

02393 C++ Programming Exercises

Assignment 2

To be handed in via CodeJudge

<https://dtu.codejudge.net/02393-e19/assignments/>

In the following exercises, you will have to compute a function with an input parameter that you should read from `cin`. The result is to be provided on `cout`.

Gaussian Sum. Write a program that computes the sum $1 + 2 + \dots + n$ for a given positive integer n . For example, for $n = 100$, the result is 5050.

Another sum. Write a program that computes the sum of all even integers between 0 and n . For instance, for $n = 6$, the result is $0 + 2 + 4 + 6 = 12$.

Prime Factorization. Write a program that computes the prime factorization of a given positive integer. For instance, the factorization of 60 is $2 * 2 * 3 * 5$.

Hints:

- In C++, the modulus function `%` gives the remainder of integer division, i.e., x is divisible by y if and only if $x\%y == 0$.
- Given the number n to factorize, iterate through all the numbers $i = 2, 3, 4, 5, \dots$ and check whether i divides n . If so, print out “ $i *$ ” and continue to check the factorization of n/i . Stop when n cannot be further factorised.

In order to check with CodeJudge, please ensure that (i) the factors are printed in ascending order, (ii) between two factors print a space, an asterisk (*), and another space, (iii) and at the end there is a newline (see example above).

Approximating π . Compute an approximation of π using Leibniz’ formula:

$$\frac{\pi}{4} = \sum_{i=0}^{\infty} \frac{(-1)^i}{2i+1} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - \frac{1}{11} + \dots$$

To that end write a function with header `double pi(int n)` that computes the first n terms of the infinite summation (and then multiplies by 4). For instance for $n = 1$ we get the bad approximation 4, and with increasing n , the approximation gets better.

Hint. Note that “ i ” and “ n ” are two different things. In particular:

- for $n = 1$ you should compute 1
- for $n = 2$ you should compute the previous and $-\frac{1}{3}$
- for $n = 3$ you should compute all the previous and $\frac{1}{5}$
- ...

It is part of the assignment to figure out how to variate i to reach this goal.