Lab Assignment - 1

MTH 308 and MTH 308B : Numerical Analysis and Scientific Computing-I

Department of Mathematics and Statistics, IIT Kanpur

Semester: January-April, 2024 (Even),

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1. Write a C/Matlab program to solve the quadratic equation

$$ax^2 + bx + c = 0$$

using the standard quadratic formula

$$x_{\pm} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a},$$

or the alternative formula

$$x_{\pm} = \frac{2c}{-b \mp \sqrt{b^2 - 4ac}}.$$

Your program should accept values for the coefficients a, b, and c as input and produce the two roots of the equation as output. Your program should detect when the roots are not real, but need not use complex arithmetic explicitly (for example, you could return the real and imaginary parts of the complex conjugate roots in this case). You should guard against unnecessary overflow, underflow, and cancellation. Try to make your program robust when given unusual input values, such as $a = 0$ or $c = 0$, which otherwise would make one of the formulas fail. Test your program using the following values for the coefficients:

a	b	c
6	5	-4
6×10^{154}	5×10^{154}	-4×10^{154}
1	-10^5	1
1	-4	3.999999
10^{-155}	-10^{155}	10^{155}.

2. Write a C/Matlab program to determine approximate values for ϵ_{mach}. Print the resulting values in decimal and also try to determine the number of bits in the mantissa.

End.