Assignment #3

Due Thursday, 19 September 2018, at the start of class

Finish-up reading Chapter 4 of the textbook. Please also read Chapter 5, especially sections 5.2, 5.3, 5.4. This Assignment is about Chapter 4 only.

Remember that when you turn in homework problems involving MATLAB (or OCTAVE), the following two expectations will always apply:

1. The commands that you used must be shown, along with the results.
2. Please strive to minimize use of paper while answering the question.

Do the following exercises:

- Exercise A. Find the Taylor polynomial $P_4(x)$ for $f(x) = e^{-x}$ using $a = 2$ as a basepoint. Then use the formula for $R_4(x)$ to estimate the maximum error $|f(x) - P_4(x)|$ on the interval $[1.5, 2.5]$. Now find n so that $|f(x) - P_n(x)| \le 10^{-7}$ on the same interval. (*There is no need to compute this* $P_n(x)$.)
- Exercise B. By plotting one can see that the graphs $y = e^{-x^2}$ and $y = x^2$ cross between $x = 0.7$ and $x = 0.8$. (*You can generate such a plot, or just believe me.*) Use the secant method, and MATLAB, to find the crossing point to within 10^{-14} using $x_0 = 0.7$ and $x_1 = 0.75$. (*You may write a script, or work at the command line. In any case, do show the inputs and outputs sufficient to illustrate your understanding.*) Also use Newton's method with $x_0 = 0.75$ to do the same job. How many iterations of the secant method are needed? Of Newton's method?
- Exercise C. Consider the problem of solving $f(x) = x^3 - 7x + 2 = 0$ on the interval $[0, 1]$. (*We know from the intermediate value theorem that there* is *a solution on that interval. We have already used bisection, at least, to find it.*) Write down Newton's method for this problem as a fixed-point iteration $x_{k+1} = \varphi(x_k)$. What is $\varphi(x)$ in this case? By computing $\varphi'(x)$, and plotting it on the interval $[0, 1]$, find an interval I so that if x_0 is in I then you can be sure that Newton's method will converge.

CHAPTER 4

- Exercise 8 on page 103.
- Exercise 12 on page 104.
- Exercise 14 on page 104.
- Exercise 15 on page 104.