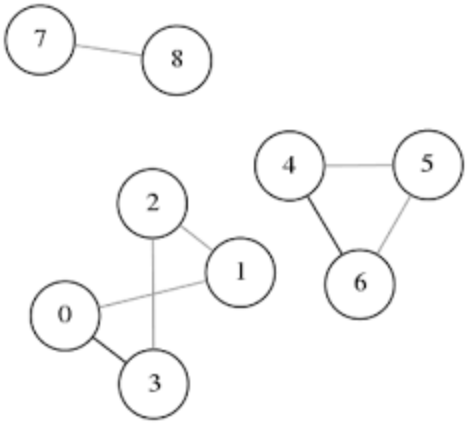
# Problem A. Advertising in Social Medias

| | |
|---|---|
| Input file: | `standard input` |
| Output file: | `standard output` |
| Time limit: | `1 second` |
| Balloon color: | `purple` |

CSEC ASTU is looking to expand to other departments in ASTU and share the awesomeness of programming to other departments in the university. The club administrators came with a decision to expand the club through advertising in social media specifically on Facebook.

The club prepared a short introduction movie about the club. Now all they need to is send it to as many students as they can and those students will share to their friends on the Facebook. But this process is boring so they don't want to send the content for more than n students. So given ASTU students' Facebook user relationship network what is the maximum number of students that will receive the content.




The network is represented by an undirected graph where an edge represents a two-way relationship between the users(students). A user is represented by a unique id (integer number) from 0 to n-1. It is guaranteed that when a student receives a message (the video) he will send it to all his friends.

## Input

Input begins with three integers *n, m* and *s* ($1 \le n, m \le 10000$) and ($1 \le s \le n$), number of students, number of edges and number of times they want to send the video respectively. The following *m* lines contain two numbers *v* and *u* representing the edge between user *v* and *u* ($0 \le v, u \le$ n-1).

$m \le n(n-1)/2$

## Output

Print maximum number of students that will receive the video in one line.

## Example

| Sample Input 1 | Sample Output 1 |
|---|---|
| 9 8 2<br>0 1<br>0 3<br>1 2<br>2 3<br>4 5<br>4 6<br>5 6<br>7 8 | 7 |

# Problem B. Black Friday

| | |
|---|---|
| Input file: | `standard input` |
| Output file: | `standard output` |
| Time limit: | `1 second` |
| Balloon color: | `black` |

Black Friday is a colloquial term for the Friday following Thanksgiving Day in the United States. Many stores offer highly promoted sales on Black Friday and open very early. Black Friday has routinely been the busiest shopping day of the year in the United States since at least 2005.

Andalus Team Coach Desta who lives in America uses this opportunity to buy items for his store every year. Unfortunately, this year an incident happened. The supermarket was too busy and the cashiers were handling too many customers. So, Desta decided to buy only two kind of items 1 and 2 with a price of A and B respectively**.** So he packed *X* units of item 1 and *Y* units of item 2 with a total price of and headed $T = AX+BY$ over the cashier to cash out. But while calculating the cashier unconsciously press "-" instead of "+" resulting in $T=AX-BY=D$ or $T=BY-AX$ **,** where *D* is the greatest common divisor (GCD) of *A* and *B***.**

Desta didn't know about this mistake and paid D amount, thanked the cashier and went home After a while he realized that the cashier made a mistake and went back to correct the bill by paying the remaining money. And while thinking a way to find the remaining amount together with the cashier they discovered that each items are not a factor of one another. Which means

$$B\%A \neq 0 \text{ and } A\%B \neq 0$$

So your task is to help Desta find the remaining amount of money he has to pay back to the cashier given the information that

| | |
|---|---|
| The total cost | $T = AX+BY$ |
| What Desta paid | $D=GCD(A, B)$ which is D$=AX-BY$ or $D=BY-AX$ |

where *D*, *X* and *Y* are positive integers.

If there are several such *X* and *Y*, you should find the pair for which $X+Y$ is the minimal since he doesn't want to pay more than he should.

## Input

Input begins with an integer $1 \le t \le 100$, indicating the number of test cases that follow. Each of the next $t$ lines contain exactly two integer A and B the price of item 1 and item 2 respectively. $2 \le A, B \le 10^6$ .

## Output

For each test case, output a line containing integer the possible minimum amount of money Desta return to the cashier to compensate the bill.

## Example

| Sample Input 1 | Sample Output 1 |
|---|---|
| 5<br>4 3<br>7 5<br>6 13<br>50 17<br>1000 21 | 6<br>28<br>24<br>100<br>16000 |

# Problem C. Cellular Network

| | |
|---|---|
| Input file: | `standard input` |
| Output file: | `standard output` |
| Time limit: | `1 second` |
| Balloon color: | `yellow` |

The geographical area is divided into small hexagonal regions called cells. It is the basic unit of the cellular system. These cells collectively provide coverage over large geographical areas.

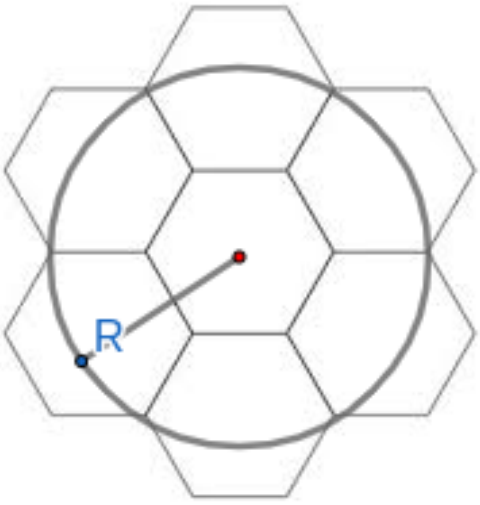
Hexagonal shapes are preferred than square or circle in cellular architecture because it covers an entire area without overlapping.

The frequency reuse become possible using hexagonal shape. The hexagonal region is regular hexagon.

The radiation pattern of the antennas used is 60 degree which means 6 are required for the full 360 degrees coverage which is the same number of sides the hexagon consists. It create minimum interference.

Frequency Reuse is the scheme in which allocation and reuse of channels throughout a coverage region is done. Each cellular base station is allocated a group of radio channels or Frequency sub-bands to be used within a small geographic area known as a cell. The shape of the cell is Hexagonal. The process of selecting and allocating the frequency sub-bands for all of the cellular base station within a system is called Frequency reuse or Frequency Planning.

7 cells which collectively use the complete set of available frequencies is called a Cluster.



The radius R of the largest circle inscribed in the cluster is given.

This guy Mustefa is a Communication Engineering student who wants to design a cellular network coverage area. He wants to calculate the area of the cluster formed by a group of 7 similar regular hexagons. Just let you help him.

## Input

Input begins with an integer $1 \leq t \leq 100$, indicating the number of test cases that follow. Each of the next $t$ lines contain exactly one integer value for R radius of the largest circle in the range $1 \leq N \leq 10^8$.

## Output

For each test case, output the area of the cluster in 6 decimal place.

## Example

| Sample Input 1 | Sample Output 1 |
|---|---|
| 4<br>1<br>2<br>4<br>10 | 4.546633<br>18.186533<br>72.746134<br>454.663337 |

# Problem D. Distinct Palindrome

| | |
|---|---|
| Input file: | standard input |
| Output file: | standard output |
| Time limit: | 1 second |
| Balloon color: | burgundy |

In Ethiopian General Secondary Education Certificate Examination (EGSECE) there are N courses the students must take. The possible results of the course is represented by capital letter from A to F except such that A, B, C. D and F. For each student there are N letters that represent the result. Put the letters in the order of course number, each course have sequence number from 1 to N based on the order of exam tooks place. Course1, Course2, …, CourseN.

The letters of the result form a string by putting in the order of course sequence number. In Andalus Community School all students get a palindromic string result of their courses. Fortunately all student's string result is distinct(unique). What is the maximum number of students those who took EGSECE exam from Andalus Community School.

For example student Zahra took 5 courses and get the result A, B, F, B and A as the order of the exam is taken, so the formed string is ABFBA.

## Input

Input begins with an integer $1 \le t \le 100$, indicating the number of test cases that follow. Each of the next $t$ lines contain exactly one integer value for $N$ in the range $1 \le N \le 10^{18}$ that is the number of courses.

## Output

For each test case, output a line containing integer representing the maximum number of students those who took EGSECE exam and get a unique palindromic string result. As the answer might be huge, print it module 1000000007.

## Example

| Sample Input 1 | Sample Output 1 |
|---|---|
| 3<br>13<br>100<br>2500 | 78125<br>876125953<br>936336589 |

# Problem E. EthCPC Anniversary

| | |
|---|---|
| Input file: | standard input |
| Output file: | standard output |
| Time limit: | 1 second |
| Balloon color: | red |

EthCPC is Ethiopian Collegiate Programming Contest Community which Compete all Ethiopian Universities and celebrate their anniversary on June month in every year. When they celebrate their anniversary day they used to burn a candles. For their $M^{th}$ anniversary they burn K number of candles. K is the number of divisor of M.

For example for their $8^{th}$ anniversary they burn 4 candles because 8 has 4 divisors such as 1, 2, 4 and 8.

In this year the competition was held in Adama Science and Technology University for $N^{th}$ times. At the competition they celebrated their $N^{th}$ anniversary. What is the total number of candles they burnt since the EthCPC community founded.

## Input

Input begins with an integer $1 \le t \le 10000$, indicating the number of test cases that follow. Each of the next $t$ lines contain exactly one integer value for $N$ in the range $2 \le N \le 10^5$.

## Output

For each test case, output a line containing integer the sum of the total number of candles they burn since the EthCPC community founded.

## Example

| Sample Input 1 | Sample Output 1 |
|---|---|
| 4<br>5<br>10<br>80<br>100000 | 10<br>27<br>368<br>1166750 |

# Problem F. Family Night Prize

| | |
|---|---|
| Input file: | `standard input` |
| Output file: | `standard output` |
| Time limit: | `1 second` |
| Balloon color: | `golden` |

In CSEC club there are *N* student members. They have family game night program every Saturday. Wendirad is one of the coordinator of the family game night. He prepares a big prize for only 1 student for their semester closing family game night. For this semester He used an algorithm to choose a student for the prize. The students have a unique ID number from 1 to *N*. Wendirad also has a chance to get the prize.

So Wendirad wrote *N* unique prime numbers on a paper in order to each student pick only 1 number $P_i$ from the list and they picked. There is no duplicated number between any student. Then each student selected a random positive integer $A_i$ which is less than $P_i$ and it doesn't matter if students select the same integer. Then John the mathematician, have collected pair numbers ($P_i$, $A_i$) from all students and started to find a minimum positive integer *X* such that


$X \% P_1 = A_1$

$X \% P_2 = A_2$

…

$X \% P_N = A_N$

After getting the number X, the students took a seat in a circular form by the order of their ID number. They count from 1 and goes on. A student who obtained that number X will be the winner of the prize. Here, A student who started to count is a one whose ID number is equal to 1. Print the student ID of the winner of the prize.

## Input

Input begins with an integer $1 \le t \le 100$, indicating the number of test cases that follow. For each test case the first line contain integer N, for the next N lines there are two integers $P_i$ and $A_i$ selected by student i.

$3 \le N \le 13 \qquad 1 \le A_i < P_i < 42$

## Output

For each test case, print the ID number of the winner student.

## Example

| Sample Input 1 | Sample Output 1 |
|---|---|
| 1<br>3<br>7 4<br>5 2<br>11 3 | 3 |

# Problem G. Get to the Decimal Point

| | |
|---|---|
| Input file: | standard input |
| Output file: | standard output |
| Time limit: | 1 second |
| Balloon color: | green |

Floating point numbers are represented by non-computers (humans) in scientific notation (** represents raising to a power)

4.01 X 10**8 = 401,000,000.0

4.01 X 10**-3 = 0.00401

- 4.01 X 10**8 = -401,000,000.0

-4.01 X 10**-3 = -0.00401

The computer represents each of these signed numbers differently in a floating point number exponent and sign - excess 7FH notation while mantissa and sign - signed magnitude

Actual representation in the computer

Things aren't quite as simple as the above paragraph would indicate. If the above format were followed, then 33 bits would be needed to represent a floating point number (1 bit for the sign, 4 bits for each hex digit). 33 is bad, 32 is good. So, how is the extra bit discarded? Through absolute trickery!

Actually, all of the precision of the above format is obtained, but it is accomplished using 32 bits instead of 33. The trick is to remember that in reality these numbers are stored in binary. Also, every number is always in NORMALIZED form, which means that it starts with a 1, not a 0. The exponent is always adjusted to eliminate any leading 0's from the mantissa. So this is where the extra bit is squeezed in (or out).

In base 10, a number like 0.123 represents

1/10 + 2/100 + 3/1000

What is the significance of the denominators 10, 100, 1000? They are the powers of the base (base 10). So, what would the number 0.101 represent in binary?

1/2 + 0/4 + 1/8 = 5/8

since the powers of two are 2, 4, 8.

There is another way to calculate this, just count the number of decimal places, and raise 2 to that power. Since there are three decimal places in this example, then the denominator is 2**3 = 8. Then, just calculate the numerator as a binary number, in this case 5. So the final number is 5/8.

Here are some more examples

101.1101 = 5 13/16

- 11101.11101 = - 29 29/32

0.001011 = 11/64

However, after reading this, Amir decided not to use floating points at all. So, whenever he encounters two floating numbers he takes highest integer that exist between them. If there is none he takes -1.

## Input

Input begins with an integer $1 \leq t \leq 100$, indicating the number of test cases that follow. Each of the next $t$ lines contain exactly two float numbers X and Y. $0 \leq X \leq Y \leq 10^9$.

## Output

For each test case, output a line containing the highest integer between X and Y, inclusive. If there is no integer print -1.

## Example

| Sample Input 1 | Sample Output 1 |
|---|---|
| 6<br>2.4 3.77<br>5.8 5.99<br>4.2 88.6<br>6.1 7.0<br>4.0 4.6<br>4.01 4.6 | 3<br>-1<br>88<br>7<br>4<br>-1 |

# Problem H. Harry Fibo-Sum

| | |
|---|---|
| Input file: | standard input |
| Output file: | standard output |
| Time limit: | 1 second |
| Balloon color: | pink |

Harry is one of many who believes in luck. He has a lucky number which is N. So whenever he encounters the number N in his life he beliefs his luck will turn to his favor. But he rarely encounters the number, so he decided he needed to maximize the chance. In order to do that he came to the idea of having more than one lucky number to maximize his chance. So he needed to generate new lucky numbers. To do that, he searched for the best way to generate them and he decided to use Fibonacci sequence (his lucky sequence) to generate them. What he did was use the Fibonacci sequence up to N and take the minimum unique number of list from the sequence that their summation is equal to his previous lucky number N. Help Harry find his lucky numbers.

## Input

Input begins with an integer $1 \le t \le 100$, indicating the number of test cases that follow. Each of the next $t$ lines contain exactly one integer. $1 \le N \le 10^{18}$.

## Output

For each test case, output a line containing list of integers in ascending order their summation is equal to the given number N.

## Example

| Sample Input 1 | Sample Output 1 |
|---|---|
| 4<br>10<br>30<br>55<br>100 | 2 8<br>1 8 21<br>55<br>3 8 89 |

# Problem I. Interested Group Placement

| | |
|---|---|
| Input file: | `standard input` |
| Output file: | `standard output` |
| Time limit: | `1 second` |
| Balloon color: | `blue` |

Adama Science and Technology University, Computer Science and Engineering Department Post Graduate Dean wants to place MSc students into K number of SIG(Special Interested Group) based on their first semester GPA(Grade Point Average) rank and first choice. The SIGs sequence number is from 1 to K. Each SIG accepts up to its maximum capacity. There are N students with their rank and first choice. The rank of the students is from 1 to N and all ranks are unique. 1 is the highest rank, 2 is the second highest rank and so on. A student that have best rank will get priority to place with their first choice. The main goal is to fulfill the students favorite by giving their first choice based on their rank. Print the maximum summation of rank of the students who got their first choice.

## Input

Input begins with an integer $1 \le t \le 10$, indicating the number of test cases that follow. For each test case the first line contain two integers K and N, the number of SIGs and the number of students respectively. The next line contains K integers, $C_i$ the maximum capacity of each SIGs on the order of their sequence number. For the next N lines each line contains two integers $R_i$ and S. $R_i$ is the rank of student i and S is sequence number of first choice SIG.

Each student have a unique rank and the maximum rank is N that is the worst rank.

$$\sum_{i=1}^{i=K} C_i = N$$

$1 \le K \le 100$ $1 \le C_i \le 10^4$ $1 \le N \le 10000$ $1 \le R_i \le N$

## Output

For each test case, output a line containing integer the maximum summation of rank of the students who got their first choice.

## Example

| Sample Input 1 | Sample Output 1 |
|---|---|
| 1<br>4 10<br>3 2 2 3<br>7 3<br>5 1<br>8 1<br>4 3<br>10 1<br>9 4<br>1 2<br>3 1<br>6 1<br>2 3 | 30 |

***Explanation for the test case 1***

The student rank who got their first choice is listed below

SIG 1 -> 3 5 6

SIG 2 -> 1

SIG 3 -> 2 4

SIG 4 -> 9

The student whose rank is 7 did not get his first choice because his first choice was SIG 1 and SIG 1 accepted students who have highest rank up to its maximum capacity. The same for the student whose rank is 8 and 10.

# Problem J. Jibril GPA

| | |
|---|---|
| Input file: | standard input |
| Output file: | standard output |
| Time limit: | 1 second |
| Balloon color: | silver |

Ethiopian Universities use fixed grade scale. There are 11 grade scales for each course. Such as

$A^+$, A, $A^-$, $B^+$, B, $B^-$, $C^+$, C, $C^-$, D and F.

The numerical value for letters of grade scale is $V_i$

| | | |
|---|---|---|
| $A^+ = 4.00$ | $A = 4.00$ | $A^- = 3.75$ |
| $B^+ = 3.50$ | $B = 3.00$ | $B^- = 2.75$ |
| $C^+ = 2.50$ | $C = 2.00$ | $C^- = 1.75$ |
| $D = 1.00$ | $F = 0.00$ | |

Jibril has taken K different courses in his university career. He has finished all courses without F grade. Jibril got balance number of grades for all grade scale except F (i.e. get balance number of grades for all grade scale). Therefore, maximum difference between the number of courses that he got for any two grade scales is 1. For the given credit hour ($1 \le C_i \le 4$), find the possible maximum GPA (Grade Point Average) of Jibril.

$$GPA = \frac{\sum_{i=1}^{i=k} V_i * C_i}{\sum_{i=1}^{i=k} C_i}$$

## Input

The first line of the input contains a single integer $1 \le K \le 100000$, the number of courses.

The second line of input contains K space-separated integers, $C_i$ the credit hour of the courses. The credit hour of the course is in the range [1, 4].

## Output

Output a single 2 decimal place representing the possible maximum GPA of Jibril.

## Example

| Sample Input 1 | Sample Output 1 |
| --- | --- |
| 10<br>4 3 1 2 1 2 3 3 4 2 | 3.20 |

| Sample Input 2 | Sample Output 2 |
| --- | --- |
| 14<br>3 2 1 3 4 3 1 2 1 2 3 3 4 2 | 3.45 |