Problem A. Weird Algorithm

Time Limit 1000 ms
Mem Limit 524288 kB

Consider an algorithm that takes as input a positive integer n. If n is even, the algorithm divides it by two, and if n is odd, the algorithm multiplies it by three and adds one. The algorithm repeats this, until n is one. For example, the sequence for $n = 3$ is as follows:

$$3 \to 10 \to 5 \to 16 \to 8 \to 4 \to 2 \to 1$$

Your task is to simulate the execution of the algorithm for a given value of n.

Input

The only input line contains an integer n.

Output

Print a line that contains all values of n during the algorithm.

Constraints

- $1 \leq n \leq 10^6$

Example

Input	Output
3	3 10 5 16 8 4 2 1

Problem B. Missing Number

Time Limit 1000 ms
Mem Limit 524288 kB

You are given all numbers between $1, 2, \ldots, n$ except one. Your task is to find the missing number.

Input

The first input line contains an integer n.

The second line contains $n - 1$ numbers. Each number is distinct and between 1 and n (inclusive).

Output

Print the missing number.

Constraints

- $2 \leq n \leq 2 \cdot 10^5$

Example

Input	Output
5 2 3 1 5	4

Problem C. Repetitions

Time Limit 1000 ms
Mem Limit 524288 kB

You are given a DNA sequence: a string consisting of characters A, C, G, and T. Your task is to find the longest repetition in the sequence. This is a maximum-length substring containing only one type of character.

Input

The only input line contains a string of n characters.

Output

Print one integer: the length of the longest repetition.

Constraints

- $1 \leq n \leq 10^6$

Example

Input	Output
ATTCGGGA	3

Problem D. Increasing Array

Time Limit 1000 ms
Mem Limit 524288 kB

You are given an array of n integers. You want to modify the array so that it is increasing, i.e., every element is at least as large as the previous element.

On each move, you may increase the value of any element by one. What is the minimum number of moves required?

Input

The first input line contains an integer n: the size of the array.

Then, the second line contains n integers $x_1, x_2, \ldots, x_n$: the contents of the array.

Output

Print the minimum number of moves.

Constraints

- $1 \le n \le 2 \cdot 10^5$
- $1 \le x_i \le 10^9$

Example

Input	Output
5 3 2 5 1 7	5

Problem E. Permutations

Time Limit 1000 ms
Mem Limit 524288 kB

A permutation of integers $1, 2, \ldots, n$ is called *beautiful* if there are no adjacent elements whose difference is 1.

Given n, construct a beautiful permutation if such a permutation exists.

Input

The only input line contains an integer n.

Output

Print a beautiful permutation of integers $1, 2, \ldots, n$. If there are several solutions, you may print any of them. If there are no solutions, print "NO SOLUTION".

Constraints

- $1 \leq n \leq 10^6$

Example 1

Input	Output
5	4 2 5 3 1

Example 2

Input	Output
3	NO SOLUTION

Problem F. Number Spiral

Time Limit 1000 ms
Mem Limit 524288 kB

A number spiral is an infinite grid whose upper-left square has number 1. Here are the first five layers of the spiral:

1	2	9	10	25
4	3	8	11	24
5	6	7	12	23
16	15	14	13	22
17	18	19	20	21

Your task is to find out the number in row y and column x.

Input

The first input line contains an integer t: the number of tests.

After this, there are t lines, each containing integers y and x.

Output

For each test, print the number in row y and column x.

Constraints

- $1 \leq t \leq 10^5$
- $1 \leq y, x \leq 10^9$

Example

Input	Output
3 2 3 1 1 4 2	8 1 15

Problem G. Two Knights

Time Limit 1000 ms
Mem Limit 524288 kB

Your task is to count for $k = 1, 2, \ldots, n$ the number of ways two knights can be placed on a $k \times k$ chessboard so that they do not attack each other.

Input

The only input line contains an integer n.

Output

Print n integers: the results.

Constraints

- $1 \leq n \leq 10000$

Example

Input	Output
8	0 6 28 96 252 550 1056 1848

Problem H. Two Sets

Time Limit 1000 ms
Mem Limit 524288 kB

Your task is to divide the numbers $1, 2, \ldots, n$ into two sets of equal sum.

Input

The only input line contains an integer n.

Output

Print "YES", if the division is possible, and "NO" otherwise.

After this, if the division is possible, print an example of how to create the sets. First, print the number of elements in the first set followed by the elements themselves in a separate line, and then, print the second set in a similar way.

Constraints

- $1 \leq n \leq 10^6$

Example 1

Input	Output
7	YES 4 1 2 4 7 3 3 5 6

Example 2

Input	Output
6	NO

Problem I. Bit Strings

Time Limit 1000 ms
Mem Limit 524288 kB

Your task is to calculate the number of bit strings of length n.

For example, if $n = 3$, the correct answer is 8, because the possible bit strings are 000, 001, 010, 011, 100, 101, 110, and 111.

Input

The only input line has an integer n.

Output

Print the result modulo $10^9 + 7$.

Constraints

- $1 \le n \le 10^6$

Example

Input	Output
3	8

Problem J. Trailing Zeros

Time Limit 1000 ms
Mem Limit 524288 kB

Your task is to calculate the number of trailing zeros in the factorial $n!$.

For example, $20! = 2432902008176640000$ and it has 4 trailing zeros.

Input

The only input line has an integer n.

Output

Print the number of trailing zeros in $n!$.

Constraints

- $1 \leq n \leq 10^9$

Example

Input	Output
20	4

Problem K. Coin Piles

Time Limit 1000 ms
Mem Limit 524288 kB

You have two coin piles containing a and b coins. On each move, you can either remove one coin from the left pile and two coins from the right pile, or two coins from the left pile and one coin from the right pile.

Your task is to efficiently find out if you can empty both the piles.

Input

The first input line has an integer t: the number of tests.

After this, there are t lines, each of which has two integers a and b: the numbers of coins in the piles.

Output

For each test, print "YES" if you can empty the piles and "NO" otherwise.

Constraints

- $1 \leq t \leq 10^5$
- $0 \leq a, b \leq 10^9$

Example

Input	Output
3 2 1 2 2 3 3	YES NO YES

Problem L. Palindrome Reorder

Time Limit 1000 ms
Mem Limit 524288 kB

Given a string, your task is to reorder its letters in such a way that it becomes a palindrome (i.e., it reads the same forwards and backwards).

Input

The only input line has a string of length n consisting of characters A–Z.

Output

Print a palindrome consisting of the characters of the original string. You may print any valid solution. If there are no solutions, print "NO SOLUTION".

Constraints

- $1 \leq n \leq 10^6$

Example

Input	Output
AAAACACBA	AACABACAA

Problem M. Gray Code

Time Limit 1000 ms
Mem Limit 524288 kB

A Gray code is a list of all 2^n bit strings of length n, where any two successive strings differ in exactly one bit (i.e., their Hamming distance is one).

Your task is to create a Gray code for a given length n.

Input

The only input line has an integer n.

Output

Print 2^n lines that describe the Gray code. You can print any valid solution.

Constraints

- $1 \le n \le 16$

Example

Input	Output
2	00 01 11 10

Problem N. Tower of Hanoi

Time Limit 1000 ms
Mem Limit 524288 kB

The Tower of Hanoi game consists of three stacks (left, middle and right) and n round disks of different sizes. Initially, the left stack has all the disks, in increasing order of size from top to bottom.

The goal is to move all the disks to the right stack using the middle stack. On each move you can move the uppermost disk from a stack to another stack. In addition, it is not allowed to place a larger disk on a smaller disk.

Your task is to find a solution that minimizes the number of moves.

Input

The only input line has an integer n: the number of disks.

Output

First print an integer k: the minimum number of moves.

After this, print k lines that describe the moves. Each line has two integers a and b: you move a disk from stack a to stack b.

Constraints

- $1 \leq n \leq 16$

Example

Input	Output
2	3 1 2 1 3 2 3

Problem O. Creating Strings

Time Limit 1000 ms
Mem Limit 524288 kB

Given a string, your task is to generate all different strings that can be created using its characters.

Input

The only input line has a string of length n. Each character is between a–z.

Output

First print an integer k: the number of strings. Then print k lines: the strings in alphabetical order.

Constraints

- $1 \leq n \leq 8$

Example

Input	Output
aabac	20 aaabc aaacb aabac aabca aacab aacba abaac abaca abcaa acaab acaba acbaa baaac baaca bacaa bcaaa caaab caaba cabaa cbaaa

Problem P. Apple Division

Time Limit 1000 ms
Mem Limit 524288 kB

There are n apples with known weights. Your task is to divide the apples into two groups so that the difference between the weights of the groups is minimal.

Input

The first input line has an integer n: the number of apples.

The next line has n integers $p_1, p_2, \ldots, p_n$: the weight of each apple.

Output

Print one integer: the minimum difference between the weights of the groups.

Constraints

- $1 \leq n \leq 20$
- $1 \leq p_i \leq 10^9$

Example

Input	Output
5 3 2 7 4 1	1

Explanation: Group 1 has weights 2, 3 and 4 (total weight 9), and group 2 has weights 1 and 7 (total weight 8).

Problem Q. Chessboard and Queens

Time Limit 1000 ms
Mem Limit 524288 kB

Your task is to place eight queens on a chessboard so that no two queens are attacking each other. As an additional challenge, each square is either free or reserved, and you can only place queens on the free squares. However, the reserved squares do not prevent queens from attacking each other.

How many possible ways are there to place the queens?

Input

The input has eight lines, and each of them has eight characters. Each square is either free (`.`) or reserved (`*`).

Output

Print one integer: the number of ways you can place the queens.

Example

Input	Output
....*..... ....**. ...*....	65

Problem R. Raab Game I

Time Limit 1000 ms
Mem Limit 524288 kB

Consider a two player game where each player has n cards numbered $1, 2, \ldots, n$. On each turn both players place one of their cards on the table. The player who placed the higher card gets one point. If the cards are equal, neither player gets a point. The game continues until all cards have been played.

You are given the number of cards n and the players' scores at the end of the game, a and b. Your task is to give an example of how the game could have played out.

Input

The first line contains one integer t: the number of tests.

Then there are t lines, each with three integers n, a and b.

Output

For each test case print `YES` if there is a game with the given outcome and `NO` otherwise.

If the answer is `YES`, print an example of one possible game. Print two lines representing the order in which the players place their cards. You can give any valid example.

Constraints

- $1 \leq t \leq 1000$
- $1 \leq n \leq 100$
- $0 \leq a, b \leq n$

Example

Input	Output
5 4 1 2 2 0 1 3 0 0 2 1 1 4 4 1	YES 1 4 3 2 2 1 3 4 NO YES 1 2 3 1 2 3 YES 1 2 2 1 NO

Problem S. Mex Grid Construction

Time Limit 1000 ms
Mem Limit 524288 kB

Your task is to construct an $n \times n$ grid where each square has the smallest nonnegative integer that does not appear to the left on the same row or above on the same column.

Input

The only line has an integer n.

Output

Print the grid according to the example.

Constraints

- $1 \leq n \leq 100$

Example

Input	Output
5	0 1 2 3 4 1 0 3 2 5 2 3 0 1 6 3 2 1 0 7 4 5 6 7 0

Problem T. Knight Moves Grid

Time Limit 1000 ms
Mem Limit 524288 kB

There is a knight on an $n \times n$ chessboard. For each square, print the minimum number of moves the knight needs to do to reach the top-left corner.

Input

The only line has an integer n.

Output

Print the number of moves for each square.

Constraints

- $4 \leq n \leq 1000$

Example

Input	Output
8	0 3 2 3 2 3 4 5 3 4 1 2 3 4 3 4 2 1 4 3 2 3 4 5 3 2 3 2 3 4 3 4 2 3 2 3 4 3 4 5 3 4 3 4 3 4 5 4 4 3 4 3 4 5 4 5 5 4 5 4 5 4 5 6

Problem U. Grid Coloring I

Time Limit 1000 ms
Mem Limit 524288 kB

You are given an $n \times m$ grid where each cell contains one character `A`, `B`, `C` or `D`.

For each cell, you must change the character to `A`, `B`, `C` or `D`. The new character must be different from the old one.

Your task is to change the characters in every cell such that no two adjacent cells have the same character.

Input

The first line has two integers n and m: the number of rows and columns.

The next n lines each have m characters: the description of the grid.

Output

Print n lines each with m characters: the description of the final grid.

You may print any valid solution.

If no solution exists, just print `IMPOSSIBLE`.

Constraints

- $1 \leq n, m \leq 500$

Example

Input	Output
3 4 AAAA BBBB CCDD	CDCD DCDC ABAB

Problem V. Digit Queries

Time Limit 1000 ms
Mem Limit 524288 kB

Consider an infinite string that consists of all positive integers in increasing order:

12345678910111213141516171819202122232425...

Your task is to process q queries of the form: what is the digit at position k in the string?

Input

The first input line has an integer q: the number of queries.

After this, there are q lines that describe the queries. Each line has an integer k: a 1-indexed position in the string.

Output

For each query, print the corresponding digit.

Constraints

- $1 \leq q \leq 1000$
- $1 \leq k \leq 10^{18}$

Example

Input	Output
3 7 19 12	7 4 1

Problem W. String Reorder

Time Limit 1000 ms
Mem Limit 524288 kB

Your task is to reorder the characters of a string so that no two adjacent characters are the same. What is the lexicographically minimal such string?

Input

The only line has a string of length n consisting of characters A–Z.

Output

Print the lexicographically minimal reordered string where no two adjacent characters are the same. If it is not possible to create such a string, print -1.

Constraints

- $1 \leq n \leq 10^6$

Example

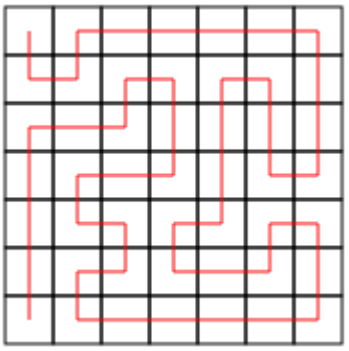
Input	Output
HATTIVATTI	AHATITITVT

Problem X. Grid Path Description

Time Limit 1000 ms
Mem Limit 524288 kB

There are 88418 paths in a 7×7 grid from the upper-left square to the lower-left square. Each path corresponds to a 48-character description consisting of characters `D` (down), `U` (up), `L` (left) and `R` (right).

For example, the path



corresponds to the description `DRURRRRDDDLUULDDDLDRRURDDLLLLLURULURRUULDLLDDDD`.

You are given a description of a path which may also contain characters `?` (any direction). Your task is to calculate the number of paths that match the description.

Input

The only input line has a 48-character string of characters `?`, `D`, `U`, `L` and `R`.

Output

Print one integer: the total number of paths.

Example

Input	Output
??????R??????U??????????????????????????LD????D?	201