ICPC - Programming Contest
South German Winter Contest 2008

January 26, 2008

Problem Overview:

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Good luck and have fun!

Login - Instructions

1. choose window manager in the *Session* menu
2. log in as the given user `icpc??` with assigned password
3. open a shell, execute `mydomjudge`
4. close the shell

Memory and Time Limit

The memory limit for all problems is set to 64 MB. The time limit depends on the problem and is given in the problem statements.

Documentation Links

Java5:	`http://icpc.informatik.uni-erlangen.de/documentation/j5sdk-1.5.0/`
STL:	`http://icpc.informatik.uni-erlangen.de/documentation/STL/`
Domjudge:	`http://icpc.informatik.uni-erlangen.de/documentation/domjudge/`

Compiler Options

Compile `sample.{c,cpp,java}` in

C:	`gcc -O2 -Wall -Werror -lm sample.c`
C++:	`g++ -O2 -Wall -Werror sample.cpp`
Java:	`javac sample.java`

Execution Commands

C:	`./a.out`
C++:	`./a.out`
Java:	`java -classpath . -Xmx64m sample`

Problem A
Behind the Screens

Author: Gill Bates

Time Limit: 1 second(s)

Everybody knows the evil company. You know which. The one that must not be named. The one that makes money from what *they* call operating systems. But be careful, they are watching you. Yes, you. Just from right behind the screens. By having software on so many computers it is quite easy for them to observe all of you. Believe me, I know for sure.

But there is a way to protect you. We will beat them with their very own weapons. With windows. Yes, trust me, it's just that easy. We know that they are watching us from behind the screens, but obviously not even they can look through the windows, can they? So let's just cover up our entire screen with windows, to hide ourselves from their searching eyes. But to be really sure, we should always calculate how good they can still see us and how much of our screens is still uncovered.

Input

The input consists only of one test case. The first line contains two numbers W and H ($1 \leq W, H \leq 30,000$) giving the width and height of our screen in pixels. The top left corner of our screen has the coordinates $(0, 0)$. The bottom right corner is labeled $(W - 1, H - 1)$. The second line of the input contains a single number n ($0 \leq n \leq 15$) that gives the number of windows. Each of the next n lines consists of four integer numbers x, y, w, h that specify the position and size of a window. Here (x, y) with $-30,000 \leq x, y \leq 30,000$ are the coordinates of the top left corner of the window. This corner, namely (x, y), is covered by the window, of course. w and h ($1 \leq w, h \leq 30,000$) are the width and height, respectively, of the window (again in pixels).

Output

The number of pixels that are not covered by windows, followed by a single newline.

Sample Input

```
100 50
2
80 -4 200 200
70 10 20 20
```

Sample Output

```
3800
```

Problem B
Disarming Bombs

Author: Robert Langdon

Time Limit: 2 second(s)

The *Illuminati* is a secret organization founded in the 16th century to oppose the tyranny of the Roman Catholic Church. The church made an example of their power by violently executing four members of the Illuminati. From that time on, they seek for revenge by trying to annihilate the Roman Catholic Church. They failed up to now! At today's conclave, the College of Cardinals, is meeting in the Sistine Chapel to elect a new pope. The Illuminati managed to plant an anti-matter bomb with an immense explosive force in the catacombs below the chapel. You are trapped down there alone — the red digits on a small display tell you that you have less than five hours to disarm the bomb. So you better hurry!

Your knowledge about the structure of the bomb is limited. But, fortunately, you have been able to obtain some details by torturing the engineer of the bomb earlier. The bomb has many identical fuzes that can initiate the detonation. *Some* of them are triggered by the countdown. In order that those fuzes fire synchronously, they are all connected to each other. However the remaining fuzes serve a different purpose: To complicate the disarming, these *dummy fuzes* fire immediately if you happen to disarm one of them. The dummy fuzes are also connected to each other but *not* to the fuzes of the other type. Thus, you must somehow distinguish the two types of fuzes, so that you can safely disarm all fuzes except from the dummy fuzes.

After examining the internals of the bomb for a while, you observe for a couple of fuzes, that they are definitely *not connected* (neither directly nor indirectly) and consequently of *different type*. The situation still seems to be hopeless and you nearly give up in despair as suddenly you remember that the engineer revealed the number of dummy fuzes he added to the bomb. After a moment of intense silence, you recognize that you still have a chance to escape the catacombs alive. The key question is — can you be absolutely sure about the types of all fuzes under the assumptions given above?

Input

The first line of input contains the number of test cases (at most 10). The descriptions of the test cases follow, separated from each other by empty lines. Each test case starts with three integer values, separated by spaces, on the first line: The total number n of fuzes ($0 < n < 6,500$), the number d of dummy fuzes ($0 \leq d < n$), and the number e of fuze pairs for which you can determine that they are definitely *not* connected. The following e lines ($0 \leq e < 8 \cdot 10^6$) hold two integers a_i and b_i ($a_i \neq b_i$, $0 \leq a_i < n$, $0 \leq b_i < n$), separated by a space, that identify the fuzes that are of different type. No equivalent pairs are listed twice. The fuzes are numbered from 0 to $n - 1$.

Output

For each test case print "`Yes`" on a line of its own if it is possible to disarm the bomb safely, print "`No`" if you cannot determine the fuze types for sure and print "`Darn`" if the assumptions are self-contradictory.

Calm down, keep cool, and save your life by solving the problem — *now*! You are better off by making *no mistake* and finishing *in time*! Retain the facts in *memory* but better be careful! Now get going...

(Sample Input and Output are provided on the next page.)

Sample Input

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

6 3 4
0 1
0 2
3 4
3 5

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

Sample Output

```
Yes
No
Darn
```

Problem C
Hidden Messages

Author: Overmind

Time Limit: 2 second(s)

John is an ingenious mathematician. Therefore, it did not take long before the government contacted him to help with a problem. Since it is a well-known fact that foreign intelligence agencies use newspapers to transmit secret messages, John was assigned to discover these. He found out that the agencies usually employ a simple pattern. They encode their messages in the first character of each line in every article. All other characters in the article are not important and are just inserted to confuse the normal readers. When written one after another in the order in which they appear in the text, the characters reveal the true nature of the article. As there are so many foreign newspapers, you were assigned to write a program to speed up the decryption process.

Input

The first line contains the number of test cases that will follow (at most $1,000$). Each test case consists of a number n on a single line ($0 < n \leq 1,000$) followed by n lines of text. Every text line will have at least one and at most $1,024$ characters. There are no blank lines in the text or between the different test cases.

Output

For each test case print the hidden message on a single line. Do *not* print any blank lines between the different test cases.

Sample Input

```
2
4
Einzigartiger Fund!
Nuernberg - Am Dutzenteich in Nuernberg wurde eine neue
Tierart entdeckt. Dabei handelt es sich um eine
eierlegende Wollmilchsau. Wir meinen: Klasse!
8
Topstory!
Hamburg not save anymore?
In Hamburg happened a spectacular bank robbery earlier that day.
Seven elephants entered the bank at 9:15 am. But this was no early carnival.
Inside of the costumes were seven bank robbers. All armed with pistols and
shotguns. In a fast raid, which did not take more than ten minutes, about
4 million Euros were stolen.
2 bank employees were harmed during the robbery.
```

Sample Output

```
ENTe
THISIs42
```

Problem D
Hide UFOs

Author: Djozer CL

Time Limit: 1 second(s)

The AFRNBNHDC (association for research of native but not hopelessly dumb civilizations) noticed the earth for the first time when they saw the rising of the Egyptian civilization. They decided to send a group of scientists to observe the humans. However, the aliens stayed hidden because they wanted to keep the evolution under surveillance without any interference.

Soon, the scientists realized that humans are very aggressive and so they decided to prepare for a fast escape. But hiding UFOs in an always *ready to start* position is not that easy. Therefore, the AFRNBNHDC let a few humans into the secret of their existence who could act more freely on earth. These humans founded a secret sect under the leadership of pharaoh Djozer. Since the aliens were in need of really big buildings, the humans began to construct the first pyramids.

Egyptian pyramids consist of three parts: The bottom part is a solid block with small channels for the exhaust gases of the UFOs. The middle part is the UFO itself covered by thin stone plates on the sides to hide it. The top part exists to better fit into the mythological explanation of the pyramids. It is just a small, hollow pyramid that is made up of four thin plates – plates as they were used in the middle part.

Unfortunately, the human race proved in the following years that they were not worth the effort and the AFRNBNHDC consequently left the planet. However, the sect was instructed to stay and wait for the return in case of any unexpected evolutionary improvements.

Recently, scientists at CERN tried to produce a black hole in the laboratory. The sect immediately reported this major evolutionary step to the aliens. In response to the report, the AFRNBNHDC promptly alarmed the AANCWRDI (association against native civilizations with really dumb ideas) who immediately sent off their UFOs. However, these UFOs have different shapes and the ancient pyramids cannot be used anymore. The AANCWRDI asked the sect to construct new buildings. Unfortunately, the knowledge of how to build pyramids is a bit rusty and that's why the sect needs *your* help. They ask you to write a program that calculates how many solid blocks and how many thin plates they need to hide a specific UFO. The old UFOs were pyramidal frusta with a quadratic bottom side and a centered peak. The new ones are still guaranteed to be pyramidal frusta, but have rectangular bottom and top sides and an off-center peak.

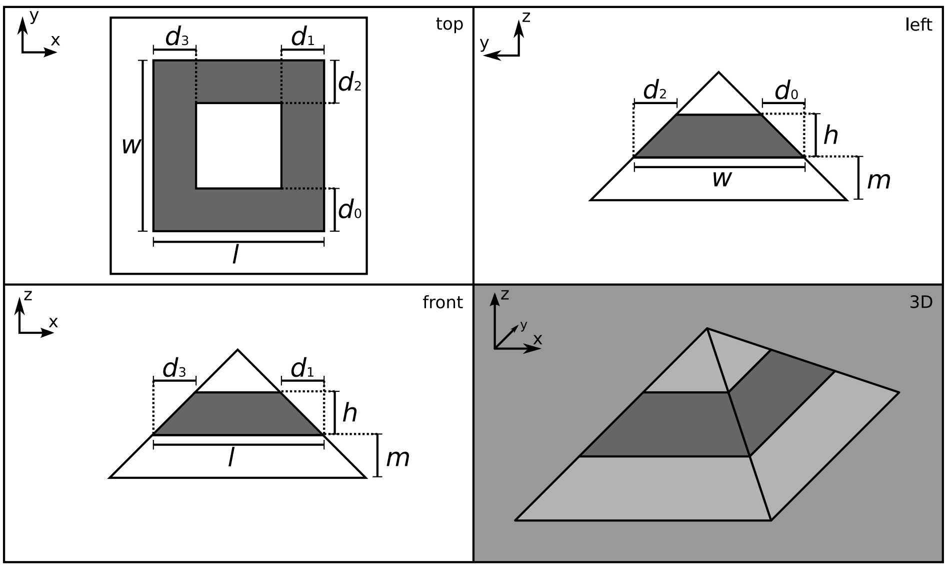

Figure 1 – Drawings of the pyramid, and the enclosed dark gray UFO = pyramidal frustum

Input

The first line gives the number of test cases n (at most $1,000$). Each test case consists of three lines. The first line of each test case holds both the height h of the UFO and the height m of the bottom part of the pyramid. The second line consists of the length l and the width w of the bottom of the UFO ($0 < h, m, l, w < 1,000$). The third line contains the four displacements of the upper sides of the UFO (d_0 front, d_1 right, d_2 back, d_3 left). You can assume that $d_0 + d_2 < w$, $d_1 + d_3 < l$ and $0 \leq d_0, d_1, d_2, d_3 < 1,000$. All measurements are potentially floating point numbers.

Output

For each test case, print a line with two values that are separated by a single space. The first value must be the total surface of the thin plates that is needed to cover the UFO on the four outer sides and to build the upper part of the pyramid. The second value is the volume of the massive stone that is needed to build the lower part of the pyramid. Print both values rounded to two digits after the decimal point.

Sample Input

```
2
1 1
4 4
1 1 1 1
1 2
4 8
2 1 2 1
```

Sample Output

```
22.63 25.33
40.52 149.33
```

Problem E
International C Programmers Conspiracy

Author: The Brain

Time Limit: 3 second(s)

Forget about all those conspiracies, I want world dominance for myself and I'll take it. The concept is ingenious: Establish small elite groups on different continents in order to take over the critical infrastructure – et voilà!

Since the only thing I can do is writing C-code, I decided to call my approach the *International C Programmers Conspiracy (ICPC)*. Besides the master plan, there are many minor details to be considered. One thing is the application procedure for becoming a member of the elite groups: Eligible is every one who can solve an ancient riddle (actually, it's not that ancient. I've made it up several days ago, but I won't tell the applicants):

The Grand Master of the International C Programmers Conspiracy once had n different letters that should in a neat way be written on k rings for His most highly decorated C-coders. Each letter may be used at most once. There is a large number of possible distributions of the n letters on the k rings. Since His cache was not large enough to keep all of these possible distributions in mind, He wrote a smart program enumerating only *distinct* possibilities. As a matter of course, no ring should be without letters. Since He planned to engrave the letter combinations on a ring, he has to count combinations that are unique up to cyclic shifts only once (so the sequences ABC and BCA are the same and not counted twice). Additionally, the typeface of the engravings made clear where the top line and the bottom line of the letters are, i.e., it is not possible to mix up the sequences IXO and OXI by flipping the ring.

How many possibilities did His program output?

Input

The first line holds the number of test cases c, $c \leq 1,000$. The following c lines consist of two integer numbers n and k, separated by a single space ($1 \leq k \leq n \leq 20$).

Output

For every test case, compute the number of possible distributions, as explained in the ancient riddle above and print the number of possibilities on a line of its own. Note that the result can get quite large.

Sample Input

```
2
4 1
4 2
```

Sample Output

```
6
11
```

Problem F
Kennedy

Author: Deep Blue

Time Limit: 1 second(s)

Well, everyone knows about the assassination of John F. Kennedy in Dallas on November 22. There are several conspiracy theories concerning his assassination and much remains unclear. You, however, have been offered a unique opportunity. A secret agent of the CIA, who – of course – would not like to disclose his identity, is willing to tell you the full story under the condition that you are able to solve the following problem. (Since he is not very good at math, he considers this problem to be impossible to solve.)

Given an integer n, find a set of integer numbers $a = \{s_1, \ldots, s_k\}$ such that

- $s_i > 0$,
- $n = \sum_{i=1}^{k} s_i$,
- every number m, $0 < m \leq n$, equals the sum of the numbers of a subset of a,
- and k is minimal.

Numbers may be inserted several times and not just once into the set.

Input

The first line of input will contain the number of test cases (at most $10,000$). Each following line will contain exactly one number n, the number that has to be partitioned into summands ($0 < n < 2^{31}$).

Output

Print the number k of elements of a partition that satisfies all of the above conditions on a separate line for each test case.

Sample Input

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

Sample Output

```
1
2
2
3
3
```

Problem G
Legacy

Author: Knights Templar

Time Limit: 2 second(s)

The Knights Templar has finally retrieved the legacy of their almighty founder Hugo von Payens. Hugo von Payens was not only a powerful French knight but also a wise academic that could predict future events. He wrote down all his prophecies in a book that was the most valuable resource the Knights Templar possessed. This book holds the key to absolute power. Unfortunately, it is not only encrypted. But even worse, because over centuries monks in monasteries all over the ancient world have copied the text, it is full of spelling mistakes.

Before the decryption department of the NSA can decipher the book, you have to reconstruct the original text. The text has been transcripted over and over again and is therefore full of spelling mistakes. You have to match each word that differs in the various distinct transcriptions to a dictionary of possible words, the word that is most likely. To do so, you assign a penalty point for each character that has been altered, added, or removed in order to transform the word in the text to a word in the dictionary. The word with the fewest points is most likely to be the correct word.

Input

The first line of input contains the number of test cases (at most 100). The first line of each such test case holds the word that has to be matched to the dictionary. The following line holds the number n $(0 < n \leq 5,000)$ of dictionary entries that follow. Each of the following n lines holds one word of the dictionary. All words are ASCII-7 encoded, do not contain any whitespace and have at most 500 characters.

Output

For each test case, print the word you have compared against the dictionary, the dictionary word that is most similar and the number of characters that have to be changed (i.e. deleted, inserted, or altered). If the result is ambiguous, print the dictionary word, that occurs first in the list. See the Sample Output for the exact output format.

Sample Input

```
2
pouer
3
our
shower
power
via
4
wia
why
tia
via
```

Sample Output

```
best match for 'pouer' is 'power' with score 1
best match for 'via' is 'via' with score 0
```

Problem H
Lotto in Bielefeld

Author: One of THEM?

Time Limit: 5 second(s)

Have you ever wondered that the winners of German 6/49 Lotto disproportionately often come from anonymous cities in the state North Rhine-Westphalia? I realized an almost unbelievable fact last time while searching the internet for proofs of my theory: In North Rhine-Westphalia, there is a city that does not exist! THEY only created the illusion about the existence of Bielefeld. It is the truth! Or do you know anyone from Bielefeld? Have you ever been there? Do you know anybody who has ever been to Bielefeld?

This illusion of Bielefeld probably is very costly, so THEY seem to finance THEIR system by winning huge Lotto jackpots. I did not bring to light how THEY could manipulate the whole Lotto system but perhaps THEY know the six numbers one week earlier...

Since winning huge jackpots draws many people's attraction, this kind of approach is not very smart. Therefore, I propose a smarter Lotto manipulation strategy: I would play with the same numbers for a consecutive sequence of weeks in a row. As I know the Lotto numbers for some weeks in advance, I can compute the estimated profit for each week. Now I ask you for a computer program that tells me at which stretch of weeks my numbers make the largest profit. These are my constraints:

- The same numbers will be used every week.
- My profit should be maximized.
- I will play Lotto in **each** drawing of the interval of weeks regardless of a possible bad result in single drawings (in order not to attract too much attention).

Be aware: THEY keep an eye on you!

Input

There is only one test case. First, you get six numbers on a line, representing my lotto numbers L_i ($0 < L_i < 50$, no number twice). The second line of a test case holds the number W ($0 \leq W \leq 1,000,000$) of weeks for which I know the lotto numbers in advance. The last line of a test case consists of W integer values P_i, the profit in week i in Euros. If my numbers were not drawn, the profit may be negative. You may safely assume that $|P_i| \leq 10,000$.

Output

Write the maximal profit I can get with my Lotto strategy on a single line as shown in the sample output. If you cannot make money, you do not have to play Lotto at all. You may safely assume that the maximal profit is less than 2^{63} Euro.

In the sample input, the maximal profit can be reached with the interval that starts at week 3 and ends at week 6 (both inclusive). Although week 4 gives negative profit, it is required to play the same numbers also in this drawing in order not to attract too much attention.

Sample Input

```
2 3 5 7 23 42
8
3 -7 12 -5 8 8 -4 2
```

Sample Output

```
23 Euro
```

Problem I
Martin Luther King

Author: James Earl Ray

Time Limit: 2 second(s)

The assassination of Martin Luther King was one of the stranger cases in ancient criminology. He was shot on April 4, 1968 at 18:01 while standing on the balcony of the Lorraine Motel in Memphis. His suspected murderer, James Earl Ray, first confessed but three days later recanted his confession. Therefore, until now it is not really clear what happened on this day. Was it really this strange guy named Raoul? Or James' brother Johnny? Was it a murder for hire? Maybe even from the government?

Nowadays, as it is possible to travel back in time, the Department of Modern Criminology got funding for a huge research project to investigate unsolved cases of the 20th century. As you are a student in criminology and find the topic fascinating, you volunteer to travel back in time to April 4, 1968 and to watch what really happened then. Unfortunately, the time machine did not bring you to Memphis but instead, you find yourself in San Francisco. Fortunately it is April 3, 19:05, so you still have time to travel to Memphis. Having no idea of how to drive any of the old vehicles called "cars" you are forced to take public transport. It is common knowledge, that public transport was quite bad in these days so you wonder if you will make it on time. During the journey, you usually have to switch trains (often more than just once) and to wait for the next connections. Being also a programmer you start writing a program that works on the train schedules and computes how long it takes to get to Memphis if you take the fastest possible way.

Input

There is only one test case. The first line gives the number $0 \leq n \leq 100,000$ of connections. The following n lines contain the connections in the form *cityA cityB distance connectionTime*. *cityA* and *cityB* are the names of the cities (which do not contain spaces and are at most 50 characters long) between which there is a one–way connection (from *cityA* to *cityB*). There are at most 10,000 cities. The *distance* is the distance rounded to full miles. Assume that the trains drive with a constant speed of 60 mph. The *connectionTime* is the time in minutes you have to wait in *cityB* to get the next connection (regardless to which city it will lead). Distances are strictly positive integers smaller or equal 10,000. Connection times are non-negative integers smaller or equal than 1,000. You may assume that there is only one connection (per direction) between each pair of cities.

Output

Output the earliest possible arrival time in `Memphis` when you start in `SanFrancisco` on April 3rd at 19:10. The time should be given as *hh:mm +d*, with d being the days between April 3rd and the arrival date. The time must be given with leading zeros if necessary. If the arrival day is April, 3rd, d is 0 (time has to be written as *hh:mm +0* in this case).

Sample Input

```
8
SanFrancisco Reno 219 5
SanFrancisco Berkeley 14 10
Berkeley SanFrancisco 14 5
Berkeley Denver 1259 65
Denver Memphis 1095 11
Reno LasVegas 448 25
Denver LasVegas 749 5
LasVegas Memphis 1578 12
```

Sample Output

```
09:05 +2
```

Problem J
Roman Enigma

Author: Marcus Tullius Cicero

Time Limit: 1 second(s)

Deep in his heart, Marcus Iunius Brutus Caepio, also simply known as Brutus, is a strong supporter of democracy and fearing the rise of a new dictator in the roman republic. Together with several senators, Brutus joined a conspiracy to get rid of Gaius Julius Caesar, who was getting stronger every day in the roman government. They are planning the assassination of the victorious warlord. To exchange possible dates for the murder, the famous Wikipedius has come up with the idea to use an unknown number system, the so-called decimal system developed in the eastern deserts. Wikipedius found an ancient document explaining the translation from the decimal system to the roman system. Here is what this document said:

> The following equivalences are used to translate from decimal numbers to roman numbers:
>
> | 1 | 5 | 10 | 50 | 100 | 500 | 1000 |
> |---|---|---|---|---|---|---|
> | I | V | X | L | C | D | M |
>
> Multiple symbols may be combined to produce numbers in between these values. For roman numbers, it is not common to write the same letter four times. The *subtraction rule* applies. Following this rule, 4 is not written as *IIII* but as *IV* meaning $5 - 1$. Other numbers the subtraction rule applies to are:
>
> | 4 | 9 | 40 | 90 | 400 | 900 |
> |---|---|---|---|---|---|
> | IV | IX | XL | XC | CD | CM |
>
> The accurate way to write large numbers in roman numerals is to handle first the thousands, then hundreds, then tens, then units. For example the number 1988 is translated as: one thousand is *M*, nine hundred is *CM*, eighty is *LXXX*, eight is *VIII*. Putting it together results in *MCMLXXXVIII*.

Wikipedius and Brutus spend a lot of time to find a way to translate from roman numbers to decimal numbers. This is not really described in the document. Can you help them by writing a little program for this translation? Rumors say that you know this strange number system from the eastern desert.

Input

The number of roman numbers is given in the first line. Each roman number is given in one line. Only correct roman numbers appear. $3,999$ roman numbers are given at most, the longest roman number has 15 digits.

Output

Translate each roman number into the corresponding decimal number and output each number in a new line.

Sample Input

```
3
III
IV
MDCCCXLIX
```

Sample Output

```
3
4
1849
```

Problem K
THEY

Author: THEY

Time Limit: 2 second(s)

THEY are behind you. You do not know THEIR name, you do not know exactly, who THEY are, but you do know THEY are evil and THEY have to be stopped. THEY control most means of communications and THEY are able to kill you, if THEY find out that you are working against THEM.

You have some people that will help you in the battle, but you need to find a way to communicate. You agreed with your helpers on communicating via a morse-like code that you can transmit via some secret ways of communication. Each message has to fit exactly in a given time window. The code consists of long and short beeps. The long beeps take two units of time; the short beeps take just one. The break between two beeps is so short that you can ignore it. Additionally, you are not allowed to extend this break, i.e. you have to use every unit of the given time window either with a short beep, the first half of a long beep or the second half of a long beep. Now you need to know how many different messages you are able to express in a time window of a given length.

Input

Input consists of a series of test cases. The first line of input contains a positive number t ($1 \leq t \leq 1,000$), the number of test cases. Each test case consists of a single line that holds a positive integer l ($1 \leq l \leq 2^{23}$), that indicates the length of the time window.

Output

Output how many different messages can be formed using exactly l time units as described above. If there are more than 2^{42} messages possible you know THEY tricked you with false information and you have to write the word `tricked` on a single line instead.

Sample Input

```
3
3
1
123
```

Sample Output

```
3
1
tricked
```