

## Numerical Integration Homework 2022-2023

Practical exercises to do at home **before 17th of December**. These exercises are part of the continuous evaluation of the course. For any question, contact with Elena Formoso.

1. **Write a general program to find the roots of one-dimensional function,**

$$f(x) = e^{-x} (3.2 \sin(x) - 0.5 \cos(x))$$

**using Bolzano's methods:**

- (a) Bisection method
- (b) Regula Falsi method

Start  $a = 3$  and  $b = 4$ . The program should check whether the values of the function at those points are of different sign, otherwise (if that condition is not fulfilled) the program should ask for two new starting points. Impose a convergence threshold  $10^{-8}$ .

2. **Write a general program to find the minimum of one-dimensional function,**

$$f(x) = x^2 - x$$

**using one-dimensional Newton-Raphson method.**

Take initial point at  $x_0 = 3$  and impose a convergence threshold  $10^{-8}$ . Calculate the gradient and second derivative numerically applying the finite difference method (use subroutines). The program should print at each iteration step the value of  $x$ ,  $f(x)$  and gradient.