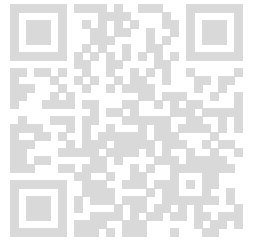


# Codekata Report:



**Name:** Deepu Pandey

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**Specialization:** School of Computer Science & Engineering

**Completion Year:** 2028-3rd Sem

**Section:** Section-7

**1. Problem Statement:** Compute  $(a^b) \bmod m$  using binary exponentiation.

**Completion Status:** Completed

**Concepts Included:**

GU 28 3rd Sem Computational Mathematics

**Language Used:** C

**Source Code:**

```
#include <stdio.h>

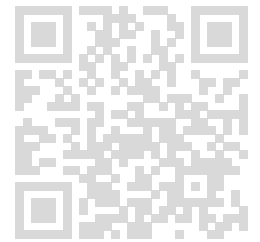
long long modularExp(long long a, long long b, long long m) {
    long long result = 1;
    a = a % m;

    while (b > 0) {
        if (b % 2 == 1) {
            result = (result * a) % m;
        }
        b = b / 2;
        a = (a * a) % m;
    }

    return result;
}

int main() {
    long long a, b, m;
```

```
scanf("a=%lld,b=%lld,m=%lld", &a, &b, &m);  
  
long long result = modularExp(a, b, m);  
  
printf("%lld\n", result);  
  
return 0;  
}
```



## Compilation Details:

### TestCase1:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

1

**Compilation Status:** Passed

#### Execution Time:

0.001s

### TestCase2:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

24

**Compilation Status:** Passed

#### Execution Time:

0.001s

### TestCase3:

#### Input:

< hidden >

### Expected Output:

< hidden >

### Output:

5

**Compilation Status:** Passed

**Execution Time:**

0.001s

**2. Problem Statement:** Compute  $2^n \bmod m$  for very large  $n$  efficiently.

**Completion Status:** Completed

### Concepts Included:

GU 28 3rd Sem Computational Mathematics

**Language Used:** PYTHON 3

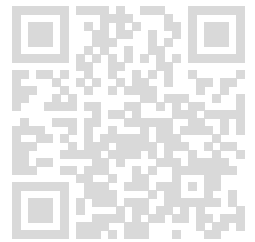
### Source Code:

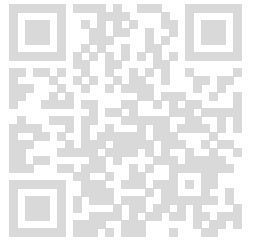
```
def power_mod(n, m):  
    # Fast exponentiation with modulo  
    result = 1  
    base = 2  
    while n > 0:  
        if n % 2 == 1:  
            result = (result * base) % m  
        n = n // 2  
        base = (base * base) % m  
    return result
```

```
input_str = input()  
parts = input_str.split(',')  
n = int(parts[0].split('=')[1])  
m = int(parts[1].split('=')[1])  
print(power_mod(n, m))
```

### Compilation Details:

### TestCase1:



**Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

24

**Compilation Status:** Passed

**Execution Time:**

0.01s

**TestCase2:****Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

4

**Compilation Status:** Passed

**Execution Time:**

0.01s

**TestCase3:****Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

178116276

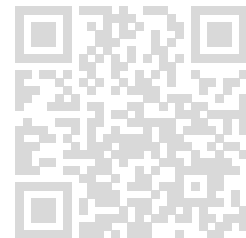
**Compilation Status:** Passed

**Execution Time:**

0.01s

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**3. Problem Statement:** Given  $a, b, m$  compute  $(a^b - b) \bmod m$  (use modular inverse).



**Completion Status:** Completed

**Concepts Included:**

GU 28 3rd Sem Computational Mathematics

**Language Used:** PYTHON 3

**Source Code:**

```
def power_mod(base, exp, mod):  
    result = 1  
    base = base % mod  
    while exp > 0:  
        if exp % 2 == 1:  
            result = (result * base) % mod  
        exp = exp >> 1  
        base = (base * base) % mod  
    return result
```

```
input_str = input()  
parts = input_str.split(',')  
a = int(parts[0].split('=')[1])  
b = int(parts[1].split('=')[1])  
m = int(parts[2].split('=')[1])
```

```
result = power_mod(a, b, m)  
print(result)
```

**Compilation Details:**

**TestCase1:**

**Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

9

**Compilation Status:** Passed

**Execution Time:**

0.014s

#### TestCase2:

##### Input:

< hidden >

##### Expected Output:

< hidden >

##### Output:

5

**Compilation Status:** Passed

##### Execution Time:

0.014s

#### TestCase3:

##### Input:

< hidden >

##### Expected Output:

< hidden >

##### Output:

16

**Compilation Status:** Passed

##### Execution Time:

0.01s

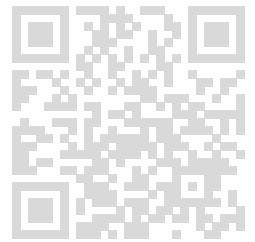
**4. Problem Statement:** Answer q queries: for each (a,b,m) print (a<sup>b</sup>) mod m.

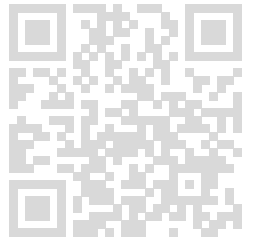
**Completion Status:** Completed

#### Concepts Included:

GU 28 3rd Sem Computational Mathematics

**Language Used:** PYTHON 3





### Source Code:

```
def power_mod(base, exp, mod):
    result = 1
    base = base % mod
    while exp > 0:
        if exp % 2 == 1:
            result = (result * base) % mod
        exp = exp >> 1
        base = (base * base) % mod
    return result

query = input().strip()
# Remove parentheses and split by comma
query = query.strip('(')
values = list(map(int, query.split(',')))
a, b, m = values[0], values[1], values[2]
result = power_mod(a, b, m)
print(result)
```

### Compilation Details:

#### TestCase1:

##### Input:

< hidden >

##### Expected Output:

< hidden >

##### Output:

1

**Compilation Status:** Passed

##### Execution Time:

0.011s

#### TestCase2:

##### Input:

< hidden >

##### Expected Output:

< hidden >

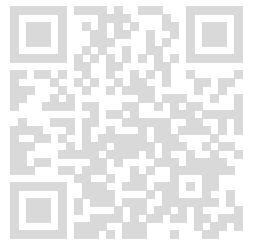
##### Output:

24

**Compilation Status:** Passed

**Execution Time:**

0.01s



**TestCase3:**

**Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

5

**Compilation Status:** Passed

**Execution Time:**

0.01s

**5. Problem Statement:** Compute nth Fibonacci number using iterative method.

**Completion Status:** Completed

**Concepts Included:**

GU 28 3rd Sem Computational Mathematics

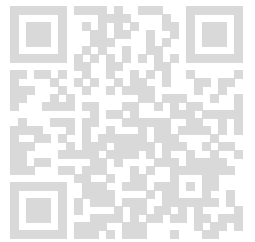
**Language Used:** PYTHON 3

**Source Code:**

```
n = int(input().split('=')[1])
if n <= 0:
    print(0)
elif n == 1:
    print(1)
else:
    a, b = 0, 1
    for _ in range(2, n + 1):
        a, b = b, a + b
    print(b)
```



## Compilation Details:



### TestCase1:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

5

**Compilation Status:** Passed

#### Execution Time:

0.013s

### TestCase2:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

55

**Compilation Status:** Passed

#### Execution Time:

0.014s

### TestCase3:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

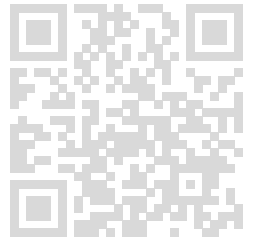
6765

**Compilation Status:** Passed

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**Execution Time:**

0.01s



**6. Problem Statement:** Compute nth Fibonacci using recursion + memoization.

**Completion Status:** Completed

**Concepts Included:**

GU 28 3rd Sem Computational Mathematics

**Language Used:** PYTHON 3

**Source Code:**

```
memo = {}  
def fib(n):  
    if n in memo:  
        return memo[n]  
    if n <= 1:  
        return n  
    memo[n] = fib(n-1) + fib(n-2)  
    return memo[n]  
  
n = int(input().split('=')[1])  
print(fib(n))
```

**Compilation Details:**

**TestCase1:**

**Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

5

**Compilation Status:** Passed

**Execution Time:**

0.01s

### TestCase2:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

55

**Compilation Status:** Passed

#### Execution Time:

0.014s

### TestCase3:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

6765

**Compilation Status:** Passed

#### Execution Time:

0.014s

**7. Problem Statement:** Compute nth Fibonacci in  $O(\log n)$  using fast doubling.

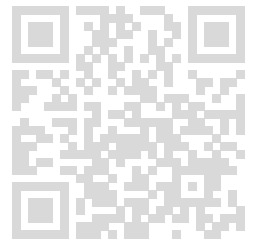
**Completion Status:** Completed

#### Concepts Included:

GU 28 3rd Sem Computational Mathematics

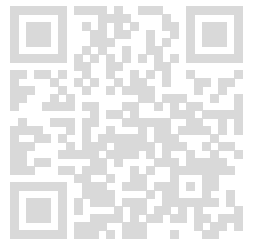
**Language Used:** PYTHON 3

**Source Code:**



```
def fib_fast_doubling(n):
    if n == 0:
        return 0
    def fib_pair(k):
        if k == 0:
            return (0, 1)
        m = k // 2
        a, b = fib_pair(m)
        c = a * (2 * b - a)
        d = a * a + b * b
        if k % 2 == 0:
            return (c, d)
        else:
            return (d, c + d)
    return fib_pair(n)[0]

n = int(input().split('=')[1])
print(fib_fast_doubling(n))
```



## Compilation Details:

### TestCase1:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

5

**Compilation Status:** Passed

#### Execution Time:

0.01s

### TestCase2:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

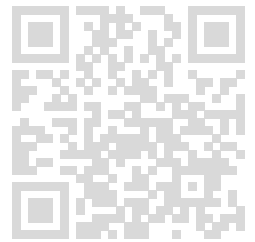
55

Deepu Pandey (deepu.24scse1011405@galgotiasuniversity.ac.in)

**Compilation Status:** Passed

**Execution Time:**

0.013s



**TestCase3:**

**Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

12586269025

**Compilation Status:** Passed

**Execution Time:**

0.014s

**8. Problem Statement:** Compute nth Fibonacci modulo m efficiently.

**Completion Status:** Completed

**Concepts Included:**

GU 28 3rd Sem Computational Mathematics

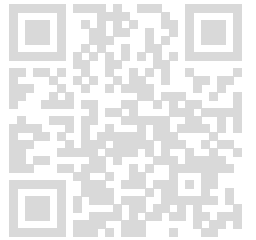
**Language Used:** PYTHON 3

**Source Code:**

```
line = input().split(',')
n = int(line[0].split('=')[1])
m = int(line[1].split('=')[1])
```

```
if n <= 1:
    print(n % m)
else:
    a, b = 0, 1
    for _ in range(2, n + 1):
        a, b = b, (a + b) % m
    print(b)
```

**Compilation Details:**



### TestCase1:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

55

**Compilation Status:** Passed

#### Execution Time:

0.01s

### TestCase2:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

586268941

**Compilation Status:** Passed

#### Execution Time:

0.016s

### TestCase3:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

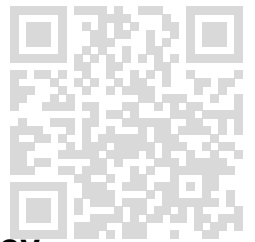
918091266

**Compilation Status:** Passed

#### Execution Time:

Deepu Pandey (deepu.24scse1011405@galgotiasuniversity.ac.in)

0.147s



**9. Problem Statement:** Given permutation  $p$  (1-indexed) of size  $n$ , compute  $p^k$  (apply permutation  $k$  times) and output resulting array.

**Completion Status:** Completed

**Concepts Included:**

GU 28 3rd Sem Computational Mathematics

**Language Used:** JAVA 8

**Source Code:**

```
import java.util.*;
class Main {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        String input = sc.nextLine();
        // Parse input: p=[2,3,1],k=1
        String[] parts = input.split(",k=");
        String pStr = parts[0].substring(3, parts[0].length() - 1); // Remove "p=" and "]"
        int k = Integer.parseInt(parts[1]);
        String[] pArr = pStr.split(",");
        int n = pArr.length;
        int[] p = new int[n + 1]; // 1-indexed
        for (int i = 0; i < n; i++) {
            p[i + 1] = Integer.parseInt(pArr[i]);
        }
        // Apply permutation k times
        int[] result = new int[n + 1];
        for (int i = 1; i <= n; i++) {
            result[i] = i;
        }
        for (int iter = 0; iter < k; iter++) {
            int[] temp = new int[n + 1];
            for (int i = 1; i <= n; i++) {
                temp[p[i]] = result[i];
            }
            result = temp;
        }
        // Output result
        System.out.print("[");
        for (int i = 1; i <= n; i++) {
            System.out.print(result[i]);
            if (i < n) System.out.print(",");
        }
        System.out.println("]");
    }
}
```

}

## Compilation Details:

### TestCase1:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

[3,1,2]

**Compilation Status:** Passed

#### Execution Time:

0.087s

### TestCase2:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

[1,2,3,4]

**Compilation Status:** Passed

#### Execution Time:

0.089s

### TestCase3:

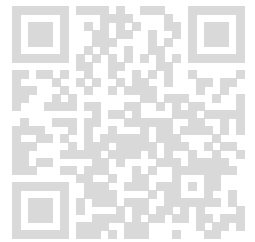
#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:



Deepu Pandey (deepu.24scse1011405@galgotiasuniversity.ac.in)

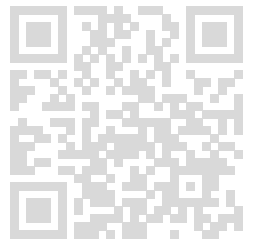


[3,4,5,1,2]

**Compilation Status:** Passed

**Execution Time:**

0.091s



**10. Problem Statement:** Apply permutation k times but answer only where element i goes after k applications.

**Completion Status:** Completed

**Concepts Included:**

GU 28 3rd Sem Computational Mathematics

**Language Used:** PYTHON 3

**Source Code:**

```
line = input()
p_str = line[2:line.find(',')+1]
i_str = line[line.find('i=') + 2:line.find(',k')]
k_str = line[line.find('k=') + 2:]
p = eval(p_str)
i = int(i_str)
k = int(k_str)

pos = i
for _ in range(k):
    pos = p[pos - 1]
print(pos)
```

**Compilation Details:**

**TestCase1:**

**Input:**

< hidden >

**Expected Output:**

< hidden >

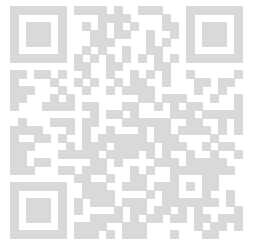
**Output:**

3

**Compilation Status:** Passed

**Execution Time:**

0.011s



**TestCase2:**

**Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

3

**Compilation Status:** Passed

**Execution Time:**

0.01s

**TestCase3:**

**Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

4

**Compilation Status:** Passed

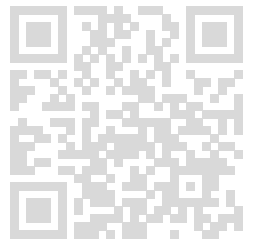
**Execution Time:**

0.01s

**11. Problem Statement:** Given permutation  $p$  and  $k$  up to  $1e18$ , compute  $p^k$  efficiently for all positions.

**Completion Status:** Completed

**Concepts Included:**



## Language Used: JAVA 8

### Source Code:

```
import java.util.*;

public class Main {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        String input = sc.nextLine();

        // Parse input: p=[2,3,1],k=1
        String[] parts = input.split(",k=");
        String pStr = parts[0].substring(parts[0].indexOf('['));
        long k = Long.parseLong(parts[1]);

        // Parse permutation array
        pStr = pStr.replaceAll("[\\[\\]]", "");
        String[] pArr = pStr.split(",");
        int n = pArr.length;
        int[] p = new int[n];
        for (int i = 0; i < n; i++) {
            p[i] = Integer.parseInt(pArr[i].trim());
        }

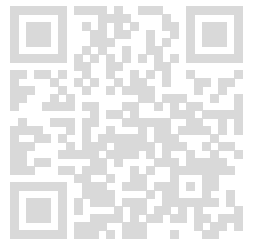
        // Build binary lifting table
        int maxLog = 60;
        int[][] lift = new int[maxLog][n];

        // lift[0][i] = p[i]-1 (0-indexed, jump to position p[i] once)
        for (int i = 0; i < n; i++) {
            lift[0][i] = p[i] - 1;
        }

        // lift[j][i] = position after 2^j jumps from i
        for (int j = 1; j < maxLog; j++) {
            for (int i = 0; i < n; i++) {
                lift[j][i] = lift[j-1][lift[j-1][i]];
            }
        }

        // For each position, find where we end up after k jumps
        int[] result = new int[n];
        for (int i = 0; i < n; i++) {
            int pos = i;
            long remaining = k;
            for (int j = 0; j < maxLog && remaining > 0; j++) {
                if ((remaining & 1) == 1) {
                    pos = lift[j][pos];
                }
            }
            remaining >>= 1;
        }
    }
}
```

```
}  
// The value at the ending position in the original array  
result[i] = p[pos];  
}  
  
// Format output  
System.out.print("[");  
for (int i = 0; i < n; i++) {  
    System.out.print(result[i]);  
    if (i < n - 1) System.out.print(",");  
}  
System.out.println("]");  
}  
}
```



### Compilation Details:

#### TestCase1:

##### Input:

< hidden >

##### Expected Output:

< hidden >

##### Output:

[3,1,2]

**Compilation Status:** Passed

##### Execution Time:

0.089s

#### TestCase2:

##### Input:

< hidden >

##### Expected Output:

< hidden >

##### Output:

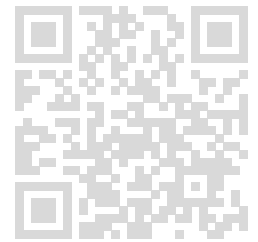
[3,1,2]

**Compilation Status:** Passed

##### Execution Time:

Deepu Pandey (deepu.24scse1011405@galgotiasuniversity.ac.in)

0.089s



**12. Problem Statement:** Given permutation  $p$ , find minimum  $k > 0$  such that  $p^k$  is identity (order of permutation).

**Completion Status:** Completed

**Concepts Included:**

GU 28 3rd Sem Computational Mathematics

**Language Used:** PYTHON 3

**Source Code:**

```
import math
from functools import reduce

def gcd(a, b):
    while b:
        a, b = b, a % b
    return a

def lcm(a, b):
    return abs(a * b) // gcd(a, b)

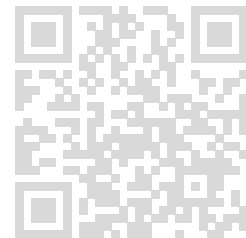
def find_order(p):
    n = len(p)
    visited = [False] * n
    cycle_lengths = []

    for i in range(n):
        if not visited[i]:
            cycle_length = 0
            j = i
            while not visited[j]:
                visited[j] = True
                j = p[j] - 1 # Convert to 0-indexed
                cycle_length += 1
            cycle_lengths.append(cycle_length)

    # Find LCM of all cycle lengths
    result = reduce(lcm, cycle_lengths)
    return result

# Read input
input_str = input().strip()
# Parse the permutation from format 'p=[2,3,1]'
p = eval(input_str.split('=')[1])
```

```
# Calculate and print the order
print(find_order(p))
```



## Compilation Details:

### TestCase1:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

3

**Compilation Status:** Passed

#### Execution Time:

0.013s

### TestCase2:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

2

**Compilation Status:** Passed

#### Execution Time:

0.017s

### TestCase3:

#### Input:

< hidden >

#### Expected Output:

< hidden >

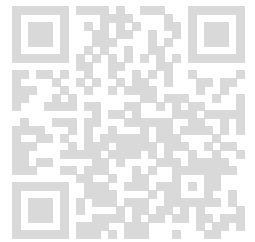
#### Output:

5

**Compilation Status:** Passed

**Execution Time:**

0.017s



**13. Problem Statement:** Compute gcd(a,b) using Euclidean algorithm.

**Completion Status:** Completed

**Concepts Included:**

GU 28 3rd Sem Computational Mathematics

**Language Used:** PYTHON 3

**Source Code:**

```
user_input = input()
parts = user_input.split(',')
a = int(parts[0].split('=')[1])
b = int(parts[1].split('=')[1])
```

```
def gcd(a, b):
    while b != 0:
        temp = b
        b = a % b
        a = temp
    return a
```

```
result = gcd(a, b)
print(result)
```

**Compilation Details:**

**TestCase1:**

**Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

Deepu Pandey (deepu.24scse1017405@galgotiasuniversity.ac.in)

6

**Compilation Status:** Passed

**Execution Time:**

0.01s

**TestCase2:**

**Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

1

**Compilation Status:** Passed

**Execution Time:**

0.012s

**TestCase3:**

**Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

2

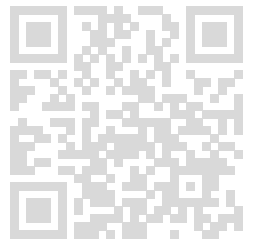
**Compilation Status:** Passed

**Execution Time:**

0.015s

**14. Problem Statement:** Compute lcm(a,b) using gcd to avoid overflow.

**Completion Status:** Completed





## Concepts Included:

GU 28 3rd Sem Computational Mathematics

**Language Used:** PYTHON 3

## Source Code:

```
import math
```

```
# Read input
```

```
user_input = input()
```

```
# Parse the input 'a=12,b=15'
```

```
parts = user_input.split(',')
```

```
a = int(parts[0].split('=')[1])
```

```
b = int(parts[1].split('=')[1])
```

```
# Calculate GCD
```

```
gcd = math.gcd(a, b)
```

```
# Calculate LCM using formula: lcm(a,b) = (a*b) / gcd(a,b)
```

```
lcm = (a * b) // gcd
```

```
# Print result
```

```
print(lcm)
```

## Compilation Details:

### TestCase1:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

60

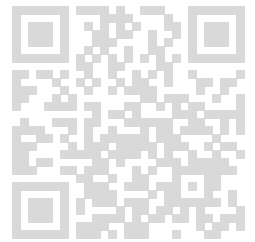
**Compilation Status:** Passed

#### Execution Time:

0.01s

### TestCase2:

#### Input:



Deepu Pandey (deepu.24scse1017405@galgotiasuniversity.ac.in)

< hidden >

**Expected Output:**

< hidden >

**Output:**

35

**Compilation Status:** Passed

**Execution Time:**

0.015s

**TestCase3:**

**Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

500000

**Compilation Status:** Passed

**Execution Time:**

0.014s

**15. Problem Statement:** Compute gcd for many pairs quickly (q up to  $1e5$ ).

**Completion Status:** Completed

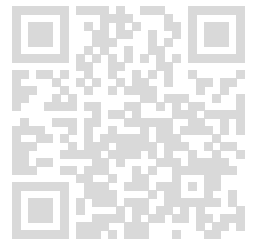
**Concepts Included:**

GU 28 3rd Sem Computational Mathematics

**Language Used:** PYTHON 3

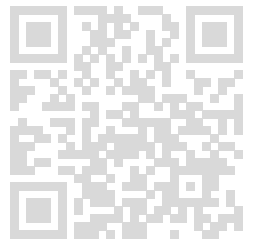
**Source Code:**

```
import math
import ast
```



```
# Read input and parse as list of tuples
userInput = input()
pairs = ast.literal_eval(userInput)

# Compute GCD for each pair and print results
for pair in pairs:
    result = math.gcd(pair[0], pair[1])
    print(result)
```



### Compilation Details:

#### TestCase1:

##### Input:

< hidden >

##### Expected Output:

< hidden >

##### Output:

6

**Compilation Status:** Passed

##### Execution Time:

0.011s

#### TestCase2:

##### Input:

< hidden >

##### Expected Output:

< hidden >

##### Output:

1

**Compilation Status:** Passed

##### Execution Time:

0.013s

#### TestCase3:

##### Input:

< hidden >

### Expected Output:

< hidden >

### Output:

25

**Compilation Status:** Passed

**Execution Time:**

0.012s

**16. Problem Statement:** Find  $x, y$  such that  $ax + by = \gcd(a, b)$  (Extended Euclidean).

**Completion Status:** Completed

### Concepts Included:

GU 28 3rd Sem Computational Mathematics

**Language Used:** PYTHON 3

### Source Code:

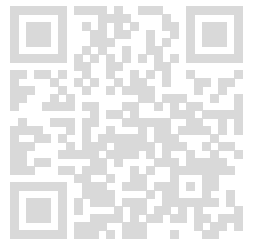
```
def extended_gcd(a, b):  
    if b == 0:  
        return a, 1, 0  
    else:  
        gcd, x1, y1 = extended_gcd(b, a % b)  
        x = y1  
        y = x1 - (a // b) * y1  
        return gcd, x, y
```

```
line = input().split(',')  
a = int(line[0].split('=')[1])  
b = int(line[1].split('=')[1])  
gcd, x, y = extended_gcd(a, b)  
print(x, y)
```

### Compilation Details:

### TestCase1:

**Input:**



< hidden >

**Expected Output:**

< hidden >

**Output:**

1 -1

**Compilation Status:** Passed

**Execution Time:**

0.015s

**TestCase2:**

**Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

4 -1

**Compilation Status:** Passed

**Execution Time:**

0.014s

**TestCase3:**

**Input:**

< hidden >

**Expected Output:**

< hidden >

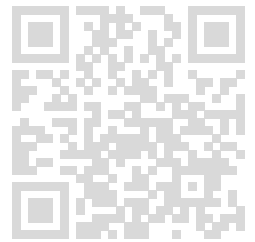
**Output:**

1 -10

**Compilation Status:** Passed

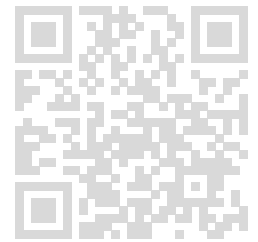
**Execution Time:**

0.01s



Deepu Pandey (deepu.24scse1011405@galgotiasuniversity.ac.in)

## 17. Problem Statement: Solve $ax+by=c$ : determine if integer solutions exist and output any one solution.



**Completion Status:** Completed

### Concepts Included:

GU 28 3rd Sem Computational Mathematics

**Language Used:** PYTHON 3

### Source Code:

```
import math

# Parse input
input_str = input().strip()
parts = input_str.split(',')
a = int(parts[0].split('=')[1])
b = int(parts[1].split('=')[1])
c = int(parts[2].split('=')[1])

# Extended Euclidean Algorithm
def extended_gcd(a, b):
    if b == 0:
        return a, 1, 0
    gcd, x1, y1 = extended_gcd(b, a % b)
    x = y1
    y = x1 - (a // b) * y1
    return gcd, x, y

# Find GCD and check if solution exists
gcd = math.gcd(a, b)

if c % gcd != 0:
    print("No solution")
else:
    # Get a particular solution using extended GCD
    _, x0, y0 = extended_gcd(a, b)

    # Scale the solution
    x0 = x0 * (c // gcd)
    y0 = y0 * (c // gcd)

    # The general solution is: x = x0 + (b/gcd)*k, y = y0 - (a/gcd)*k
    # We want to find k such that both x and y have appropriate values
    b_step = b // gcd
    a_step = a // gcd

    # Find k to minimize |x| + |y| or make them positive
    # Try to make x positive and small
```

```
if b_step != 0:
    k = -x0 // b_step
    x = x0 + b_step * k
    y = y0 - a_step * k
```

```
# Check both k and k+1 to find the best solution
candidates = []
for offset in [-1, 0, 1]:
    k_try = k + offset
    x_try = x0 + b_step * k_try
    y_try = y0 - a_step * k_try
    # Verify the solution
    if a * x_try + b * y_try == c:
        candidates.append((x_try, y_try, abs(x_try) + abs(y_try)))
```

```
# Choose the solution with smallest sum of absolute values
# Or prefer positive x
best = min(candidates, key=lambda t: (t[2], -t[0] if t[0] > 0 else float('inf')))
print(best[0], best[1])
else:
    print(x0, y0)
```

## Compilation Details:

### TestCase1:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

2 1

**Compilation Status:** Passed

#### Execution Time:

0.01s

### TestCase2:

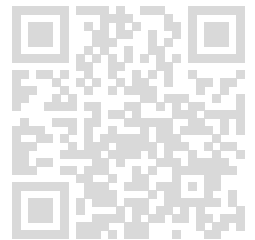
#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:



1 1

**Compilation Status:** Passed

**Execution Time:**

0.01s

**TestCase3:**

**Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

No solution

**Compilation Status:** Passed

**Execution Time:**

0.01s

**18. Problem Statement:** Find number of integer solutions (x,y) in bounds  $0 \leq x \leq X$ ,  $0 \leq y \leq Y$  for  $ax+by=c$ .

**Completion Status:** Completed

**Concepts Included:**

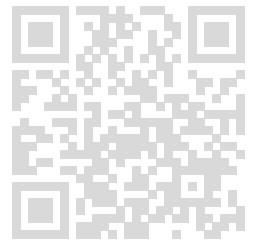
GU 28 3rd Sem Computational Mathematics

**Language Used:** PYTHON 3

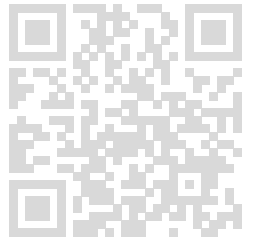
**Source Code:**

```
# Read input
input_str = input()
parts = input_str.split(',')

# Parse values
a = int(parts[0].split('=')[1])
b = int(parts[1].split('=')[1])
c = int(parts[2].split('=')[1])
X = int(parts[3].split('=')[1])
Y = int(parts[4].split('=')[1])
```







```
count = 0

# Check all possible values of x
for x in range(X + 1):
# For given x, check if y is valid
# ax + by = c => by = c - ax => y = (c - ax) / b
remainder = c - a * x

# Check if y is an integer and within bounds
if remainder >= 0 and remainder % b == 0:
y = remainder // b
if 0 <= y <= Y:
count += 1

print(count)
```

### Compilation Details:

#### TestCase1:

##### Input:

< hidden >

##### Expected Output:

< hidden >

##### Output:

1

**Compilation Status:** Passed

##### Execution Time:

0.014s

#### TestCase2:

##### Input:

< hidden >

##### Expected Output:

< hidden >

##### Output:

1

**Compilation Status:** Passed

**Execution Time:**

0.014s

**TestCase3:**

**Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

0

**Compilation Status:** Passed

**Execution Time:**

0.011s

**19. Problem Statement:**Generate all solutions for  $ax+by=c$  within given x-range  $[L,R]$ .

**Completion Status:** Completed

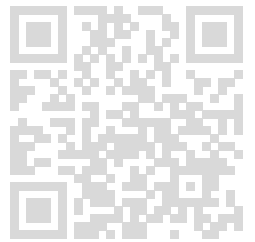
**Concepts Included:**

GU 28 3rd Sem Computational Mathematics

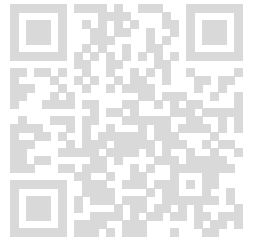
**Language Used:** JAVA 8

**Source Code:**

```
import java.util.Scanner;
class Main { // <-- Rename class to Main
public static void main(String[] args) {
Scanner sc = new Scanner(System.in);
String input = sc.nextLine().replace(",", " ").trim();
String[] parts = input.split("\\s+");
int a = Integer.parseInt(parts[0].split("=")[1]);
int b = Integer.parseInt(parts[1].split("=")[1]);
int c = Integer.parseInt(parts[2].split("=")[1]);
int L = Integer.parseInt(parts[3].split("=")[1]);
int R = Integer.parseInt(parts[4].split("=")[1]);
boolean found = false;
for (int x = L; x <= R; x++) {
if ((c - a * x) % b == 0) {
```



```
int y = (c - a * x) / b;
System.out.println(x + " " + y);
found = true;
break;
}
}
if (!found) System.out.println("No solution");
sc.close();
}
}
```



### Compilation Details:

#### TestCase1:

##### Input:

< hidden >

##### Expected Output:

< hidden >

##### Output:

2 1

**Compilation Status:** Passed

##### Execution Time:

0.109s

#### TestCase2:

##### Input:

< hidden >

##### Expected Output:

< hidden >

##### Output:

1 1

**Compilation Status:** Passed

##### Execution Time:

0.108s

#### TestCase3:

**Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

0 2

**Compilation Status:** Passed

**Execution Time:**

0.113s

**20. Problem Statement:** Find solution (x,y) to  $ax+by=c$  that minimizes  $x+y$  (non-negative solutions).

**Completion Status:** Completed

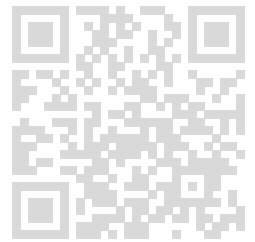
**Concepts Included:**

GU 28 3rd Sem Computational Mathematics

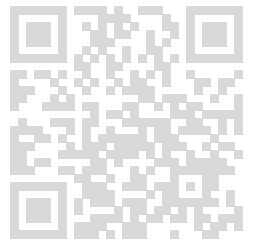
**Language Used:** C

**Source Code:**

```
#include <stdio.h>
long long extended_gcd(long long a, long long b, long long *x, long long *y) {
    if (b == 0) { *x = 1; *y = 0; return a; }
    long long x1, y1;
    long long g = extended_gcd(b, a % b, &x1, &y1);
    *x = y1;
    *y = x1 - (a / b) * y1;
    return g;
}
long long ceil_div(long long a, long long b) {
    if (b < 0) { a = -a; b = -b; }
    return (a + b - 1) / b;
}
long long floor_div(long long a, long long b) {
    if (b < 0) { a = -a; b = -b; }
    return a / b;
}
int main() {
    long long a, b, c;
    scanf("a=%lld,b=%lld,c=%lld", &a, &b, &c);
```



```
long long x0, y0;
long long g = extended_gcd(a, b, &x0, &y0);
if (c % g != 0) {
    printf("No solution\n");
    return 0;
}
x0 *= c / g;
y0 *= c / g;
long long step_x = b / g;
long long step_y = a / g;
long long t_min = ceil_div(-x0, step_x);
long long t_max = floor_div(y0, step_y);
if (t_min > t_max) {
    printf("No non-negative solution\n");
    return 0;
}
long long t;
if (step_x - step_y > 0) t = t_min;
else t = t_max;
long long x = x0 + step_x * t;
long long y = y0 - step_y * t;
printf("%lld %lld\n", x, y);
return 0;
}
```



### Compilation Details:

#### TestCase1:

##### Input:

< hidden >

##### Expected Output:

< hidden >

##### Output:

2 1

**Compilation Status:** Passed

##### Execution Time:

0.001s

#### TestCase2:

##### Input:

< hidden >

##### Expected Output:

< hidden >

**Output:**

0 4

**Compilation Status:** Passed

**Execution Time:**

0.001s

**TestCase3:**

**Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

No solution

**Compilation Status:** Passed

**Execution Time:**

0.001s

**21. Problem Statement:**Encode a positive integer N using Fibonacci coding (Zeckendorf representation).

**Completion Status:** Completed

**Concepts Included:**

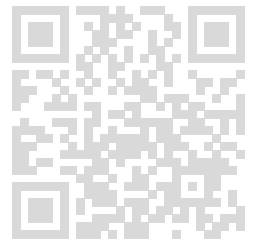
GU 28 3rd Sem Computational Mathematics

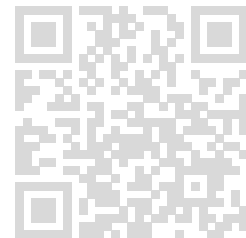
**Language Used:** PYTHON 3

**Source Code:**

```
# Read input
n = int(input().split('=')[1])

# Generate Fibonacci numbers up to n
fib = [1, 2]
while fib[-1] < n:
    fib.append(fib[-1] + fib[-2])
```





```
# Build Zeckendorf representation
result = []
for i in range(len(fib) - 1, -1, -1):
    if fib[i] <= n:
        result.append('1')
        n -= fib[i]
    elif result: # Only add 0 if we've already added a 1
        result.append('0')

# Add trailing 1 for Fibonacci coding
result.append('1')
print("".join(result))
```

### Compilation Details:

#### TestCase1:

##### Input:

< hidden >

##### Expected Output:

< hidden >

##### Output:

100101

**Compilation Status:** Passed

##### Execution Time:

0.009s

#### TestCase2:

##### Input:

< hidden >

##### Expected Output:

< hidden >

##### Output:

11

**Compilation Status:** Passed

##### Execution Time:

0.01s

Deepu Pandey (deepu.24scse1011405@galgotiasuniversity.ac.in)

### TestCase3:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

10000101001

**Compilation Status:** Passed

**Execution Time:**

0.01s

**22. Problem Statement:** Given  $n$ , compute  $n$ th Fibonacci using closed-form (double) for small  $n$ .

**Completion Status:** Completed

#### Concepts Included:

GU 28 3rd Sem Computational Mathematics

**Language Used:** PYTHON 3

#### Source Code:

```
import math

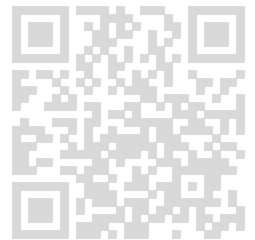
# Read input
input_str = input()
n = int(input_str.split('=')[1])

# Binet's formula
phi = (1 + math.sqrt(5)) / 2
psi = (1 - math.sqrt(5)) / 2

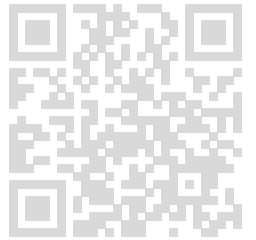
fib = (phi**n - psi**n) / math.sqrt(5)

# Round to nearest integer
result = round(fib)
print(result)
```

#### Compilation Details:







### TestCase1:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

5

**Compilation Status:** Passed

#### Execution Time:

0.01s

### TestCase2:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

55

**Compilation Status:** Passed

#### Execution Time:

0.01s

### TestCase3:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

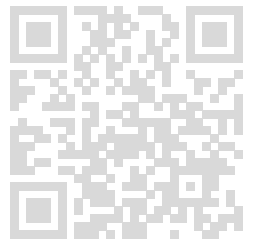
6765

**Compilation Status:** Passed

#### Execution Time:

Deepu Pandey (deepu.24scse1011405@galgotiasuniversity.ac.in)

0.011s



## 23. Problem Statement: Compute nth Fibonacci using matrix exponentiation ( $O(\log n)$ ).

**Completion Status:** Completed

### Concepts Included:

GU 28 3rd Sem Computational Mathematics

**Language Used:** PYTHON 3

### Source Code:

```
def matrix_mult(A, B, m):
    result = [[0, 0], [0, 0]]
    for i in range(2):
        for j in range(2):
            for k in range(2):
                result[i][j] = (result[i][j] + A[i][k] * B[k][j]) % m
    return result

def matrix_power(matrix, n, m):
    if n == 0:
        return [[1, 0], [0, 1]]
    if n == 1:
        return matrix

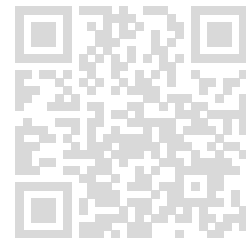
    if n % 2 == 0:
        half = matrix_power(matrix, n // 2, m)
        return matrix_mult(half, half, m)
    else:
        return matrix_mult(matrix, matrix_power(matrix, n - 1, m), m)

def fibonacci(n, m):
    if n == 0:
        return 0
    if n == 1:
        return 1

    base_matrix = [[1, 1], [1, 0]]
    result_matrix = matrix_power(base_matrix, n, m)
    return result_matrix[0][1]

userInput = input()
parts = userInput.split(',')
n = int(parts[0].split('=')[1])
m = int(parts[1].split('=')[1])
```

```
print(fibonacci(n, m))
```



## Compilation Details:

### TestCase1:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

55

**Compilation Status:** Passed

#### Execution Time:

0.01s

### TestCase2:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

586268941

**Compilation Status:** Passed

#### Execution Time:

0.01s

### TestCase3:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

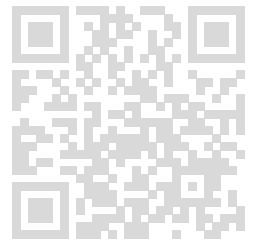
Deepu Pandey (deepu.24scse1011405@galgotiasuniversity.ac.in)

918091266

**Compilation Status:** Passed

**Execution Time:**

0.01s



**24. Problem Statement:** Find Pisano period (period of Fibonacci modulo  $m$ ) for given  $m$ .

**Completion Status:** Completed

**Concepts Included:**

GU 28 3rd Sem Computational Mathematics

**Language Used:** PYTHON 3

**Source Code:**

```
# Read input
user_input = input()
m = int(user_input.split('=')[1])

# Generate Fibonacci sequence modulo m until it repeats
fib_mod = [0, 1]
while True:
    next_val = (fib_mod[-1] + fib_mod[-2]) % m
    fib_mod.append(next_val)

# Check if we found the period (sequence starts repeating with 0, 1)
if len(fib_mod) > 2 and fib_mod[-2] == 0 and fib_mod[-1] == 1:
    fib_mod = fib_mod[:-2] # Remove the repeated 0, 1
    break

# Output the result
period = len(fib_mod)
sequence = ''.join(map(str, fib_mod))
print(f"Period: {period}")
print(f"Sequence: {sequence}")
```

**Compilation Details:**

**TestCase1:**

**Input:**

< hidden >

### Expected Output:

< hidden >

### Output:

Period: 20

Sequence: 0 1 1 2 3 0 3 3 1 4 0 4 4 3 2 0 2 2 4 1

**Compilation Status:** Passed

### Execution Time:

0.013s

### TestCase2:

#### Input:

< hidden >

### Expected Output:

< hidden >

### Output:

Period: 8

Sequence: 0 1 1 2 0 2 2 1

**Compilation Status:** Passed

### Execution Time:

0.01s

### TestCase3:

#### Input:

< hidden >

### Expected Output:

< hidden >

### Output:

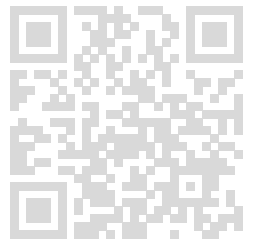
Period: 60

Sequence: 0 1 1 2 3 5 8 3 1 4 5 9 4 3 7 0 7 7 4 1 5 6 1 7 8 5 3 8 1 9 0 9 9 8 7 5 2 7 9 6 5  
1 6 7 3 0 3 3 6 9 5 4 9 3 2 5 7 2 9 1

**Compilation Status:** Passed

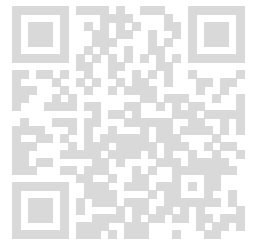
### Execution Time:

0.01s



Deepu Pandey (deepu.24scse1011405@galgotiasuniversity.ac.in)

## 25. Problem Statement:Sieve of Eratosthenes: list primes $\leq n$ .



**Completion Status:** Completed

### Concepts Included:

GU 28 3rd Sem Computational Mathematics

**Language Used:** PYTHON 3

### Source Code:

```
# Read input
user_input = input()
n = int(user_input.split('=')[1])

# Sieve of Eratosthenes
def sieve_of_eratosthenes(n):
    if n < 2:
        return []

    # Create a boolean array and initialize all entries as true
    prime = [True] * (n + 1)
    prime[0] = prime[1] = False

    p = 2
    while p * p <= n:
        # If prime[p] is not changed, then it is a prime
        if prime[p]:
            # Update all multiples of p
            for i in range(p * p, n + 1, p):
                prime[i] = False
            p += 1

    # Collect all prime numbers
    primes = [i for i in range(2, n + 1) if prime[i]]
    return primes

# Get primes and print as list without spaces
primes = sieve_of_eratosthenes(n)
print('[ ' + ', '.join(map(str, primes)) + ' ]')
```

### Compilation Details:

### TestCase1:

#### Input:

< hidden >

**Expected Output:**

< hidden >

**Output:**

[2,3,5,7]

**Compilation Status:** Passed

**Execution Time:**

0.011s

**TestCase2:****Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

[2,3,5,7,11,13,17,19]

**Compilation Status:** Passed

**Execution Time:**

0.01s

**TestCase3:****Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

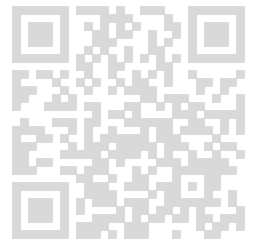
[]

**Compilation Status:** Passed

**Execution Time:**

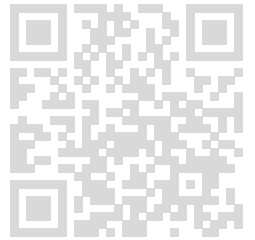
0.01s

**26. Problem Statement:**Linear sieve (Euler sieve) to compute



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**smallest prime factor and primes  $\leq n$ .**



**Completion Status:** Completed

**Concepts Included:**

GU 28 3rd Sem Computational Mathematics

**Language Used:** PYTHON 3

**Source Code:**

```
s = input().strip() # e.g. n=10
n = int(s.split('=')[1])

if n < 2:
    print("")
else:
    primes = []
    lp = [0] * (n + 1) # lowest prime factor

    for i in range(2, n + 1):
        if lp[i] == 0:
            lp[i] = i
            primes.append(i)
            for p in primes:
                if p > lp[i] or i * p > n:
                    break
                lp[i * p] = p

    print("[ " + ",".join(map(str, primes)) + " ]")
```

**Compilation Details:**

**TestCase1:**

**Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

[2,3,5,7]

**Compilation Status:** Passed

**Execution Time:**



0.01s

### TestCase2:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

[2,3,5,7,11,13,17,19]

**Compilation Status:** Passed

#### Execution Time:

0.01s

### TestCase3:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

[2,3,5,7,11,13,17,19,23,29,31,37,41,43,47]

**Compilation Status:** Passed

#### Execution Time:

0.014s

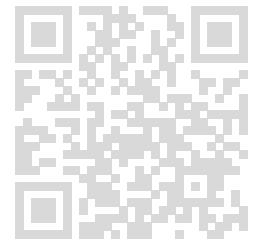
**27. Problem Statement:**Primality test: implement Miller-Rabin deterministic for 64-bit numbers.

**Completion Status:** Completed

#### Concepts Included:

GU 28 3rd Sem Computational Mathematics

**Language Used:** JAVA 8



## Source Code:

```
import java.util.*;

public class Main {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        String input = sc.nextLine();

        // Parse input: n=2
        long n = Long.parseLong(input.substring(input.indexOf('=') + 1));

        boolean result = isPrime(n);
        System.out.println(result);
    }

    static boolean isPrime(long n) {
        if (n < 2) return false;
        if (n == 2 || n == 3) return true;
        if (n % 2 == 0) return false;

        // Write n-1 as d * 2^r
        long d = n - 1;
        int r = 0;
        while (d % 2 == 0) {
            d /= 2;
            r++;
        }

        // Deterministic witnesses for 64-bit numbers
        long[] witnesses = {2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37};

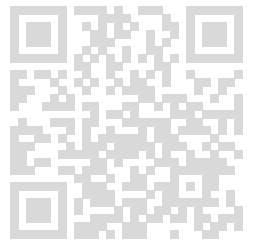
        for (long a : witnesses) {
            if (a >= n) continue;
            if (!millerTest(n, d, r, a)) {
                return false;
            }
        }
        return true;
    }

    static boolean millerTest(long n, long d, int r, long a) {
        long x = modPow(a, d, n);

        if (x == 1 || x == n - 1) return true;

        for (int i = 0; i < r - 1; i++) {
            x = modMul(x, x, n);
            if (x == n - 1) return true;
        }
        return false;
    }

    static long modPow(long base, long exp, long mod) {
```



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```
long result = 1;
base %= mod;
while (exp > 0) {
    if (exp % 2 == 1) {
        result = modMul(result, base, mod);
    }
    base = modMul(base, base, mod);
    exp /= 2;
}
return result;
}
```

```
static long modMul(long a, long b, long mod) {
    return ((a % mod) * (b % mod)) % mod;
}
}
```

### Compilation Details:

#### TestCase1:

##### Input:

< hidden >

##### Expected Output:

< hidden >

##### Output:

true

**Compilation Status:** Passed

##### Execution Time:

0.096s

#### TestCase2:

##### Input:

< hidden >

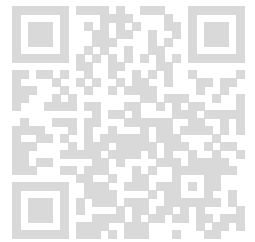
##### Expected Output:

< hidden >

##### Output:

true

**Compilation Status:** Passed



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**Execution Time:**

0.097s

**TestCase3:****Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

true

**Compilation Status:** Passed

**Execution Time:**

0.092s

**28. Problem Statement:** Integer factorization (pollard rho simple) for composite n up to 64-bit.

**Completion Status:** Completed

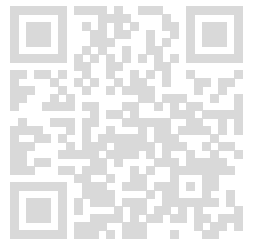
**Concepts Included:**

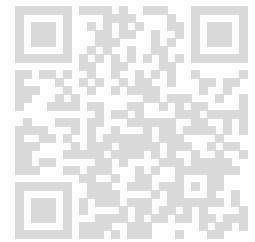
GU 28 3rd Sem Computational Mathematics

**Language Used:** JAVA 8

**Source Code:**

```
import java.util.*;
import java.math.BigInteger;
public class Main { // Rename to Main for online judge
static final Random rnd = new Random();
public static void main(String[] args) {
Scanner sc = new Scanner(System.in);
String s = sc.nextLine().trim();
sc.close();
// Parse input like n=12345 or just 12345
if (s.startsWith("n=")) s = s.substring(2);
if (s.isEmpty()) return;
BigInteger n = new BigInteger(s);
if (n.compareTo(BigInteger.ONE) <= 0) {
System.out.println("");
}
```





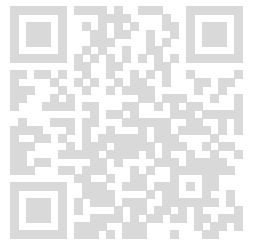
```
return;
}
List<BigInteger> primes = factorAll(n);
Collections.sort(primes);
StringBuilder sb = new StringBuilder();
sb.append("[");
for (int i = 0; i < primes.size(); i++) {
    if (i > 0) sb.append(",");
    sb.append(primes.get(i).toString());
}
sb.append("]");
System.out.println(sb.toString());
}

// Factor n into prime factors using Pollard's Rho
static List<BigInteger> factorAll(BigInteger n) {
    List<BigInteger> found = new ArrayList<>();
    Deque<BigInteger> stack = new ArrayDeque<>();
    stack.push(n);
    while (!stack.isEmpty()) {
        BigInteger m = stack.pop();
        if (m.equals(BigInteger.ONE)) continue;
        if (m.isProbablePrime(40)) {
            if (!found.contains(m)) found.add(m);
            continue;
        }
        BigInteger d = rhoFactor(m);
        if (d == null || d.equals(m)) {
            BigInteger small = smallDivisor(m);
            if (small == null) { // Prime
                found.add(m);
                continue;
            }
            d = small;
        }
        stack.push(d);
        stack.push(m.divide(d));
    }
    return found;
}

// Check small divisors up to 100000
static BigInteger smallDivisor(BigInteger n) {
    BigInteger two = BigInteger.valueOf(2);
    if (n.mod(two).equals(BigInteger.ZERO)) return two;
    BigInteger limit = BigInteger.valueOf(100000);
    for (BigInteger i = BigInteger.valueOf(3); i.compareTo(limit) <= 0; i = i.add(two)) {
        if (n.mod(i).equals(BigInteger.ZERO)) return i;
    }
    return null;
}

// Pollard's Rho factorization
static BigInteger rhoFactor(BigInteger n) {
    if (n.mod(BigInteger.valueOf(2)).equals(BigInteger.ZERO)) return
    BigInteger.valueOf(2);
    BigInteger c = new BigInteger(n.bitLength(),
```

```
rnd).mod(n.subtract(BigInteger.ONE)).add(BigInteger.ONE);
BigInteger x = new BigInteger(n.bitLength(),
rnd).mod(n.subtract(BigInteger.ONE)).add(BigInteger.ONE);
BigInteger y = x;
BigInteger d = BigInteger.ONE;
while (d.equals(BigInteger.ONE)) {
x = x.multiply(x).mod(n).add(c).mod(n);
y = y.multiply(y).mod(n).add(c).mod(n);
y = y.multiply(y).mod(n).add(c).mod(n);
d = x.subtract(y).abs().gcd(n);
if (d.equals(n)) return null;
}
return d;
}
```



### Compilation Details:

#### TestCase1:

##### Input:

< hidden >

##### Expected Output:

< hidden >

##### Output:

[83,97]

**Compilation Status:** Passed

##### Execution Time:

0.101s

#### TestCase2:

##### Input:

< hidden >

##### Expected Output:

< hidden >

##### Output:

[101,103]

**Compilation Status:** Passed

##### Execution Time:

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0.104s

### TestCase3:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

[71,839,1471,6857]

**Compilation Status:** Passed

#### Execution Time:

0.114s

**29. Problem Statement:** Compute number of divisors of  $n$  (tau function) by trial division.

**Completion Status:** Completed

#### Concepts Included:

GU 28 3rd Sem Computational Mathematics

**Language Used:** PYTHON 3

#### Source Code:

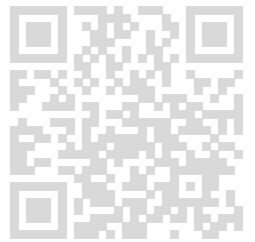
```
n = int(input().split('=')[1])
count = 0
for i in range(1, n + 1):
    if n % i == 0:
        count += 1
print(count)
```

#### Compilation Details:

### TestCase1:

#### Input:

< hidden >



**Expected Output:**

< hidden >

**Output:**

1

**Compilation Status:** Passed

**Execution Time:**

0.016s

**TestCase2:****Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

6

**Compilation Status:** Passed

**Execution Time:**

0.014s

**TestCase3:****Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

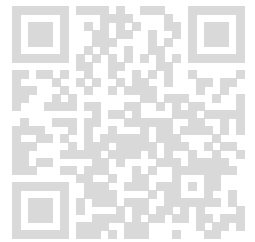
9

**Compilation Status:** Passed

**Execution Time:**

0.01s

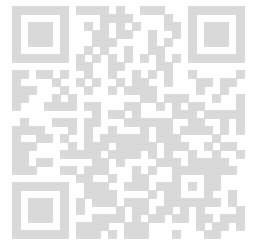
**30. Problem Statement:** Compute sum of divisors  $\sigma(n)$  by



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**factorization.**



**Completion Status:** Completed

**Concepts Included:**

GU 28 3rd Sem Computational Mathematics

**Language Used:** C

**Source Code:**

```
#include <stdio.h>

int main() {
    int n;
    scanf("n=%d", &n);

    int sum = 0;

    // Find all divisors
    for (int i = 1; i * i <= n; i++) {
        if (n % i == 0) {
            sum += i;
            if (i != n / i) {
                sum += n / i;
            }
        }
    }

    printf("%d", sum);
    return 0;
}
```

**Compilation Details:**

**TestCase1:**

**Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

12

**Compilation Status:** Passed

**Execution Time:**

0.001s

**TestCase2:**

**Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

56

**Compilation Status:** Passed

**Execution Time:**

0.001s

**TestCase3:**

**Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

217

**Compilation Status:** Passed

**Execution Time:**

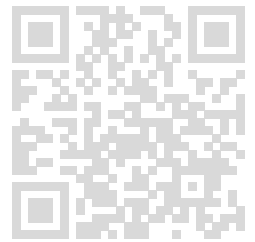
0.001s

**31. Problem Statement:** Compute Euler's totient function  $\phi(n)$  using factorization.

**Completion Status:** Completed

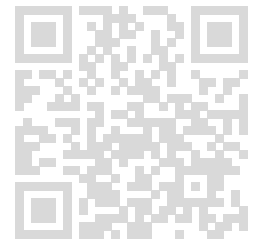
**Concepts Included:**

GU 28 3rd Sem Computational Mathematics



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**Language Used:** PYTHON 3



### Source Code:

```
n_input = input()
n = int(n_input.split('=')[1])

result = n
temp = n

# Find all prime factors
i = 2
while i * i <= temp:
    if temp % i == 0:
        # Remove all occurrences of this prime
        while temp % i == 0:
            temp //= i
        # Apply formula: result = result * (1 - 1/i)
        result -= result // i
        i += 1

# If temp > 1, then it's a prime factor
if temp > 1:
    result -= result // temp

print(result)
```

### Compilation Details:

#### TestCase1:

##### Input:

< hidden >

##### Expected Output:

< hidden >

##### Output:

6

**Compilation Status:** Passed

##### Execution Time:

0.01s

#### TestCase2:

##### Input:

< hidden >

### Expected Output:

< hidden >

### Output:

4

**Compilation Status:** Passed

**Execution Time:**

0.01s

### TestCase3:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

12

**Compilation Status:** Passed

**Execution Time:**

0.013s

**32. Problem Statement:** Compute Möbius function  $\mu(n)$  for  $n$  up to  $N$  using sieve ( $\mu$  of  $n$ ).

**Completion Status:** Completed

### Concepts Included:

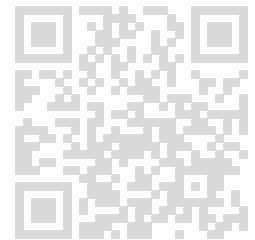
GU 28 3rd Sem Computational Mathematics

**Language Used:** PYTHON 3

### Source Code:

```
N_input = input()
N = int(N_input.split('=')[1])

mu = [0] * (N + 1)
mu[1] = 1
```



```
is_prime = [True] * (N + 1)
primes = []
```

```
for i in range(2, N + 1):
    if is_prime[i]:
        primes.append(i)
        mu[i] = -1
```

```
for p in primes:
    if i * p > N:
        break
    is_prime[i * p] = False
    if i % p == 0:
        mu[i * p] = 0
        break
    else:
        mu[i * p] = -mu[i]
```

```
print(mu)
```

### Compilation Details:

#### TestCase1:

##### Input:

< hidden >

##### Expected Output:

< hidden >

##### Output:

[0, 1, -1, -1, 0, -1, 1, -1, 0, 0, 1]

**Compilation Status:** Passed

##### Execution Time:

0.013s

#### TestCase2:

##### Input:

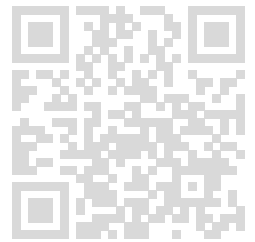
< hidden >

##### Expected Output:

< hidden >

##### Output:

[0, 1, -1, -1, 0, -1, 1, -1, 0, 0, 1, -1, 0, -1, 1, 1, 0, -1, 0, -1, 0]

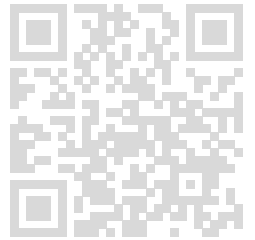


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**Compilation Status:** Passed

**Execution Time:**

0.014s



**TestCase3:**

**Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

[0, 1]

**Compilation Status:** Passed

**Execution Time:**

0.01s

**33. Problem Statement:** Compute modular inverse of a modulo m (m prime) using fast exponentiation.

**Completion Status:** Completed

**Concepts Included:**

GU 28 3rd Sem Computational Mathematics

**Language Used:** PYTHON 3

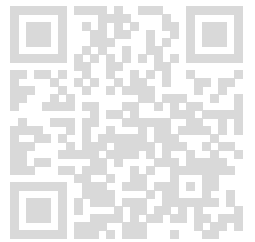
**Source Code:**

```
input_str = input()
parts = input_str.split(',')
a = int(parts[0].split('=')[1])
m = int(parts[1].split('=')[1])

# Compute modular inverse using Fermat's Little Theorem
#  $a^{-1} = a^{(m-2)} \bmod m$  (when m is prime)
result = pow(a, m - 2, m)

print(result)
```

## Compilation Details:



### TestCase1:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

4

**Compilation Status:** Passed

#### Execution Time:

0.013s

### TestCase2:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

9

**Compilation Status:** Passed

#### Execution Time:

0.015s

### TestCase3:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

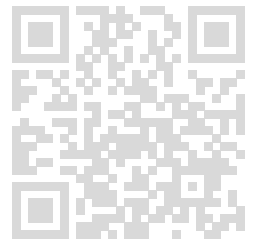
4

**Compilation Status:** Passed

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## Execution Time:

0.01s



**34. Problem Statement:** Solve linear congruence  $a \cdot x \equiv b \pmod{m}$  and output one solution or none.

**Completion Status:** Completed

## Concepts Included:

GU 28 3rd Sem Computational Mathematics

**Language Used:** PYTHON 3

## Source Code:

```
import math

input_str = input()
parts = input_str.split(',')
a = int(parts[0].split('=')[1])
b = int(parts[1].split('=')[1])
m = int(parts[2].split('=')[1])

# Find gcd
gcd = math.gcd(a, m)

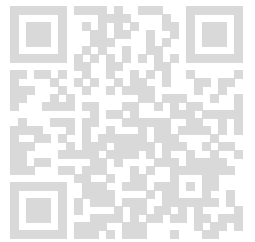
# Check if solution exists
if b % gcd != 0:
    print("none")
else:
    # Reduce the problem
    a //= gcd
    b //= gcd
    m //= gcd

# Find modular inverse of a mod m using extended Euclidean algorithm
def extended_gcd(a, b):
    if a == 0:
        return b, 0, 1
    gcd, x1, y1 = extended_gcd(b % a, a)
    x = y1 - (b // a) * x1
    y = x1
    return gcd, x, y

_, inv, _ = extended_gcd(a, m)
x = (b * inv) % m
print(x)
```



## Compilation Details:



### TestCase1:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

4

**Compilation Status:** Passed

#### Execution Time:

0.011s

### TestCase2:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

6

**Compilation Status:** Passed

#### Execution Time:

0.01s

### TestCase3:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

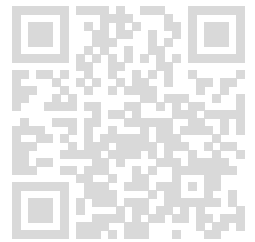
2

**Compilation Status:** Passed

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## Execution Time:

0.01s



**35. Problem Statement:**Chinese Remainder Theorem: given pairwise coprime moduli compute x satisfying system.

**Completion Status:** Completed

## Concepts Included:

GU 28 3rd Sem Computational Mathematics

**Language Used:** PYTHON 3

## Source Code:

```
import math

input_str = input()
# Parse input: r=[2,3],m=[3,5]
parts = input_str.split(',')
r = eval(parts[0].split('=')[1] + ']')
m = eval(parts[1])

# Extended Euclidean Algorithm
def extended_gcd(a, b):
    if a == 0:
        return b, 0, 1
    gcd, x1, y1 = extended_gcd(b % a, a)
    x = y1 - (b // a) * x1
    y = x1
    return gcd, x, y

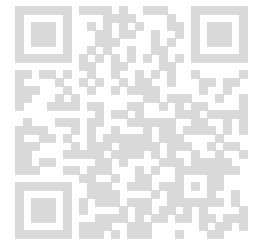
# Chinese Remainder Theorem
def crt(r, m):
    M = 1
    for mi in m:
        M *= mi

    x = 0
    for i in range(len(r)):
        Mi = M // m[i]
        _, inv, _ = extended_gcd(Mi, m[i])
        x += r[i] * Mi * inv

    return x % M

result = crt(r, m)
print(result)
```

## Compilation Details:



### TestCase1:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

8

**Compilation Status:** Passed

#### Execution Time:

0.011s

### TestCase2:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

11

**Compilation Status:** Passed

#### Execution Time:

0.01s

### TestCase3:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

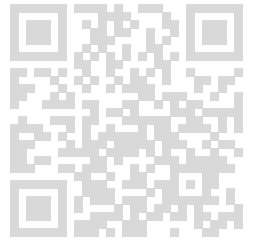
4

**Compilation Status:** Passed

Deepu Pandey (deepu.24scse1011405@galgotiasuniversity.ac.in)

**Execution Time:**

0.01s



**36. Problem Statement:**Generate n-bit Gray code sequence.

**Completion Status:** Completed

**Concepts Included:**

GU 28 3rd Sem Computational Mathematics

**Language Used:** PYTHON 3

**Source Code:**

```
n_input = input()
n = int(n_input.split('=')[1])
```

```
# Generate Gray code
gray_code = []
for i in range(2 ** n):
    gray = i ^ (i >> 1)
    gray_code.append(gray)
```

```
# Print without spaces
print('[' + ','.join(map(str, gray_code)) + '']')
```

**Compilation Details:**

**TestCase1:**

**Input:**

< hidden >

**Expected Output:**

< hidden >

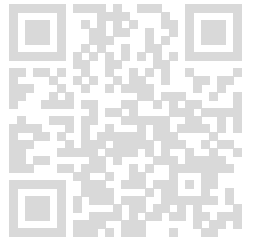
**Output:**

[0,1,3,2]

**Compilation Status:** Passed

**Execution Time:**

0.01s



### TestCase2:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

[0,1,3,2,6,7,5,4]

**Compilation Status:** Passed

#### Execution Time:

0.01s

### TestCase3:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

[0,1]

**Compilation Status:** Passed

#### Execution Time:

0.01s

### 37. Problem Statement: Convert integer to balanced ternary representation.

**Completion Status:** Completed

#### Concepts Included:

GU 28 3rd Sem Computational Mathematics

**Language Used:** PYTHON 3

#### Source Code:

```
n_input = input()
n = int(n_input.split('=')[1])

def to_balanced_ternary(n):
    if n == 0:
        return '0'

    result = []
    while n != 0:
        if n > 0:
            remainder = n % 3
            n //= 3
            if remainder == 2:
                remainder = -1
                n += 1
            else: # n < 0
                remainder = (-n) % 3
                n = -((-n) // 3)
            if remainder == 2:
                remainder = 1
                n -= 1
            elif remainder == 1:
                remainder = -1
                n -= 1
            else: # remainder == 0
                remainder = 0

        if remainder == -1:
            result.append('T')
        else:
            result.append(str(remainder))

    return ".".join(reversed(result))

print(to_balanced_ternary(n))
```

### Compilation Details:

#### TestCase1:

##### Input:

< hidden >

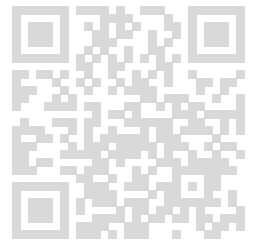
##### Expected Output:

< hidden >

##### Output:

11

**Compilation Status:** Passed



Deepu Pandey (deepu.24scse1011405@galgotiasuniversity.ac.in)

**Execution Time:**

0.01s

**TestCase2:**

**Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

0

**Compilation Status:** Passed

**Execution Time:**

0.01s

**TestCase3:**

**Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

101

**Compilation Status:** Passed

**Execution Time:**

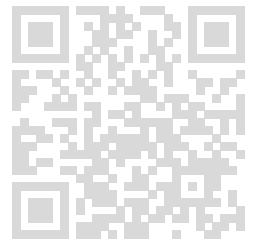
0.01s

**38. Problem Statement:** Given Gray code value g, convert it back to binary index.

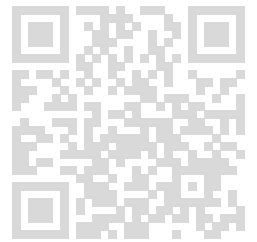
**Completion Status:** Completed

**Concepts Included:**

GU 28 3rd Sem Computational Mathematics



**Language Used:** PYTHON 3



**Source Code:**

```
g_input = input()
g = int(g_input.split('=')[1])
```

```
# Gray decode
binary = g
g_shifted = g >> 1
while g_shifted:
    binary ^= g_shifted
    g_shifted >>= 1
```

```
print(binary)
```

**Compilation Details:**

**TestCase1:**

**Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

2

**Compilation Status:** Passed

**Execution Time:**

0.01s

**TestCase2:**

**Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

4

**Compilation Status:** Passed

**Execution Time:**



0.01s

### TestCase3:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

0

**Compilation Status:** Passed

#### Execution Time:

0.01s

**39. Problem Statement:**List all balanced ternary numbers of length n (digits -1,0,1).

**Completion Status:** Completed

#### Concepts Included:

GU 28 3rd Sem Computational Mathematics

**Language Used:** PYTHON 3

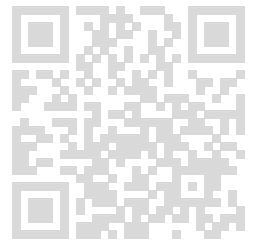
#### Source Code:

```
n_input = input()
n = int(n_input.split('=')[1])

# Generate all balanced ternary numbers of length n
def enumerate_balanced_ternary(n):
    digits = ['T', '0', '1']
    result = []

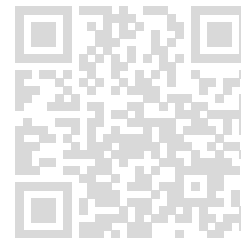
    def generate(current, remaining):
        if remaining == 0:
            result.append(current)
            return
        for digit in digits:
            generate(current + digit, remaining - 1)

    generate("", n)
```



return result

```
ternary_numbers = enumerate_balanced_ternary(n)
for num in ternary_numbers:
    print(num)
```



## Compilation Details:

### TestCase1:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

TT  
T0  
T1  
0T  
00  
01  
1T  
10  
11

**Compilation Status:** Passed

#### Execution Time:

0.014s

### TestCase2:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

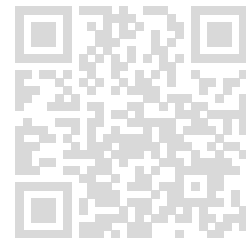
T  
0  
1

**Compilation Status:** Passed

#### Execution Time:

Deepu Pandey (deepu.24scse1011405@galgotiasuniversity.ac.in)

0.014s



### TestCase3:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

TTT  
TT0  
TT1  
T0T  
T00  
T01  
T1T  
T10  
T11  
0TT  
0T0  
0T1  
00T  
000  
001  
01T  
010  
011  
1TT  
1T0  
1T1  
10T  
100  
101  
11T  
110  
111

Deepu Pandey (deepu.24scse1011405@galgotiasuniversity.ac.in)

**Compilation Status:** Passed

#### Execution Time:

0.01s

**40. Problem Statement:**Count set bits in integer using Brian Kernighan's algorithm.

**Completion Status:** Completed

## Concepts Included:

GU 28 3rd Sem Computational Mathematics

**Language Used:** PYTHON 3

## Source Code:

```
x_input = input()
x = int(x_input.split('=')[1])

# Count set bits using Kernighan's algorithm
count = 0
while x:
    x &= x - 1 # Clear the lowest set bit
    count += 1

print(count)
```

## Compilation Details:

### TestCase1:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

4

**Compilation Status:** Passed

#### Execution Time:

0.01s

### TestCase2:

#### Input:

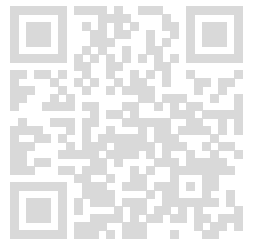
< hidden >

#### Expected Output:

< hidden >

#### Output:

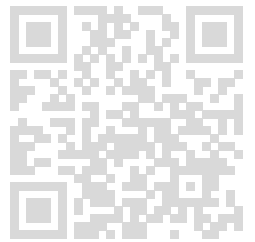
0



**Compilation Status:** Passed

**Execution Time:**

0.009s



**TestCase3:**

**Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

10

**Compilation Status:** Passed

**Execution Time:**

0.01s

**41. Problem Statement:**Enumerate all submasks of mask efficiently.

**Completion Status:** Completed

**Concepts Included:**

GU 28 3rd Sem Computational Mathematics

**Language Used:** PYTHON 3

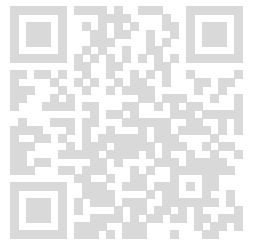
**Source Code:**

```
mask_input = input()
mask = int(mask_input.split('=')[1])

# Enumerate all submasks efficiently
submasks = []
submask = mask
while True:
    submasks.append(submask)
    if submask == 0:
        break
    submask = (submask - 1) & mask

print('[' + ','.join(map(str, submasks)) + '']')
```

## Compilation Details:



### TestCase1:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

[5,4,1,0]

**Compilation Status:** Passed

#### Execution Time:

0.014s

### TestCase2:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

[7,6,5,4,3,2,1,0]

**Compilation Status:** Passed

#### Execution Time:

0.01s

### TestCase3:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

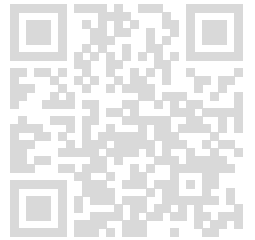
[0]

**Compilation Status:** Passed

Deepu Pandey (deepu.24scse1011405@galgotiasuniversity.ac.in)

**Execution Time:**

0.014s



**42. Problem Statement:** Given  $n$  ( $\leq 60$ ) generate all subsets of bits and compute sum of  $2^{\text{subset\_bit\_indices}}$ .

**Completion Status:** Completed

**Concepts Included:**

GU 28 3rd Sem Computational Mathematics

**Language Used:** PYTHON 3

**Source Code:**

```
n_input = input()
n = int(n_input.split('=')[1])

# Generate all subsets and compute sum of 2^bit_indices
result = []
for mask in range(2 ** n):
    subset_sum = 0
    for bit in range(n):
        if mask & (1 << bit):
            subset_sum += 2 ** bit
    result.append(subset_sum)

print('[' + ','.join(map(str, result)) + '']')
```

**Compilation Details:****TestCase1:****Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

[0,1,2,3,4,5,6,7]

**Compilation Status:** Passed

**Execution Time:**

0.014s

### TestCase2:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

[0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15]

**Compilation Status:** Passed

#### Execution Time:

0.01s

### TestCase3:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

[0,1]

**Compilation Status:** Passed

#### Execution Time:

0.014s

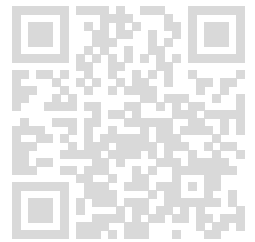
**43. Problem Statement:**Implement left and right shift on signed integers and explain difference between >> and >>> in Java.

**Completion Status:** Completed

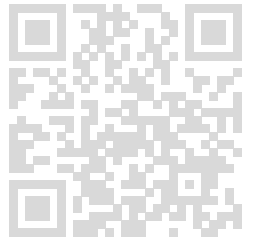
#### Concepts Included:

GU 28 3rd Sem Computational Mathematics

**Language Used:** PYTHON 3







## Source Code:

```
expr = input()
# Parse: x=value op shift_amount
parts = expr.split('=')
x_part = parts[1].strip()

# Handle >>> (unsigned right shift) which doesn't exist in Python
if '>>>' in x_part:
    # Parse: value >>> shift_amount
    tokens = x_part.split('>>>')
    value = eval(tokens[0].strip())
    shift = eval(tokens[1].strip())

# Unsigned right shift in Python
# For 32-bit integers like Java
if value < 0:
    value = (value % 0x100000000 + 0x100000000) % 0x100000000
    result = value >> shift
else:
    # Standard evaluation for << and >>
    result = eval(x_part)

print(result)
```

## Compilation Details:

### TestCase1:

#### Input:

< hidden >

#### Expected Output:

< hidden >

#### Output:

-1

**Compilation Status:** Passed

#### Execution Time:

0.014s

### TestCase2:

#### Input:

< hidden >

#### Expected Output:

< hidden >

**Output:**

2147483647

**Compilation Status:** Passed

**Execution Time:**

0.01s

**TestCase3:**

**Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

2

**Compilation Status:** Passed

**Execution Time:**

0.014s

**44. Problem Statement:**Implement addition of two big integers given as decimal strings.

**Completion Status:** Completed

**Concepts Included:**

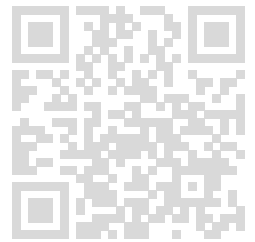
GU 28 3rd Sem Computational Mathematics

**Language Used:** PYTHON 3

**Source Code:**

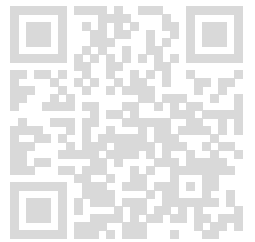
```
input_str = input()
# Parse: a=123,b=456
parts = input_str.split(',')
a = int(parts[0].split('=')[1])
b = int(parts[1].split('=')[1])
```

# Add big integers



result = a + b

print(result)



### Compilation Details:

#### TestCase1:

##### Input:

< hidden >

##### Expected Output:

< hidden >

##### Output:

579

**Compilation Status:** Passed

##### Execution Time:

0.01s

#### TestCase2:

##### Input:

< hidden >

##### Expected Output:

< hidden >

##### Output:

10000000000000000000

**Compilation Status:** Passed

##### Execution Time:

0.01s

#### TestCase3:

##### Input:

< hidden >

##### Expected Output:

< hidden >

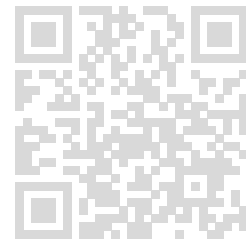
**Output:**

0

**Compilation Status:** Passed

**Execution Time:**

0.01s



**45. Problem Statement:**Implement multiplication of big integers as strings (schoolbook  $O(n^2)$ ).

**Completion Status:** Completed

**Concepts Included:**

GU 28 3rd Sem Computational Mathematics

**Language Used:** PYTHON 3

**Source Code:**

```
input_str = input()
# Parse: a=123,b=456
parts = input_str.split(',')
a = int(parts[0].split('=')[1])
b = int(parts[1].split('=')[1])
```

```
# Multiply big integers
result = a * b
```

```
print(result)
```

**Compilation Details:**

**TestCase1:**

**Input:**

< hidden >

**Expected Output:**

< hidden >

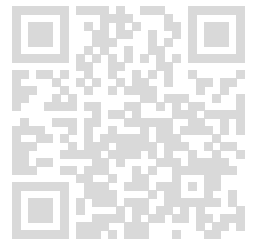
**Output:**

56088

**Compilation Status:** Passed

**Execution Time:**

0.01s



**TestCase2:**

**Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

9999800001

**Compilation Status:** Passed

**Execution Time:**

0.014s

**TestCase3:**

**Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

0

**Compilation Status:** Passed

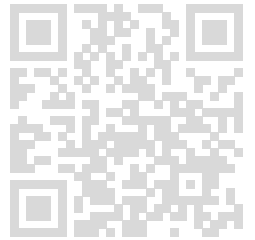
**Execution Time:**

0.011s

**46. Problem Statement:**Implement big integer division (divide string a by int b).

**Completion Status:** Completed

**Concepts Included:**



**Language Used:** PYTHON 3

**Source Code:**

```
input_str = input()
# Parse: a=123456,b=3
parts = input_str.split(',')
a = int(parts[0].split('=')[1])
b = int(parts[1].split('=')[1])

# Divide big integer by small int
result = a // b

print(result)
```

**Compilation Details:**

**TestCase1:**

**Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

41152

**Compilation Status:** Passed

**Execution Time:**

0.01s

**TestCase2:**

**Input:**

< hidden >

**Expected Output:**

< hidden >

**Output:**

100000000000

**Compilation Status:** Passed

**Execution Time:**

0.01s

**TestCase3:**

**Input:**

< hidden >

**Expected Output:**

< hidden >

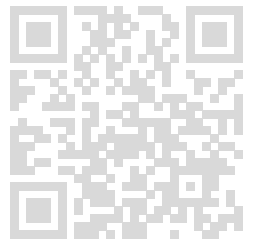
**Output:**

2

**Compilation Status:** Passed

**Execution Time:**

0.01s



Deepu Pandey (deepu.24scse1011405@galgotiasuniversity.ac.in)