Problem A. Cask Effect

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

As is widely known, Chinese children are all aware of the famous cask effect: the capability of a cask depends on the length of the shortest board of it.

Mandy gets n boards. She decides to give them to Brz to make a cask since Brz is an expert in this field. Knowing the cask effect well, to make its capability as large as possible, Brz makes up his mind to use the magic he can use only once in his life to transfer a section of one board to another.

For instance, assume that there are two boards with lengths 6 and 14. He can transfer a section of length 2.33 from the board with length 6 to the other board. After that their lengths will become 3.67 and 16.33 respectively.

Since Brz is only skilled at practice, he turns to you for the theoretical part. He wants to know what is the maximal capability of the cask he can make with his magic. Can you tell him the answer?

Input

The first line contains one integer n ($1 \le n \le 10^5$), denoting the number of boards that Mandy gives Brz.

The second line contains n integers. The i-th integer a_i ($1 \le a_i \le 10^9$) denotes the length of the i-th board.

Output

Output one line containing one real number, denoting the maximal capability of the cask. **Round the answer to exactly one decimal place.**

Example

standard input	standard output
3 1 2 3	2.0

Problem B. Problem B

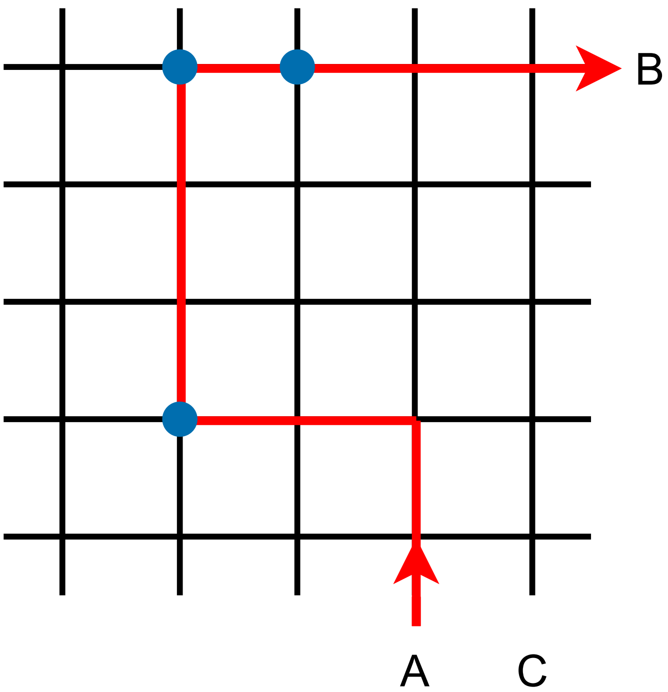
Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

There is a mysterious town near Moonland City. The roads in the town form a $n \times m$ grid. Both ends of any road connect to the outside world.

But on a certain day, a mysterious force emerged and affected the town's traffic in a weird way. Any vehicle can only turn its direction at most k ($k \geq 0$) times (in any of the four directions, include the one it comes from) from the time it drives into the town to the time it drives out of the town. When the vehicle's remaining turning chances is zero, it can only go straight ahead until it drives out of the town from the end of the road it is on. k will change every morning.

Mayor Brz bought nm advanced steering devices and installed one at every intersection. Using the device, a vehicle can change its direction in any of the four directions without consuming its own turning chances. But this device requires a large amount of electricity, and the town cannot afford turning on all the devices. Mayor Brz quickly came up with a solution: every morning, according to the k that day, turn on as few devices as possible, so that **a vehicle entering the town from any of the ends can exit from any of the ends too**.

The following figure shows a case where $n = m = 5$ and $k = 1$. The dot on the intersection means the device at that intersection is turned on. The red path enters the town from end A and exits the town from end B. It first consumed its only chance to turn and then used all the three devices. However, it is impossible for a vehicle to enter from end A and exit from end C. **So this is not a valid solution.**



Mayor Brz easily designed an algorithm to accomplish the task. But out of curiosity, he also wants to know how many different solutions there are to arrange devices for a given k. (Two solutions are considered different when and only when there is a certain intersection with different device states).

This problem later left a strong mark in the study of mathematics, historically known as Brz-Problem, or Problem-B for short.

Since the answer may be large, please output the answer modulo 998244353.

Input

The first line contains three integers n, m, q $(1 \leq n, m, q \leq 10^6)$, denoting the number of rows and columns of the roads, and the number of queries, respectively. Each of the next q lines contains an integer k $(0 \leq k \leq 10^6)$, indicating the maximum number of times a car can be turned by mysterious forces in this query.

Output

Output q lines in total. The i-th line contains an integer indicating the result for the i-th query modulo 998244353.

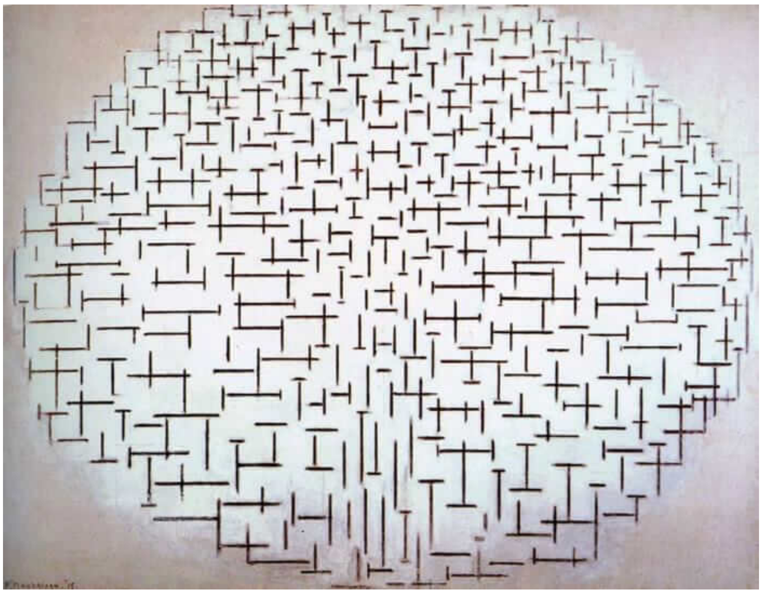
Examples

standard input	standard output
2 2 3 0 1 2	4 4 1
3 5 2 1 0	390 2025

Problem C. Abstract Painting

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

Piet Mondrian was a Dutch painter and art theoretician who is regarded as one of the greatest artists of the 20th century. He is known for being one of the pioneers of 20th-century abstract art, as he changed his artistic direction from figurative painting to an increasingly abstract style, until he reached a point where his artistic vocabulary was reduced to simple geometric elements.



Composition No.10 Pier and Ocean, 1915

After appreciating Piet Mondrian's painting *Composition No.10 Pier and Ocean*, teralem realized that it was so easy to create an abstract painting. All you need to do is to randomly draw some meaningless lines! No sooner said than done, he took out a large piece of paper and drew n straight line segments on it, all of which are either vertical or horizontal.

As a curious child, teralem wonders for a given pair of points on the paper, are they connected together by the line segments he drew.

Formally speaking, you are given q queries. For each query, you are given two points S and T, and you need to determine if there exists a sequence of line segments $L_1, L_2, \ldots, L_m$ so that S is on L_1, T is on L_m and L_i, L_{i+1} $(1 \le i < m)$ have at least one common point(including the endpoints).

Input

The first line contains a single integer n $(1 \le n \le 10^5)$ — the number of line segments.

Each of the next n lines contains four integers x_1, y_1, x_2, y_2 $(-10^9 \le x_1, y_1, x_2, y_2 \le 10^9)$, denoting a line segment from point (x_1, y_1) to point (x_2, y_2). It is guaranteed that $x_1 = x_2, y_1 \ne y_2$ or $x_1 \ne x_2, y_1 = y_2$.

The following line contains a single integer q $(1 \le q \le 10^5)$ — the number of queries.

Each of the next n lines contains four integers x_1, y_1, x_2, y_2, denoting a query of the two points (x_1, y_1) and (x_2, y_2).

Output

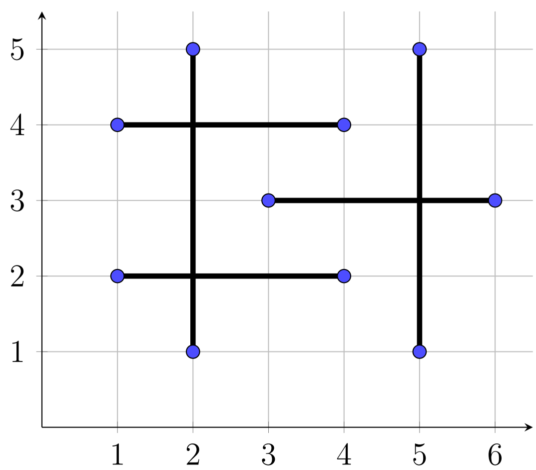
For each query, output "`Yes`" or "`No`" (without quotes) on a separate line, denoting the answer to the query.

Examples

standard input	standard output
5 1 2 4 2 1 4 4 4 3 3 6 3 2 1 2 5 5 1 5 5 3 2 5 3 2 2 2 5 4 5 3 5 3	Yes No Yes
5 3 -23 21 -23 25 -26 25 15 -5 -34 -5 -22 14 -45 14 5 -6 -25 31 -25 3 14 -26 9 -23 14 0 14 0 15 0 15 0	Yes Yes No

Note

The graph of the first example is as below.



Problem D. Concrete Painting

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

Brz and Mandy have spent long periods of time studying the number axis, familiar with all sorts of operations on it.

One day Brz obtains n intervals on the number axis, the i-th of which is represented as $[l_i, r_i]$, denoting an interval from l_i to r_i.

Mandy loves purple, so she decides to select some of the intervals to color them purple.

Brz wants to know that how long the number axis has been painted in total. Since Mandy has obtained a higher level of mathematical proficiency, she wants to know the sum of the painted length in all possible choices.

Specifically, Mandy want to know the result of $\sum_{i \subseteq S} f(i)$, where $f(i)$ denotes the length of the number axis that gets painted purple after Mandy colors all the intervals in set i, and S denotes the set containing all the intervals. If a place gets painted more than once, it will be calculated only once.

It only cost Mandy 0.001s to calculate it, while Brz is still confused. So he comes to you for your help now. Since the answer may be large, please print the answer modulo 998244353.

Input

The first line contains one integer n ($1 \le n \le 2 \times 10^5$), representing the number of interval that Brz gets.

The following n lines each contains an interval. The i-th line contains two integers l_i, r_i ($1 \le l_i < r_i \le 10^9$), denoting the i-th interval that Brz gets.

Output

Output one line containing one integer, representing the result modulo 998244353.

Example

<table>
<tr><th>standard input</th><th>standard output</th></tr>
<tr><td><pre>2
1 3
2 4</pre></td><td><pre>7</pre></td></tr>
</table>

Problem E. Triangle Pick

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

There are n triangle slices in the 3-dimensional space. Determine which triangle will a given ray intersect with first. The ray begins at $(0, 0, 0)$ and its direction is given by each query.

Input

The first line contains two integers n, m $(1 \le n \le 1000, 1 \le m \le 10000)$, describing the number of triangle slices, and the number of queries.

Each of the next n lines contains nine integers $x_1, y_1, z_1, x_2, y_2, z_2, x_3, y_3, z_3$, indicating the vertex coordinates of the triangle slice, which are (x_1, y_1, z_1), (x_2, y_2, z_2), (x_3, y_3, z_3) respectively. It is guaranteed that all coordinates will not exceed ± 10000.

Each of the next m lines contains three integers x, y, z, indicating the direction vector of the ray. It is guaranteed that x, y, z will not exceed ± 10000.

Output

For each query, print the serial number of the first intersected slice (numbered in the order in the input, starting from 1). If the ray did not intersect with any of the slices, print 0.

Examples

standard input	standard output
1 3 1 1 0 -1 1 0 0 0 2 0 1 1 0 -1 1 1 0 0	1 0 0
2 3 1 1 0 1 -1 0 0 0 1 3 0 0 0 3 0 0 0 3 2 -1 2 -1 -1 -1 1 3 1	1 0 2

Note

The slices are solid, and will not intersect with each other. The ray will not go through anywhere near the border of a slice, causing precision issues.

Problem F. MPFT

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

Teralem joined a group chat, which can hold at most N members. When the group is full and a person is still trying to join the group, the member whose latest message is the earliest will be kicked out, allowing the new comer to join.

However, this rule made the members in the group sending messages all the time in fear of being kicked out. Soon the group is filled with meaningless messages. To make the situation better, another rule is made: once a member has sent K messages in the latest time period of T (including the beginning moment and the ending moment), the member is kicked out immediately.

Please notice:

- When a member joins the group, a "hello" message is automatically sent. So it can be guaranteed that any member in the group will have the latest message.
- If a person was kicked out and rejoined the group during the latest time period of T, only the messages after the person's latest joining will be counted (including the "hello" message).

Suppose the group is empty in the beginning. A series of events will be given in order of time, which can be either a person joinning the group or a person sending a message. Please output every kickouts in order of time and the members in the group after the last event.

Input

The first line contains four integers N, M, T, K ($1 \le N \le 10^6, 1 \le M \le 10^6, 1 \le T \le 10^9, 1 \le K \le 10^6$). The meanings of N, M, K are as above. M represents the number of the given events.

The following M lines describe the given events. The i-th line contains two integers t_i, p_i ($1 \le t_i \le 10^9, 1 \le p_i \le 10^6$). If the person p_i was in the group at the moment before t_i, it means the person p_i sent a message at time t_i, otherwise it means the person p_i joined the group at time t_i. It is guaranteed that $t_i < t_{i+1}$ for $1 \le i < M$.

Output

The first line contains two integers A, B, representing the number of kickouts and the number of members in the group in the end repectively.

The following A lines each contains two positive integers representing the time of the kickout and the person been kicked out repectively. The kickout time must be strictly monotonically increasing.

The following line contains B positive integers, representing the members in the group finally. You can output in any order.

Example

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

Problem G. Expected Sum

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

You are given a number with n digits. There is a possibility of $\frac{p_i}{100}$ that a plus sign is insert between the i-th digit from the left and the $(i+1)$-th digit from the left. The presence of every plus sign is independent. What is the expected sum of the expression?

Find the answer modulo 998244353.

Input

The first line contains an integer n ($2 \le n \le 2 \times 10^6$).

The second line contains the number you are given, with n digits. There may be leading zeros.

The third line contains $n-1$ integers $p_1, p_2, \ldots, p_{n-1}$ ($0 \le p_i \le 100$ for $1 \le i \le n-1$).

Output

Output a single line containing the answer modulo 998244353.

Example

standard input	standard output
2 26 50	17

Problem H. Light the Street

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

Mandy, a possessor of great fortune, bought T streets recently. However, the brightness of the streets doesn't make Mandy happy, who is in love with great brightness. So she decides to rearrange the streetlights in her streets.

As Mandy has enough faith in Brz, she entrusts the project to him. Brz firstly represents a street as a segment with length n. Then he finds out that he can set k streetlights on it with the funds of Mandy through some calculation. Each streetlight has the same brightness coefficient d, which means it can provide $\frac{d}{r^2}$ brightness for a place at distance r. When a place is brightened by multiple streetlights, its brightness is the sum of brightness each streetlight provides.

Specially, the brightness that a streetlight provides for its own place can be regarded as infinite.

Besides, to make her business empire more famous, Mandy will hang huge billboards on each streetlight, which means the light from a streetlight can't travel across other streetlights.

On this basis, Mandy makes her most important request: make the darkest place as bright as possible. On hearing the request, Brz makes his streetlight arrangement in 0.001s. Now he wants to give you a test: What is the maximal possible brightness of the darkest place?

Input

The first line contains one integer T ($1 \le T \le 10^5$), representing the number of streets that Mandy has bought.

Each of the following T lines contains three integer n, k, d ($1 \le k \le n \le 10^9, 1 \le d \le 10^9$), representing the length of the street, the maximal number of streetlight that can be placed and the brightness coefficient respectively.

Output

Output T lines. Each line contains one real number, representing the maximal possible brightness of the darkest place of each street.

The answer will be considered correct if the absolute or relative error doesn't exceed 10^{-4}.

Example

standard input	standard output
2 1 1 1 2 2 2	4.000000 11.656854

Note

For the first street, put the only street light in exactly the middle of the street. Then the darkest places are the leftmost and the rightmost place, whose brightness is $\frac{1}{0.5\times0.5} = 4$. It can be proved that it is the most optimal arrangement.

Problem I. Subsetting and Summing

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

There are n three-dimensional vectors, each of which can be marked as $\boldsymbol{x} = (x_1, x_2, x_3)$, where x_1, x_2, x_3 are integers.

ThomasX can choose a subset S of the n vectors, and calculate its sum, denoted by $\boldsymbol{y_S} = (y_{S_1}, y_{S_2}, y_{S_3})$. Please note that S does **not** need to be a proper subset of the n vectors, which means all the n vectors can be in subset S.

Now ThomasX wants to calculate $\max_S \{|y_{S_1}| + |y_{S_2}| + |y_{S_3}|\}$. However, ThomasX has something much more important to accomplish, so he wants you to help him figure it out.

Input

The first line contains an integer n ($1 \le n \le 10^5$), indicating the number of vectors.

Then n lines follow. The i-th line contains three integers, indicating x_1, x_2, x_3 of the i-th vector respectively ($-10^4 \le x_1, x_2, x_3 \le 10^4$).

Output

Output a line containing an integer indicating your answer.

Example

standard input	standard output
3 3 -7 5 -2 4 8 6 0 -4	19

Problem J. Less Time on the Road

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

Moonland City can be viewed as a directed graph, and the lengths of all the edges are 1. Alice and Bob are the only two pipe workers in the city. Whenever there is a request from a vertex, a pipe worker must go to the vertex to fix the pipe there, while the other one stays still. Today they received a list of requests, and they must complete these requests one by one in the given order. In the beginning, Alice and Bob are all at vertex 1. Neither Alice nor Bob wants to take too much time on the road, so they find you to help them minimize $\max\{S_A, S_B\}$, where S_A is the total distance Alice needs to go and S_B is the total distance Bob needs to go.

Input

The first line contains two integers n, m ($2 \le n \le 80, n \le m \le n(n-1)$), which are the number of vertices and the number of edges in the graph, respectively.

The next m lines each contain three integers u and v ($1 \le u, v \le n, u \ne v$), which means there is an edge from vertex u to vertex v.

The next line contains an integer q ($1 \le q \le 80$), which is the number of requests.

The next line contains q integers $x_1, x_2, \ldots, x_q$ ($1 \le x_i \le n$), which are the vertices in the request list in order.

It is guaranteed that the graph is strongly connected, that is, there is a path from any vertex to any other vertex.

Output

Output a single integer, which is the minimum $\max\{S_A, S_B\}$.

Examples

standard input	standard output
3 4 1 3 3 1 1 2 2 3 3 2 1 3	1
5 7 2 1 1 4 3 5 1 2 3 1 5 4 4 3 5 4 2 4 1 5	3

Problem K. The Secret Comparison

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

As is widely known, teralem and overflowker are the two kings in the computer room, who "gauze"[1] other fellow students constantly. After every compitition, they desire to know the score of the other one so as to learn whether they "gauzed" the other one.

However, they don't want to expose their own scores to avoid being "gauzed". Brz, who has learned a little cryptography, knows that a third party is in need now to make this comparison. So you take on this job.

Now you get their scores T and O. Please secretly tell the two kings: Whose score is higher.

Input

The first line contains two integer T, O $(1 \leq T, O \leq 100)$, representing the score of teralem and overflowker.

Output

Output a line. If teralem scores higher, output "`orz teralem is the king!`"(without quotes). If overflowker scores higher, output "`orz overflowker is the king!`"(without quotes). Otherwise, if they score the same, output "`even even seven EIeven.`"(without quotes).

Examples

standard input	standard output
`100 99`	`orz teralem is the king!`
`23 32`	`orz overflowker is the king!`
`88 88`	`even even seven EIeven.`

[1] Which means "薄纱" i.e. "爆杀" in Chinese.

Problem L. Spatial Quantum Energy Theory

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

In a strange parallel universe, the rules of physics there are different from ours. But with the accumulation of time, the scientists there also gradually touched the field of microscopic physics.

People believe that an atom is composed of twenty types of elementary particles, but each type of elementary particle appears at most once in each atom. All elementary particles and atoms have energy. The energy of the i-th type of elementary particle is e_i $(1 \le i \le 20)$. The calculation of the energy of an atom is a bit complicated. Suppose that an atom contains m elementary particles, the types of which are $a_1, a_2, ..., a_m$ $(1 \le a_i, m \le 20)$ then the energy of the atom is:

$$\left(\sum_{i=1}^{m} e_{a_i}\right)^m$$

Let's define some symbols for convenience. For an atom A,

- S_A denotes the set of elementary particles A has
- $E(A)$ denotes the energy of A
- $w(A)$ denotes the number of elementary particles A has

It has been found that, two atoms A and B, as long as $S_A \subseteq S_B$ or $S_B \subseteq S_A$, will both enter the excited state under suitable conditions, releasing the energy of $E(A) \times E(B)$. **An atom can enter the excited state with multiple atoms, but a certain pair of atoms can enter the excited state only once.** These theories were proven by the high-energy collision experiments of that world.

However, with further research, more advanced quantum colliders can make multiple atoms go into excited states at the same time. It was found that there's something wrong with the above theories. Theoretically, all pairs of atoms that can enter the excited state would release energy once, but the experiment found that the real energy released is much more than predicted. Professor Teralem proposed the amazing "Spatial Quantum Energy Theory", which perfectly explains this phenomenon.

The "Spatial Quantum Energy Theory" showed that the original theory was only partially correct. The process described above is called ***inductive excitation***. However, there exists another type of excitation called ***oscillatory excitation***. When atom A and B enter ***inductive excitation***, a very large range of spatial fluctuations is generated. Atom C (different from A and B) will be influenced by the spatial fluctuation and enter ***oscillatory excitation*** once if and only if $S_A \subseteq S_C, S_C \subseteq S_B$. The energy released by ***oscillatory excitation*** is $E(A) \times E(B) \times w(C)$. Notice that C can enter ***oscillatory excitation*** for each pair of A and B. In this case, each pair of inductively excited atoms may lead to a large number of other atoms being excited by the oscillations, resulting in a geometric increase of the energy released by the whole system.

You are in Professor Teralem's class and he has given you a homework assignment: given n atoms, calculate the energy released by the whole system under suitable conditions. i.e. the total energy released by all ***inductive excitations*** and ***oscillatory excitations***.

He knows the answer to this question could be very large, but he just needs to know that you have learned it. Please output the answer modulo 998244353.

Input

The first line contains an integer n $(2 \le n \le 10^6)$, representing the number of atoms in the whole system.

The second line contains 20 integers. The i-th number represents e_i ($1 \le e_i \le 10^9$), the energy of the type i elementary particle.

The next n lines contains the elementary particle composition of each atom. The i-th line contains an integer a_i ($1 \le a_i < 2^{20}$). If the k-th bit of a_i in binary is 1, then the i-th atom contains the type k elementary particle, otherwise it does not. For example, if $a_1 = 13 = (1101)_2$, it means the first atom is composed of type 1, type 3 and type 4 elementary particles.

Output

Output an integer in a line, indicating the total energy released by the whole system under suitable conditions modulo 998244353.

Example

standard input	standard output
6 1 2 3 4 5 1 2 3 4 5 1 2 3 4 5 1 2 3 4 5 7 7 3 3 9 9	94018

Note

In the example, we number the imput atoms from 1 to 6. According the description, the energy of them is 216, 216, 9, 9, 25, 25 respectively. The detail of the released energy is as follows:

Atoms involved	**Energy**
$(1,2) \to \varnothing$	$216 \times 216 = 46656$
$(1,3) \to \{2,4\}$	$216 \times 9 + 216 \times 9 \times 3 + 216 \times 9 \times 2 = 11664$
$(1,4) \to \{2,3\}$	$216 \times 9 + 216 \times 9 \times 3 + 216 \times 9 \times 2 = 11664$
$(2,3) \to \{1,4\}$	$216 \times 9 + 216 \times 9 \times 3 + 216 \times 9 \times 2 = 11664$
$(2,4) \to \{1,3\}$	$216 \times 9 + 216 \times 9 \times 3 + 216 \times 9 \times 2 = 11664$
$(3,4) \to \varnothing$	$9 \times 9 = 81$
$(5,6) \to \varnothing$	$25 \times 25 = 625$

In the "Atoms involved" column, on the left side of the arrow is a pair of atoms in ***inductive excitation***, while on the right side of the arrow is the set of atoms that enter ***oscillatory excitation*** by the pair.

The energy released by the whole system is $46656 + 11664 + 11664 + 11664 + 11664 + 81 + 625 = 94018$.

Problem M. Easy Problem of Prime

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

One day, Brz was studying prime factorization of positive integers, which struck Mandy as a surprise: isn't it something that she had totally grasped in the second grade?

So she told Brz the traditional prime factorization by multiplication was old-fashioned, and now she was more interested in prime factorization by addition.

To introduce, Mandy showed Brz an easy problem as follows:

Let $f(n)$ be the least number of prime numbers whose sum is exactly n, calculate $\sum_{i=2}^{n} f(i)$.

For example, $f(2) = 1, f(6) = 2$, since $2 = 2$ and $6 = 3+3$. It can be proved that there aren't fewer prime numbers that satisfy the condition.

Since Brz had never studied the field of prime factorization by addition, he was confused. Can you help him find the answer?

Input

The first line contains one integer Q ($1 \le Q \le 10^6$), representing that there are Q queries.

Each of the following Q lines contains one integer n ($2 \le n \le 10^7$), which is used in the calculation.

Output

Output Q lines. The i-th line contains one integer representing the answer to the i-th query.

Example

standard input	standard output
3 3 4 5	2 4 5