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CSES Problem Set

Weird Algorithm

Time limit: 1.00 s   **Memory limit:** 512 MB

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:

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

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

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

Example

Input:
```
3
```

Output:
```
3 10 5 16 8 4 2 1
```

CSES Problem Set

Missing Number

TASK | SUBMIT | RESULTS | STATISTICS | HACKING

Time limit: 1.00 s   **Memory limit:** 512 MB

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

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

Example

Input:
```
5
2 3 1 5
```

Output:
```
4
```

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Repetitions

TASK | SUBMIT | RESULTS | STATISTICS | HACKING

Time limit: 1.00 s   **Memory limit:** 512 MB

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:
ATTCGGGA

Output:
3

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CSES Problem Set

Increasing Array

TASK | SUBMIT | RESULTS | STATISTICS | HACKING

Time limit: 1.00 s   **Memory limit:** 512 MB

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

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

Example

Input:
```
5
3 2 5 1 7
```

Output:
```
5
```

![CSES logo]

CSES Problem Set

Permutations

Time limit: 1.00 s **Memory limit:** 512 MB

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

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

Example 1

Input:
```
5
```

Output:
```
4 2 5 3 1
```

Example 2

Input:
```
3
```

Output:
```
NO SOLUTION
```

CSES Problem Set

Number Spiral

Time limit: 1.00 s   **Memory limit:** 512 MB

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

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

Example

Input:
```
3
2 3
1 1
4 2
```

Output:
```
8
1
15
```

CSES Problem Set

Two Knights

TASK | SUBMIT | RESULTS | STATISTICS | HACKING

Time limit: 1.00 s   **Memory limit:** 512 MB

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

- $1 \le n \le 10000$

Example

Input:
```
8
```

Output:
```
0
6
28
96
252
550
1056
1848
```

CSES Problem Set

Two Sets

TASK | SUBMIT | RESULTS | STATISTICS | HACKING

Time limit: 1.00 s   **Memory limit:** 512 MB

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

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

Example 1

Input:
```
7
```

Output:
```
YES
4
1 2 4 7
3
3 5 6
```

Example 2

Input:
```
6
```

Output:
```
NO
```

CSES Problem Set

Bit Strings

Time limit: 1.00 s   **Memory limit:** 512 MB

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:
```
3
```

Output:
```
8
```

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CSES Problem Set

Trailing Zeros

TASK | SUBMIT | RESULTS | STATISTICS | HACKING

Time limit: 1.00 s   **Memory limit:** 512 MB

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

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

Example

Input:
```
20
```

Output:
```
4
```

CSES Problem Set

Coin Piles

TASK | SUBMIT | RESULTS | STATISTICS | HACKING

Time limit: 1.00 s **Memory limit:** 512 MB

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

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

Example

Input:
```
3
2 1
2 2
3 3
```

Output:
```
YES
NO
YES
```

CSES Problem Set

Palindrome Reorder

TASK | SUBMIT | RESULTS | STATISTICS | HACKING

Time limit: 1.00 s   **Memory limit:** 512 MB

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

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

Example

Input:
```
AAAACACBA
```

Output:
```
AACABACAA
```

CSES Problem Set

Gray Code

TASK | SUBMIT | RESULTS | STATISTICS | HACKING

Time limit: 1.00 s   **Memory limit:** 512 MB

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:
```
2
```

Output:
```
00
01
11
10
```

CSES Problem Set

Tower of Hanoi

Time limit: 1.00 s   **Memory limit:** 512 MB

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

- $1 \le n \le 16$

Example

Input:
```
2
```

Output:
```
3
1 2
1 3
2 3
```

□

CSES Problem Set

Creating Strings

TASK │ SUBMIT │ RESULTS │ STATISTICS │ HACKING

Time limit: 1.00 s **Memory limit:** 512 MB

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:
```
aabac
```

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

CSES Problem Set

Apple Division

TASK │ SUBMIT │ RESULTS │ STATISTICS │ HACKING

Time limit: 1.00 s   **Memory limit:** 512 MB

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

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

Example

Input:
```
5
3 2 7 4 1
```

Output:
```
1
```

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

CSES Problem Set

Chessboard and Queens

TASK | SUBMIT | RESULTS | STATISTICS | HACKING

Time limit: 1.00 s   **Memory limit:** 512 MB

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
```

CSES Problem Set

Digit Queries

Time limit: 1.00 s   **Memory limit:** 512 MB

Consider an infinite string that consists of all positive integers in increasing order:
123456789101112131415161718192021222324 25...

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

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

Example

Input:
```
3
7
19
12
```
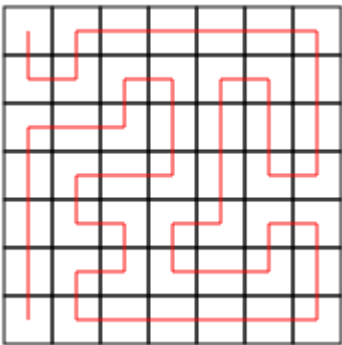
Output:
```
7
4
1
```

CSES Problem Set

Grid Paths

TASK | SUBMIT | RESULTS | STATISTICS | HACKING

Time limit: 1.00 s   **Memory limit:** 512 MB

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 DRURRRRRDDDLUULDDDLDRRURDDLLLLLURULURRUULDLLDDDD.

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:
??????R??????U?????????????????????????LD????D?

Output:
201