MAT 325 Computational Mathematics

Computer Lab 1: Machine Epsilon and Taylor Series

(Due day: February 08, 2019)

A. Machine Epsilon

1. A short Matlab code (myeps_sp.m) is provided on D2L to compute machine epsilon (smallest positive machine number such that $1+eps>1$) in two ways in single precision. Try to run it in Matlab. (1 pt)
2. Modify myeps_sp.m and make a new file called myeps_dp.m to use double precision. Compare the values obtained in 1 and 2. (1 pt)
3. Matlab has a built-in constant eps. Type
   >> format long
   >> eps
   and compare your computed epsilons with the built-in one. (1 pt)

Now you know the syntax of if- and while- statements and how to program in Matlab. Let's proceed to a more complicated problem.

B. Taylor Series

Consider the problem of approximating ln(1.9) with ten digits of accuracy, using either of the following Taylor series:

(a) $\ln(1-x) = -\sum_{k=1}^{\infty}\frac{x^k}{k}$

(b) $\ln(\frac{1+x}{1-x}) = 2\sum_{k=1}^{\infty}\frac{x^{2k-1}}{2k-1}$

(Note that $\ln(1.9)$ is approximately 0.641853886172)

1. To get $\ln(1.9)$, what value of x do you have to use in series (a)? in series (b)? (1 pt)
2. Which series do you expect to be more efficient for computing $\ln(1.9)$? (…before you do the rest!) (1 pt)
3. Write a code called Taylor.m to determine how many terms you need in series (a). (2 pts)
   Your code should print out:
   - The number of terms needed,
   - The value obtained from the series,

- The error.

4. Modify your code to do the same using series (b). (2 pts)
5. Which series is more efficient for computing $\ln(1.9)$? Briefly explain why. (1 pt)

How to submit your work:

1. Create a plain txt file titled "MAT325-Lab1_<WCU_Student_Account>.txt"
2. Type your answer to each question carefully in the file.
3. Attach your code of myeps_dp.m and Taylor.m to the end of the file.
4. Submit the file onto Assignment in D2L.