3-Laboratory work

You have a total of 18 assignments. You need to complete all the assignments before the next lesson. All these assignments are graded with a maximum of **10 points**.

1. Write a C++ program which will take integer numbers as an input until 0 is entered; Program also should display overall amount of entered numbers and their average meaning

Input:
5
10
-3
7
0
Output:
Total numbers entered: 4. Average of entered numbers: 4.75

2. Write a C++ program which will take integer numbers as an input until 0 is entered; Program also should display the maximum number among them (do not use arrays)

Input:
3
5
2
8
7
0
Output: The maximum number entered is: 8

3. Given an integer N, print all squares of natural numbers not exceeding N in ascending order.

Input: 50
Output: 1 4 9 16 25 36 49

4. Given an integer not less than 2. Output its smallest natural divisor different from 1.

Input:
15

Output:
3

5.

Write a C++ program which will take integer N as an input; Program also should compute the sum of the first N numbers from the following sequence: 1, 3, 5, 7 … and so on

Input: 5

Output: The sum of the first 5 numbers in the sequence is: 25

Explanation:

The first 5 terms of the sequence are 1, 3, 5, 7, 9.

The sum of these terms is 1 + 3 + 5 + 7 + 9 = 25.

6. For a given number N, print all integer degrees of two not exceeding N in ascending order.

Input: 50

Output: 1 2 4 8 16 32

7. The program receives as input a sequence of non-negative integers, each number is written in a separate line. The sequence ends with the number 0. When reading this number, the program must finish its work and output the number of sequence members (not counting the ending number 0). The numbers following the number 0 do not need to be read. Input data format: A sequence of integers ending with the number 0 is input. Output data format: Print the answer to the task.

Input:

1
7
9
0
5

Output: 3

8. Determine the sum of all elements of the sequence ending with the number 0. Input data format: A sequence of integers ending with the number 0 is input (the number 0 itself is not included in the sequence, but serves as a sign of its end. Output data format: Print the answer to the problem.

Input:

3
6
8
0

Output: 17

9. Write a program that calculates the factorial of a given number N. The program must support large values of N using large numbers.

Input: 5
Output: 120
10. A sequence consists of natural numbers and ends with the number 0. Determine the value of the second largest element in this sequence, that is, the element that will be the largest if the largest element is removed from the sequence. Input data format: A sequence of integers ending with the number 0 is input (the number 0 itself is not included in the sequence, but serves as a sign of its end).
Output data format: Print the answer to the problem.
Input:
4
4
2
3
0
Output:
4
Input:
2
1
0
Output:
1
11. The Fibonacci sequence is defined as follows:
$F(0) = 0, F(1) = 1, \ldots, F(n) = F(n-1) + F(n-2)$.
Given a number N, determine the Nth Fibonacci number F(N).
Input: 6
Output: 8
12. The Fibonacci sequence is defined as follows:
$F(0) = 0, F(1) = 1, \ldots, F(n) = F(n-1) + F(n-2)$.
Given a natural number A. Determine which Fibonacci number it is, i.e. output such a number N that F(N) = A. If A is not a Fibonacci number, output the number -1. Input data format: A natural number A > 1 is input.
Output data format : Print the answer to the problem.
Input: 8
Output: 6
13. Given a sequence of natural numbers ending with the number 0. Determine the largest number of consecutive elements of this sequence that are equal to each other. If there are no pairs, triples, etc. of elements equal to each other, the program must print the number 1. Input data format: A sequence of natural numbers ending with the number 0 is input (the number 0 itself is not included in the sequence, but serves as a sign of its end). Output data format: Print the answer to the problem.

Input:
1
7
7
9
1
0
Output: 2
14.

An element of a sequence is called a local maximum if it is strictly greater than both the previous and the next element in the sequence. The first and last elements of the sequence are not considered local maxima. You are given a sequence of natural numbers ending with the number 0. Determine the number of strict local maxima in this sequence. Input data format: A sequence of natural numbers ending with the number 0 is input (the number 0 itself is not included in the sequence, but serves as a sign of its end). Output data format: Print the answer to the problem.

Input:
1
2
1
2
1
0
Output: 2

Explanation: In the given sequence:

- 3 is a local maximum because it is greater than 1 (previous) and 2 (next).
- 5 is a local maximum because it is greater than 2 (previous) and 4 (next).

The first and last elements are not considered local maxima, so the total number of strict local maxima is 2.

15.

Determine the smallest distance between two local maxima in a sequence of natural numbers, ending with the number 0. If the sequence does not contain two local maxima, output the number 0. The starting and ending values are not considered local maxima. The distance is defined as the

number of spaces between the elements. For an example, see the first test case.

Input Format: A sequence of integers, ending with the number 0 (the number 0 itself is not part of the sequence but serves as an indicator of its end).

Output Format: Output the answer to the problem.

Example: Consider the sequence:1 3 2 5 4 6 0

Let's find the local maxima:

- 3 is a local maximum because it is greater than 1 and 2.
- 5 is a local maximum because it is greater than 2 and 4.
- 6 is a local maximum because it is greater than 4 and 0 (which marks the end of the sequence).

Now, compute the distances between these local maxima:

- The distance between 3 (at position 2) and 5 (at position 4) is (4 - 2 - 1) = 1.
- The distance between 3 (at position 2) and 6 (at position 6) is (6 - 2 - 1) = 3.
- The distance between 5 (at position 4) and 6 (at position 6) is (6 - 4 - 1) = 1.

The smallest distance between any two local maxima is 1.

Steps to Solve:

Identify Local Maxima:

1. Traverse the sequence (excluding the first and last elements).
2. Check each element to see if it is greater than its immediate predecessor and successor. If true, mark it as a local maximum.

Compute Distances:

3. Store the positions of all identified local maxima.
4. Compute the distances between every pair of local maxima.
5. Find the minimum distance.

Handle Special Cases:

6. If fewer than two local maxima are found, output 0.