Lab 7
FIT Staff
7th week

1 Topics

- Recursion

2 Reading Materials

In Russian

- `https://informatics.msk.ru/course/view.php?id=5`

In English

- `http://www.cplusplus.com/articles/D2N36Up4/`

3 Problem Set

Problem A. 75870. Degree

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

Find n-th degree of 2.

Input

$(0 \leq n \leq 30)$.

Output

Find n-th degree of 2.

Examples

standard input	standard output
0	1
30	1073741824

Problem B. 75878. To binary

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

You shold convert a number n from decimal system to binary system.

Input

You are given a natural number n. It is enough to use int type for n.

Output

Print in binary view a given number n.

Examples

standard input	standard output
8	1000
1	1
15	1111
9	1001

Problem C. 75883. Binary search

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

You are given an sorted array. Try to find number x from this array.

Input

You are given n and n elements. After that, in the next line you are given a number x.

Output

If the given number x is in this array, print Yes, else print No.

Examples

standard input	standard output
5 1 2 3 4 5 1	Yes
5 1 2 3 4 5 2	Yes
5 1 2 3 4 5 7	No
5 1 2 3 4 5 10	No
5 1 2 3 4 5 5	Yes

Problem D. 75880. Sum of digits

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

Find sum of digits of given number.

Input

You are given number n. It is not enough to use long long type.

Output

Print sum of digits.

Examples

standard input	standard output
45651	21
12345	15
123	6
9999	36
88888	40

Problem E. 75879. Unique divider

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

Check the given number is 2-th degree.

Input

You are given natural number n. n is less than 2-th 63 degree.

Output

Print Yes, if given number is a 2-th degree. Else, print No.

Examples

standard input	standard output
32	Yes
15	No
24	No
8	Yes
1	Yes

Problem F. 75875. Even

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

Print a count of even digits in a given number.

Input

A number n which consists from maximum 100 digits.

Output

Count of even digits.

Examples

standard input	standard output
11111111111111111111	0
23456	3
23458	3
987456123	4

Note

You should use string. Because int and long long cannot accept maximum value of n.

Problem G. 75872. Factorial

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

Find n factorial.

Input

$(0 \leq n \leq 25)$.

Output

Print a n factorial.

Examples

standard input	standard output
5	120
3	6
0	1

Problem H. 75874. Fibonacci

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

Find n-th fibonacci number. The Fibonacci sequence is a series of numbers where a number is found by adding up the two numbers before it. Starting with 0 and 1, the sequence goes 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, and so forth.

Input

$(1 \leq n \leq 40)$.

Output

Print a n-th fibonacci number.

Examples

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

Problem I. 75882. Infinite

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

You are given a sequence of numbers. It is a too long sequence. It will stop when user enters 0. Print sum of entered numbers.

Input

You are given a sequence which finishes with 0. Sum can be larger than int type.

Output

Print sum of entered numbers.

Examples

standard input	standard output
1 2 3 4 5 6 0	21
-1 -2 -3 4 5 -2 0	1
-2 2 -2 2 -2 2 0	0
100 100 12 100 -312 0	0
1 1 1 1 1 1 0	6

Problem J. 75863. Heater Almat

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

Almat does not love digits. Therefore, he always divides digits to two and takes one part for himself. For example, yesterday he noticed a number 865 in the street. At first, he took the half of first digit ($8/2 = 4$), then second digit's part ($6/2 = 3$), then third digit's part($5/2 = 2$).

Input

You are given a natural number n.

Output

Print a sum of digits which Almat takes for himself when he will notice the number n.

Example

standard input	standard output
865	9

Note

$8/2+6/2+5/2 = 9$

Problem K. 75876. Maximum digit

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

You are given a big number n. You should find a maximum digit of this big number.

Input

A number n which consists from maximum 100 digits.

Output

Print a maximum digit.

Examples

standard input	standard output
123444	4
123456	6
1234568	8
10000	1
0	0

Note

You should use string. Because int and long long cannot accept maximum value of n.

Problem L. 75881. Is it Palindrome?

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

You are given a string. Check is it palindrome or not?

Input

string s.

Output

Print Yes, if s is palindrome. Otherwise, print No.

Examples

standard input	standard output
m	Yes
ma	No
mam	Yes
mama	No
mamam	Yes

Problem M. 75858. Simple Recursion

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

Print all natural numbers until n with help of recursion (n is inclusive).

Input

Given a natural number n.

Output

Print all natural numbers until n with help of recursion (n is inclusive).

Examples

standard input	standard output
4	1 2 3 4
1	1

Note

The solving an above exercise without recursion is a meaningless job.

Problem N. 75867. Cheater

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

There were n problems in second quiz. Teachers wanted to define who is a cheater. If student solves a two or more exercise in k minutes it is a obvious that he is a cheater.

Input

You are given natural numbers n and k. Second line consists from n numbers. i-th element is a time when a student solved i-th problem. ($2 \leq n \leq 100,\ 1 \leq k \leq 10$).

Output

Print "cheater"if a student is a cheater, "no"otherwise.

Examples

standard input	standard output
5 3 1 22 12 35 20	cheater
6 5 1 7 16 29 35 45	no

Problem O. 75877. To k-inary

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

I hope that previous exercise was easy for you. Now we will solve something new. A system called as decimal because we use 10 digits. But also we have 26 letters. Now your task is a printing a number n in k-inary system.

Input

You are given a natural number n and k. It is enough to use int type for n. k can be maximum 36.

Output

Print n in k-th number system.

Examples

standard input	standard output
15 16	F
7 3	21
1000 30	13A
1000 32	V8
100 15	6A

4 Lab Contest

All given task are emplaced in automated checker system for **lab7**:
`http://acm.kbtu.kz/cgi-bin/new-register?action=211&contest_id=157`
Feel free to submit your solutions without attempt count penalty.

5 Solutions

Problem A

```
#include<iostream>

using namespace std;

int rec(int cur, int n){
    if(n == 0){
        return cur;
    }
    cur *= 2;
    rec(cur, n-1);
}

int main() {
        int n;
        cin >> n;

        int cur = 1;
        cout<<rec(cur, n);

        return 0;
}
```

Problem B

```
#include <iostream>
using namespace std;
void rec(int n){
    if(n == 0)return;
    rec(n/2);
    cout<<n%2;
```

```
}
int main(){
    int n;
    cin>>n;

    rec(n);

}
```

Problem C

```
#include <iostream>
using namespace std;
string rec(int l, int r, int a[], int x){
    if(l <= r){
        int m = (l+r)/2;
        if(a[m] == x)return "Yes";
        if(a[m] < x)return rec(m+1, r, a, x);
        return rec(l, m-1, a, x);
    }
    return "No";
}
int main(){

    int n;
    cin>>n;
    int a[n];
    for(int i = 0; i < n; i++)cin>>a[i];
    int x;
    cin>>x;
    cout<<rec(0, n-1, a, x);
}
```

Problem D

```
#include <iostream>
using namespace std;
int rec(string s, int i, int ans){
    if(i == s.size())return ans;
    ans += s[i] - '0';
    return rec(s, i+1, ans);
```

```
}
int main(){
    string s;
    cin>>s;

    cout<<rec(s,0, 0);

}
```

Problem E

```
#include <iostream>
using namespace std;
string rec(int n){
    if(n==1)return "Yes";

    if(n % 2 != 0)return "No";

    return rec(n/2);
}
int main(){
    long long n;
    cin>>n;


    cout<<rec(n);

}
```

Problem F

```
#include <iostream>
using namespace std;

int rec(string s, int i, int ans){
    if(i == s.size())return ans;
    if(int(s[i] - '0') % 2 == 0)return rec(s, i+1, ans+1);
    return rec(s, i+1, ans);
}
int main(){
    string s;
```

```
    cin >> s;

    cout<<rec(s, 0, 0);


}
```

Problem G

```
#include <iostream>
using namespace std;

long long rec(long long a, int n){
    if(n == 0)return a;
    a *= n;

    return rec(a, n-1);
}
int main(){
    int n;
    cin>>n;
    long long a = 1;
    cout<<rec(a, n);


}
```

Problem H

```
#include <iostream>
using namespace std;

long long rec(long long a, long long b, int cur){
    if(cur == 1){
                return a+b;
        }
        long long c = a+b;

    return rec(b, c, cur-1);
}
int main(){
```

```
    int n;
    cin>>n;


    long long a = 0, b = 1;

        if(n == 1)cout<<0, exit(0);
        if(n == 2)cout<<1, exit(0);

    cout<<rec(a, b, n-2);


}
```

Problem I

```
#include <iostream>
using namespace std;
long long rec(long long ans){
    int n;
    cin>>n;
    ans+=n;
    if(!n)return ans;
    return rec(ans);
}
int main(){

    cout<<rec(0);

}
```

Problem J

```
#include<iostream>

using namespace std;

int rec(int sum, int n){
        if(n == 0){
                return sum;
        }
```

```
        sum += (n%10)/2;
        return rec(sum, n/10);
}

int main() {
        int n;
        cin >> n;

        int sum = 0;
        cout<<rec(sum, n);

        return 0;
}
```

Problem K

```
#include <iostream>
using namespace std;

int rec(string s, int i, char ans){
    if(i == s.size())return ans;
    ans = max(ans, s[i]);
    return rec(s, i+1, ans);
}
int main(){
    string s;
    cin >> s;

    cout<<char(rec(s, 0, '0'));


}
```

Problem L

```
#include <iostream>
using namespace std;
string rec(string s, int i, int j){
    if(i > j)return "Yes";
```

```
    if(s[i] != s[j])return "No";
    return rec(s, i+1, j-1);
}
int main(){
    string s;
    cin>>s;

    int i = 0, j = s.size()-1;
    cout<<rec(s, i, j);

}
```

Problem M

```
#include<iostream>

using namespace std;

void recursion(int cur, int n){
        if(cur > n)return;
        cout<<cur<<' ';
        recursion(cur+1, n);
}

int main() {
        int n;
        cin >> n;

        recursion(1, n);


        return 0;
}
```

Problem N

```
#include<iostream>

using namespace std;

string rec(int a[], int i, int n, int k){
```

```
        if(i == n){
                return "no";
        }

        for(int j = 0; j < n; j++){
                if(i != j){
                        if(abs(a[i] - a[j]) <= k){
                                return "cheater";
                        }
                }
        }

        return rec(a, i+1, n, k);
}

int main() {
        int n, k;
        cin >> n >> k;

        int a[n];
        for(int i = 0; i < n; i++){
                cin>>a[i];
        }

        cout<<rec(a, 0, n, k);


        return 0;
}
```

Problem O

```
#include <iostream>
using namespace std;
char get(int a){
    if(a >= 10){
        return 'A'+a-10;
    }
    return a+'0';
}
```

```
void rec(int n, int k){
    if(n == 0)return;
    rec(n/k, k);
    cout<<get(n%k);
}
int main(){
    int n, k;
    cin>>n>>k;

    rec(n, k);

}
```

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6 Additional tasks for this lab

You can solve problems in Informatics
https://informatics.msk.ru/course/view.php?id=5
note: statements are in russian