum of K over all testcases does not exceed 10^5.

Output

For each test case, output one integer, the number of routes that can be taken to burn exactly K calories.

As the number may be large, print the answer mod 1000000007.

Example

cals.in	standard output
1 3 3 5 1 2 2 2 3 4 1 3 1	3

Note

In the sample test case, the possible routes Ali can take (starting at house 1) are:

Take the road to house 2 then go back to house 1, then go to house 3.

Take the road to house 3 then take the road to house 2.

Take the road to house 3, then go back to 1, then go back to 3 then go back to 1 then go back to 3.

Problem C. Clever Teens

Input file:	`func.in`
Output file:	`standard output`
Balloon Color:	`Gray`

It is year 2022. As you can see it has many twos, but what makes is more special is that it is the second year for the ACPC Teens. The ACPC clever teens are getting more and more excited about competiting and learning new things. And this year, Bayan, the ACPC Teens director, has so many surprises up in her sleeve for the contest.

To keep the excited clever teen busy so that Bayan can focus on her preparations, she gave them the following problem to solve.

Given an array A of N integers, Bayan defined a function $G(A)$ as the sum of the product of each element and its index. More formally $G(A) = \sum_{i=1}^{N}(i \times A[i])$. For example, if A = [2,6,3,7], then G(A) = $(2 \times 1) + (6 \times 2) + (3 \times 3) + (7 \times 4) = 51$. Notice that the array starts with index 1.

Also she defines a swap as choosing two indices i and j and replacing A_j with A_i and vice versa.

Bayan then asks the teens, what is the maximum value of $G(A)$ after performing at most one swap?

One of your students told you about the problem and asked for help. You read the problem and liked it and decided to solve it yourself.

Input

The first line contains an integer T, the number of test cases.

The first line in each test case consists of a single integer N ($2 \leq n \leq 5000$), the number of elements in the array.

The second line contains N integers, the elements of the array ($-10^9 \leq A_i \leq 10^9$).

Output

For each test case, print one line containing a single integer which is the maximum value of $G(A)$ after at most one swap.

Example

func.in	standard output
1 5 2 7 6 1 5	75

Problem D. Dedicated Contestant

Input file:	`tank.in`
Output file:	`standard output`
Balloon Color:	`Dark green`

ACPC 2022 is just around the corner. This year is not like any other year. More surprises, more contestants, more challenges and of course more opportunities. As always Coach Academy, the ACPC partner, is stepping up to accommodate trainings for the ACPC contestants.

Coach Academy provides problem solving training for school students, university students and also graduates. They prepare students to tackle algorithms and data structures challenges and train them for ACPC different competitions.

Joud is a dedicated young contestant who just started training with Coach Academy to prepare for the ACPC Teens. Joud started to apply what she learns in her life. One day, she found a water tank which is initially empty and has a maximum capacity of N gallons. She wanted to fill the tank by using two other jugs which have maximum capacities S and T gallons respectively. She can perform the following operation until the tank is full.

- Choose one of the jugs and fill it with water to its maximum capacity, then dump all the water into the tank.

Joud must use all the available capacity of the chosen jug at each operation.

If the tank becomes full during the above operation, then the extra water overflows and is wasted.

What is the number of times that Joud should use each of the jugs so that the water wasted is minimized?

Input

The first line of input contains one integer T - the number of test cases.

Then T lines will follow. Each of them contains three integers, N, ST $(1 \leq N, S, T \leq 10^5)$. The capacity of the tank and the capacities of the first and second jug respectively.

It is guaranteed that the sum of N over all testcases does not exceed 10^5.

Output

For each test case, print two numbers, the number of times that Joud should perform the above operation with the first jug and with the second jug respectively.

If there are multiple answers, you should output the one with the smallest number of times that Joud should perform the above operation with **the first jug.**

Example

tank.in	standard output
1 50 1 24	2 2

Note

For the given test case, using the second jug two times will fill the tank with 48 liters of water, then using the first jug two times will fill the tank with 2 liters, therefore filling the tank to its max capacity with 0 waste.

Problem E. Eager To Work

Input file:	`cross.in`
Output file:	`standard output`
Balloon Color:	`Orange`

Ehab just knew about Talents Arena, a new member of the ACPC family and partners. He stayed all night reading about them. He learnt that Talents Arena's platform will help him find a job that matches his skills and expectations. He will get matched with job openings that suit him most according to his profile.

After this long night, he wake up late and found out he is late for his first lecture at university and now he wants to get to class as soon as possible. To get to university, he must cross a road. Currently, the traffic light is red for cars and displays t seconds before turning green. Ehab is currently at point x (see figure) and wants to cross to point y (the university gate).

The horizontal distance between x and y is h units, and the vertical distance between them (which is also the width of the road) is v units. Ehab's speed is 1 unit/second . Ehab must be on the other side of the road when the traffic light turns green (when the t seconds are over). All distances are given in meters.

It is guaranteed that Ehab can reach the other side before the traffic light turns green ($t \geq v$)

Given h, v, and t, what is the minimum time Ehab can reach point y?

Input

The first line contains T, the number of test cases.

The first and only line of each test case contains 3 integers, h, v, and t. The horizontal distance between x and y, the vertical distance between x and y, and the time before the traffic light turns green. $1 \leq h, v, t \leq 10^9$, $(t \geq v)$.

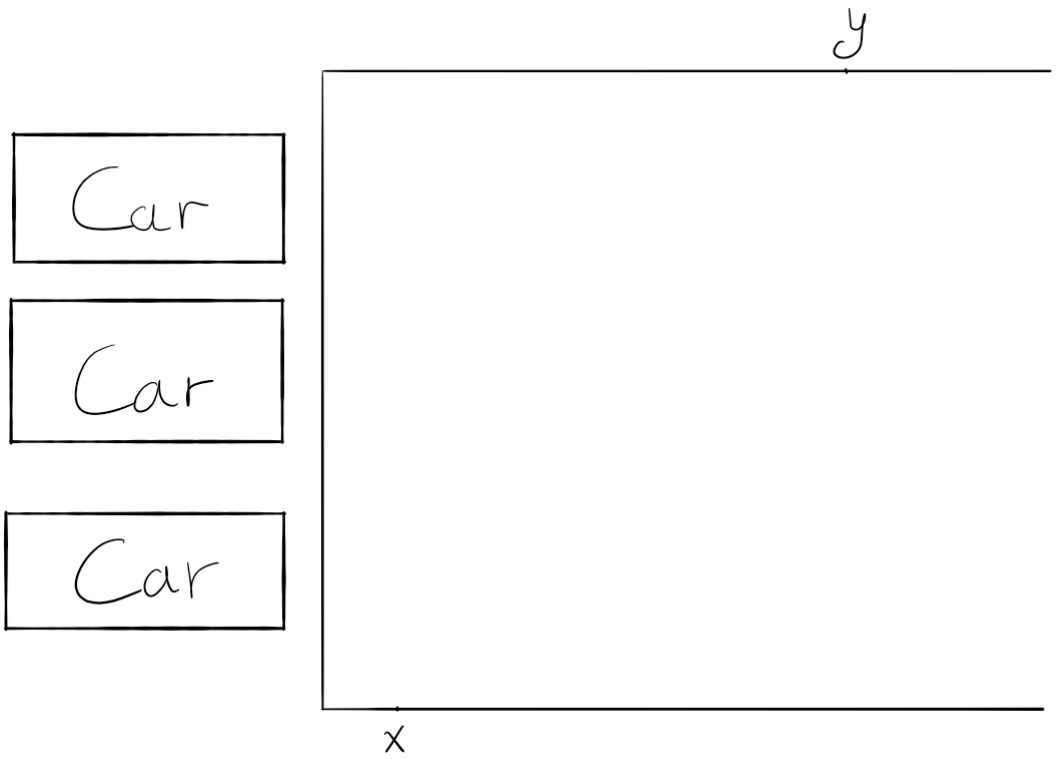
Output

The minimum time Ehab can get to the gate in while satisfying the conditions (to 9 decimal places).

Example

cross.in	standard output
1 3 4 5	5.000000000

Note


y
Car
Car
Car
x

Problem F. Focus

Input file:	`win.in`
Output file:	`standard output`
Balloon Color:	`Blue`

The ACPC is known for its strong community. It is one of the many reasons along having fun that makes people join the ACPC family. Seeing each other and building connection and also opening opportunities for Growth.

Tolba, a Principle Engineering Manager at Microsoft, noticed how much talents exist in the ACPC family and decided to know more about ACPC. Tolba attended the ACPC and started mingling around and talking with people. He knew that the ACPC is full of amazing people but he was astonished as people whom he met were far and beyond any expectations.

One time he was at the ACPC Chill Zone. He noticed two contestants, Khairy and Omar, were playing a game on paper that contains string of length N.

Khairy and Omar will play a game alternating turns with Omar going first.

On a player's turn, they must choose any character c from this string which is greater than letter $'a'$ then replace it with any character in range $['a' : c-1]$ inclusive, The first player unable to make a move loses.

Khairy wants to be the winner of the game so he decided to change the original string before the game begins by selecting some characters (possibly zero) and for each of them, replace it with another character which is less than it in the English alphabet.

Let's define change process by:

- $c1$ $c2$ k: The cost of changing character $c1$ to $c2$ is k.

There are M different possible change processes. Khairy can use any of them for any number of times (possibly zero).

What is the minimum cost of changes Khairy need to make on the original string before the game begins such that if they both play optimally Khairy will be the winner of the game?

Both players were focused on the game so Tolba decided to take notes and could answer Khairy's question. Can you do the same?

Input

The input starts with two positive integers N $(1 \le N \le 10^5)$, M $(1 \le M \le 200)$, the length of the string and number of possible change processes.

The next line will be a string S of length N.

Then M lines will follow. Each line contains 3 integers $c1$, $c2$ and k $('a' \le c1, c2 \le' z'), (1 \le k \le N)$.

Output

Print minimum cost Khairy need to win the game. If he can't win, print -1.

Examples

win.in	standard output
3 2 bbb c b 5 b a 3	3
3 2 bab c b 5 b a 3	0

Problem G. Great Hotel

Input file:	`hotel.in`
Output file:	`standard output`
Balloon Color:	`Red`

Ahmed is opening the biggest hotel in the world. It has 10^{18} floors! On each floor, there are 64 light bulbs installed in the hallway. Right now, all the light bulbs are turned off.

Since the hotel is opening soon, Ahmed wants to turn some of the light bulbs on. Precisely, he wants N floors to have K light bulbs turned on in each of them.

Since there are so many floors, Ahmed has created a robot to help him in turning on the light bulbs. This robot works in the following way:

Ahmed gives the robot a number X. The robot assigns the number $X + 1$ to the first floor, the number $X + 2$ to the second floor, and so on until the $X - th$ floor to which he assigns the number $X + X$. Then the robot goes to each floor and turns on a number of light bulbs equal to the number of ones in the binary representation of the number that was assigned to the floor.

Now Ahmed wants your help to determine the number X that he should give the robot in order to have N floors with K light bulbs turned on in each of them. It is allowed to have some floors with less or more than K light bulbs turned on but there must be exactly N floors that have exactly K light bulbs turned on.

It is guaranteed that there is an answer and that the value of X does not exceed 10^{18}.

Input

The first line contains one integer T ($1 \leq t \leq 10^3$), the number of test cases.

The only line of each test case contains two space-separated integers N and K ($1 \leq N \leq 10^{18}$), ($1 \leq K \leq 64$)

Output

For each test case print the required number X ($1 \leq X \leq 10^{18}$) on a new line.

If there are multiple answers, print any of them.

Example

hotel.in	standard output
3 1 1 3 2 1 11	1 5 1024

Problem H. Head of Media

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Cyan`

Abeer, the ACPC Media head, has a great plan to celebrate the third ACPC for Girls competition this year. After many calls with her team planning for the contest, her phone stopped working so she decided to buy a new phone.

Abeer wants the phone to have a good set of properties and also wants to buy it at a reasonable price (she knows that no phone can outstand the tremendous amount of work she and her team do).

Abeer kept searching online for a lot of time until she made a list of N phones. She then noticed that the list became too big. So she wanted to make it smaller by removing some phones from it to make the decision easier for her.

The $i-th$ phone in the list can be defined by 2 integers, P_i and X_i.

P_i is the price of the i-th phone.

X_i is an integer that defines the set of good properties of the $i-th$ phone in the list, where the $j-th$ bit in X_i is equal to 1 if the $j-th$ property is good in the $i-th$ phone in the list and 0 otherwise.

Abeer noticed that she can remove the $i-th$ phone from the list if there exists some other phone that contains all set of good properties in $i-th$ phone and have a price that is less than or equal to the price of the i-th phone. Abeer wants to know the number of the phones she will not be able to remove from the list.

Input

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

The first line of each test case contains a single integer N ($1 \leq N \leq 10^5$), the number of phones in the list.

The second line of each test case contains N integers $P_1, P_2, \ldots, P_N$ ($1 \leq P_i \leq 10^9$), the price of the phones in the list.

The third line of each test case contains N integers $X_1, x_2, \ldots, X_N$ ($1 \leq X_i \leq 10^5$), the number that defines the set of good properties of the phones in the list.

It's guaranteed that no 2 phones will have the same price and set of good properties

Output

For each test case, print one line containing a single integer, the number of the phones Abeer will not be able to remove from the list.

Example

standard input	standard output
2 4 1 1 1 1 1 2 4 8 2 1 1 3 7	4 1

Problem I. Indie Game

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Gold`

Medhat is fond of making video games. His latest game is about connecting cubes with ropes. Medhat just built a big building of cubes. The building consists of N cubes numbered from 1 to N and M bidirectional ropes, each of them connecting two different cubes. It is guaranteed there is at most one rope between any two cubes.

Medhat discovered that he has a bug in his game. This bug will destroy exactly one of the building's cubes. If a cube is destroyed, it is not a part of the building anymore and all ropes connected to it can't be used.

Unfortunately, Medhat found out about this bug too late so, he can protect at most K cubes by some software. If a cube is protected, it can't be destroyed.

Medhat needs your help to choose which cubes to protect to minimize the number of islands in the building after the bug appears regardless of which cube will be destroyed.

An island is a subset of the building's cubes where every pair of cubes is connected by some path of ropes. Every cube belongs to exactly one island. Two cubes belong to different islands if there is no path of ropes that connects them.

Input

The first line of input contains a single integer number T - the number of test cases.

For each test case:

- The first line of each test case contains there space-separated integer numbers N, M and K ($2 \le N \le 10^5, 1 \le M \le 10^5, 0 \le K < n$).
- The next M lines contains two space-separated integer numbers u and v ($1 \le u, v \le n$) which means there is a rope between cube u and v.

It is guaranteed that the sum of N over all of the test cases will not exceed 10^5.

Output

For each test case, print the minimum guaranteed number of islands after the bug.

Example

standard input	standard output
3 5 4 1 2 3 2 4 3 4 5 4 3 1 2 1 2 3 2 0 1 2 1 3	2 1 2

Problem J. Just Another Bad Segment

Input file:	bad.in
Output file:	standard output
Balloon Color:	Yellow

Kofta is a super hero in Kebab city, Hawawshi challenged him to solve this hard problem.

A bad segment is a segment $[l, r]$ which the sum of all ordered pairs product $(A_i A_j)$ where $l \leq i < j \leq r$ is odd. In other words: $\sum_{i=l}^{r} \sum_{j=i+1}^{r} A_i \cdot A_j$ is odd. A segment with only one element is not a bad segment.

Kofta has an array consisting of N numbers. he will ask M queries, each query has one of the two types:

Format of the query "1 i v". In reply to the query, you need to change value of A_i to v, where A_i is the $i - th$ element in the given array.

Format of the query "2 l r". In reply to the query you should output the number of bad segments between l and r (inclusive).

Input

The first line contains one positive integer T ($1 \leq T \leq 10^3$), denoting the number of test cases. Description of the test cases follows.

The first line of each test case contain positive integer N and Q ($1 \leq N, Q \leq 5 \cdot 10^5$).

The second line of each test case contains N integers $A_1, A_2, \ldots, A_N$ ($1 \leq a_i \leq 10^9$), the elements of the array.

Each next line from the next q lines contain three positive integers *type* (*type* $= 1$ or *type* $= 2$).

In case *type* $= 1$, it will be followed by two integers i ($1 \leq i \leq N$) and v ($1 \leq v \leq 10^9$)

In case *type* $= 2$, it will be followed by two integers l, r ($1 \leq l \leq r \leq N$)

Output

For each query *type* $= 2$, print an answer on a single line.

Example

bad.in	standard output
1 4 5 1 3 4 4 2 1 3 1 3 91 2 1 3 1 4 7 2 1 4	2 3 5

Problem K. Kiwi

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Light green`

ACPC 2022 season is kicking off and a lot of brilliant minds are gathering together. And of course, many amazing ideas are just waiting to be harnessed. And who is better to help than Endure Capital?

Endure Capital is an early-stage investment fund headed by entrepreneurs. They are always looking for startup teams with great ideas and more importantly, the relentlessly resourceful and imaginative founders.

Dima heard about them while she was participating in the ACPC Kick Off 2022 and started practicing her investment skills. She went to the supermarket to buy some kiwi. As the supermarket owners know how much Dima loves kiwi, they offered her N offers.

Each offer has price P_i and consists of K_i pieces of kiwi each of size S_i.

Could you help Dima pick the best offer? Dima thinks that the best offer is the one that yields the maximum amount of the kiwi per one unit price. She doesn't care about how much kiwi she buys or how much money she pays. She wants to get the maximum possible amount of kiwi per one unit price.

Input

First line contains an integer N, $(1 \leq N \leq 10^5)$,the number of offers.

Then N lines follow. The $i-th$ line contains three integers P_i, K_i, S_i $(1 <= P_i, K_i, S_i <= 10^5)$ indicating the price of the $i-th$ offer, number of kiwi pieces in the offer, and size of each kiwi piece, respectively.

Output

Print the index of the best offer. If there are multiple solutions print the **smallest index**.

Note: Indices is 1 based.

Examples

standard input	standard output
3 5 4 1 1 2 3 3 5 6	3
1 1 1 1	1

Problem L. Long String

Input file:	same.in
Output file:	standard output
Balloon Color:	Pink

You came across a string S in a book and wondered if you can change the characters of the string such that all characters are the same.

You thought for some time and found a solution. However, you do not need to do random operations on the string. Instead, you wrote M operations on a paper, and then wondered if you can solve the problem now using these M operations at most once!!

Each operation (the $i-th$) consists of two characters A_i and B_i, which mean you can choose at most one index j such that S_j is equal to A_i and replace it by B_i (make S_j equal to B_i).

You can use these operations in any order you want, also you don't have to use all operations. Can you solve it now?

Input

The first line contains a single integer T — the number of test cases.

The first line of each test case contains and string S ($1 \leq |S| \leq 10^4$) consists only lowercase letters, and an integer M ($1 \leq M \leq 2 \times 10^5$)− number of operations.

The next M lines contains two characters A_i and B_i ($'a' \leq A_i, B_i \leq' z'$).

Output

For each test case, print a "YES" if you can make all characters of the string S equal, or "NO" otherwise.

Example

same.in	standard output
3 abc 3 a c b c b c abc 3 a d b c b c aaa 1 a b	YES NO YES

Problem M. Many Integers

Input file:	shop.in
Output file:	standard output
Balloon Color:	Black

Ahmed knows that it is Ehab's birthday, he also knows that Ehab loves numbers. However, Ehab does not love all numbers. He loves a specific list of N integers.

So, Ahmed decided to buy as many integers **from that list** as he can afford as gifts for Ehab. Ahmed only has x pounds. He will buy integers from the integer shop across the street. Ahmed knows that the cost of an integer y in the integer shop is y pounds (e.g., the price of the integer 6 is 6 pounds).

When Ahmed buys integers, he can multiply them by each other to get other integers destroying the original integers in the process. Ahmed can multiply any number of integers. For example, to obtain the number 28, Ahmed can buy 4 and 7 and multiply them together then he no longer has the 4 and the 7.

Ahmed will buy integers optimally so that he can obtain as many integers from the list as possible. How many integers will he be able to get?

The list does not contain duplicates.

Input

The first line contains an integer T, the number of test cases.

The first line of each test case contains two integers n and x ($1 \leq N \leq 10^6$, $1 \leq x \leq 10^7$), the size of the list, and the amount of money Ahmed has.

The second line contains N integers($1 \leq A_i \leq 10^7$), the integers that Ehab loves.

Output

A single Integer, the number of integers that Ahmed will be able to buy from the list.

Example

shop.in	standard output
1 4 16 2 8 11 12	3

Note

In the sample, Ahmed can buy the 2 directly, then he can buy a 4 and a 2 and multiply them together getting an 8, then he can buy a 4 and a 3 and multiply them to get a 12. So, he can spend 2+4+2+4+3 = 15 pounds and compose 3 of the integers in the list.

There is no way to compose more than three integers from the list with 16 pounds.

Problem N. New Beginnings

Input file:	`machines.in`
Output file:	`standard output`
Balloon Color:	`Silver`

It's 2022 and ACPC is excited as it expands and grow into a larger family. With more than 20 countries in the region involved, ACPC is excited to announce the very first Saudi Collegiate Programming Contest 2022.

SaudiCPC has its own vibes and hype. We are anticipating a large and strong community to join the ACPC family. And of course, with great communities, comes great responsibilities. Sarah, the ACPC Systems Guru, daydreames how many machines she will need to accomdate big numbers of participants and problem sets. So She asked the one and only the Coach Wahab, the ACPC Scientific Committee Head.

The Coach came up with 4 rules to compute how many machines are needed given how many problems we have in a problem set.

He said that:

- Either we run each problem separately in 1 machine OR
- We can group 3 problems in 2 machines OR
- We can group 4 problems in 3 machines OR.
- We can group 7 problems in 4 machines.

Sarah wants to know if a problem set consists of N problems, What is the minimum amount of machines required to host all of them? A smart engineer she is, she writes some lines of code to compute the answer. Sarah always tests her code and validates her outputs so she asks for your help to compute the minimum amount too so she can validate her code?

Input

The first line contains one integer, T ($1 \leq T \leq 10^5$), the number of test cases.

Then T lines will follow. The first and only line of each test case contains one integer, N ($1 \leq N \leq 10^9$) the number of problems in a problem set.

Output

For each test case, Print one line containing only one number, the minimum amount of machines that can host all problems.

Example

machines.in	standard output
6 1 2 3 4 5 13	1 2 2 3 4 8

Note

The first test case, we only need to start one machine for one problem.

In the last test case, we can host 7 problems in 3 machines using the fourth rule, then we can use the second rule to twice host the remining 6 problems in 4 machines for a total of 8 machines. This is the optimal way to host 13 problems.