

OBJECT ORIENTED PROGRAMMING

LABORATORY 1

OBJECTIVES

The main objective of this laboratory is to get the students acquainted with the basic elements of C/C++ programs: the structure of a program, input/output operations, data types, and conditional and repetitive statements. In this laboratory it is recommended that you use C functions to read/display data to the user.

PROPOSED PROBLEMS

1. Write a simple *Hello world* program that prompts the user for his/her name and displays a greeting message.
2. Alice forgot her card's PIN code. She remembers that her PIN code had 4 digits, all the digits were distinct and in decreasing order, and that the sum of these digits was 24. Write a C++ program that prints all the PIN codes which fulfill these constraints.

Think of all the possibilities you can improve the performance of your program!

3. We all know that Easter falls on a Sunday in spring, but which one? Formally:

"Easter is celebrated on the first Sunday following the full Moon that occurs on or just after the spring equinox".

Sounds pretty complicated, but is it? According to an algorithm published in *Nature* journal in 1876¹, the algorithm for computing the catholic Easter date is the following:

$$A = \{\text{year}/19\}$$

$$B = \{\text{year}/4\}$$

$$C = \{\text{year}/7\}$$

$$D = \{(19*A + 24)/30\}$$

$$E = \{(2*B + 4*C + 6*D + 5)/7\}$$
 where $\{x/y\}$ is the remainder of the division of x to y .

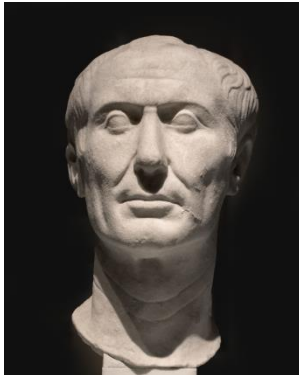
Easter day is then $(22 + E + D)$ March. Note that this formula can give a date from April if $22 + E + D > 31$; also take this case into account.

Write a program which reads a year (strictly positive integer) and displays the Easter date for that year. Create an appropriate data structure to store a date.

¹ <https://en.wikipedia.org/wiki/Computus>

Input	Expected output
1985	7 April
2008	23 March
2021	4 April

6. It is known Julius Caesar used to send his private and important military message using the following encoding: each letter from the original text is replaced by a letter situated at a fixed number of positions down the alphabet.



If he had anything confidential to say, he wrote it in cipher, that is, by so changing the order of the letters of the alphabet, that not a word could be made out. If anyone wishes to decipher these, and get at their meaning, he must substitute the fourth letter of the alphabet, namely D, for A, and so with the others. — Suetonius, Life of Julius Caesar 56

Nowadays, this is one of the simplest methods of encryption and is called a substitution cipher or Caesar's cipher.

Write a program which reads a natural number n and a string s . The string s is encoded using Caesar's cipher with a displacement of n (either positive or negative).

Decode the message and display it on the screen. Punctuation marks are left as they are.

Input	Expected output
$n = 7$ $s = \text{clup, cpkp, cpjp!}$	<i>veni, vidi, vici!</i>
$n = 10$ $s = \text{acy noybew ycdoxdk od sxswsmybew}$ $\text{sxsaesdkc eymkd. Skmdk kvok ocd!}$	<i>quo deorum ostenta et inimicorum iniquitas uocat.</i> <i>Iacta alea est!</i>

What does the program print if: $n = 5$ and the encoded string is: N qtaj tgojhy twnjisyji uwtlwfrns! ?

If you don't have any IDE (integrated development environment) installed on your machine, you can work on an online environment (https://www.onlinegdb.com/online_c_compiler) while your IDE is installing.