Computing Assignment 1

Using If Statement

In my opinion, the first key step of this computing assignment is to determine when to use equation (1.1), (1.2), and (1.3). Upon figuring out which equation is used, we can easily get the most accurate approximation answers. Therefore, considering the cancellation errors, I used "if" statement within the Matlab as usual as other programming languages. "If" statement instructs computer to test whether requirements are satisfied. The requirements in this assignment is seeking which root formula would cause cancellation error. Then it should be easy to manipulate the corresponding situations.

Cancellation Error

The second key step is to find out the reasons, much closed to 0, will cause cancellation error, the solutions are going to be meaningless. I used two variables called p1, $-b+\sqrt{b^2-4ac}$ and p2, $-b-\sqrt{b^2-4ac}$ to present the first possibility and second possibility, respectively. However, computer didn't know how much is meant by "close". So, I created a new variable named "tolerance",10^{-5} to compare whether p1 or p2 is smaller or bigger than it. So, four statements should be listed. First off, When there is no cancellation error caused, which means p1 and p2 are bigger than tolerance at the same time, using root formulas, $x1 = \frac{-b+\sqrt{b^2-4ac}}{2a}, and\ x2 = \frac{-b-\sqrt{b^2-4ac}}{2a}$ directly. When p1 is smaller than tolerance only, using equation (1.2) as the solution of $x1$, and keeping the $x2$ without changes (equation 1.1). When p2 is smaller than tolerance only, which means p2 probably will cause cancelation error, using equation (1.3) as the solution of $x2$, and keeping the $x1$ without changes. When both of p1 and p2 are smaller than tolerance, using equation (1.2) as $x1$ and (1.3) as $x2$ simultaneously. For example, in question 16(a), a =1, b =$\sqrt{7}$, c =$\sqrt{2}$, by plugging into p1, being realized p1 is bigger than 10^{-5} which predicated the cancellation error will not happen—using equation 1.1. Following the same idea, remaining questions' p1 and p2 are below:

QUESTIONS	p1	p2
Q1	3.804693	1.48681
Q2	-0.49266	-25.5073
Q3	2.44574	-4.44574
Q4	17.77069	-0.45018

Implement these solutions by using equator 1.1 is most accurate approximation because Q2, Q3, and Q4 will not cause cancellation error as well. Last but not least, if equator 1.2 and 1.3 are used, it will cause more additional errors due to more rounding processing and operations needed.

The remaining steps are easy to follow. Rounding 4-digit at each necessary step. Then using formulas to obtain corresponding absolute errors and relative errors.

QUESTIONS	$x1$	$x2$	Abs_ err $x1$	Abs_ err $x2$	Rel_ err $x1$	Rel_ err $x2$
Q1	1.903	0.743	6.535e-04	4.048e-04	3.345e-04	5.446e-04
Q2	-0.0784	-0.4082	8.794e-06	0.0224	1.122e-04	0.0055
Q3	1.223	-2.223	1.298e-04	1.298e-04	1.061e-04	5.838e-05
Q4	0.2250	-8.889	8.977e-05	0.0037	3.988e-04	4.115e-04

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