MATH 5610/6860
HOMEWORK #1, DUE THU SEP 10

Notes:

- Problems marked with “[EC]” are extra credit for Math 5610 students but required for Math 6860 students.
- The homework policy is in the class website (Aug 31 entry).
- Please read the guidelines for numerical experiments and submitting your homework electronically sections in the class website.
- Common abbreviations for problem sources are: B&F (Burden and Faires, the class textbook) and K&C (Kincaid and Cheney).

1. B&F 1.1.1 a,b
2. B&F 1.1.3 a,b
3. B&F 1.1.7
4. B&F 1.2.3 a
5. B&F 1.3.3
6. K&C 1.2.7: Choose the correct assertions (in each, $n \to \infty$)
   a. $(n + 1)/n^2 = o(1/n)$
   b. $(n + 1)/\sqrt{n} = o(1)$
   c. $1/\ln n = O(1/n)$
   d. $1/(n \ln n) = o(1/n)$
   e. $e^n/n^5 = O(1/n)$
7. K&C 1.2.8: The expressions $e^h$, $(1 - h^4)^{-1}$, $\cos(h)$, and $1 + \sin(h^3)$ all have the same limit as $h \to 0$. Express each in the following form with the best integer values of $\alpha$ and $\beta$.
   \[
f(h) = c + O(h^\alpha) = c + o(h^\beta)\]
8. K&C 2.1.10: Let \(x = 2^3 + 2^{-19} + 2^{-22}\). Find the machine numbers (in IEEE single precision) that are just to the left and to the right of \(x\). Determine \(\text{fl}(x)\) (rounding to the nearest machine number), the absolute error \(|\text{fl}(x) - x|\), and the relative error \(|\text{fl}(x) - x|/|x|\). Verify that the relative error in this case does not exceed \(\epsilon/2 = 2^{-24}\).
9. Verify numerically that \(\sin((2n - 1)/n^3) = O(1/n^2)\).
10. [EC] K&C 1.2.35: Show that \(x_n = o(\alpha_n) \Rightarrow x_n = O(\alpha_n)\). Show that the converse is not true.