Numerical Analysis Homework #4
due 2021 DEC 15, 9:50 a.m.

Caution:

- To get full credit, *you must write down sufficient intermediate steps*, only giving the final answer earns you no credit!

- Please make sure that your handwriting is recognizable, otherwise you only get partial credit for the recognizable part.

1 Theoretical problems

Answer all questions in Section 2.4.1 in the notes. These problems weigh 3, 4, 7, 6, 3, 3, 4, 8, 12, 10, 5, 5 points, respectively. There are two additional problems.

A. (5 points) If the bisection method is used in single precision FPNs of IEEE 754 starting with the interval $[128, 129]$, can we compute the root with absolute accuracy $< 10^{-6}$? Why?

B. (5 points) Assume that $\sin x$ and $\cos x$ are computed with relative error within machine roundoff. Analyze the conditioning of the algorithm that computes $f(x) = \frac{\sin x}{1+\cos x}$ for $x \in (0, \pi/2)$ with

$$f_A = \text{fl}\left[\frac{\text{fl}(\sin x)}{\text{fl}\big(1 + \text{fl}(\cos x)\big)}\right]. \tag{1}$$

Thus the number of total points in this subsection is 80.

2 C++ programming

Answer all questions in Section 2.4.2 in the notes. Each of the two problems weighs 10 points.

3 Extra credits

Additional 10% credits will be given to you if you typeset your solutions in LaTeX. You are welcome to use the LaTeX template available on my webpage. You can also get partial extra credit for typesetting solutions of *some* problems.

Note: If you choose to typeset your solutions in LaTeX, you still need to turn in a hard copy in class. In addition, please upload your latex source (.tex) and supporting files in a single zip file (**format**: `YourName_Homework4.zip`) to the course email `NumApproximation@163.com`.