

Lab 0. Preliminary

1 Instructions

- Make a **pdf** report including the solution to each point of the practice with name *Lab0_name_lastname.pdf*.
- Send the report and all created files in a rar or zip file with name *Lab0_name_lastname.rar* in the Moodle.
- You are allowed to use internet, notes, and .m files that you have created before.

2 Understanding

- (0.5 points) Use three-digit rounding arithmetic to compute the following sums:

a) $\sum_{k=1}^6 \frac{1}{3^k}$

b) $\sum_{k=1}^6 \frac{1}{3^{7-k}}$

- (1.0 points) *Improving the Quadratic Formula.* Assume that $a \neq 0$ and $b^2 - 4ac > 0$ and consider the equation $ax^2 + bx + c = 0$. The roots can be computed with the quadratic formulas

$$x_1 = \frac{-b + \sqrt{b^2 - 4ac}}{2a}, \quad x_2 = \frac{-b - \sqrt{b^2 - 4ac}}{2a}. \quad (1)$$

Show that these roots can be calculated with the equivalent formulas

$$x_1 = \frac{-2c}{b + \sqrt{b^2 - 4ac}}, \quad x_2 = \frac{-2c}{b - \sqrt{b^2 - 4ac}}. \quad (2)$$

Hint. Rationalize the numerators in (1). Remark. In the cases when $|b| \approx \sqrt{b^2 - 4ac}$, one must proceed with caution to avoid loss of precision due to a catastrophic cancellation. If $b > 0$, then x_1 should be computed with formula (2), and x_2 should be computed using (1). However, if $b < 0$, then x_1 should be computed using (1), and x_2 should be computed using (2).

3 Implementing

- (2.0 points) Create a Matlab function called *floating_point_function_name_lastname()* to determine the floating point format to stored decimal numbers in a computer with 32 bits of precision. Use the following numbers to test your function:
 - a) 1612.078125_{10}
 - b) 6317.9136_{10}
 - c) -962.0153_{10}
- (1.5 points) Use the results obtained in *Improving the Quadratic Formula* to construct a Matlab program that will accurately compute the roots of a quadratic equation in all situations, including the troublesome ones when $|b| \approx \sqrt{b^2 - 4ac}$.