Aero 320: Numerical Methods
Lab Assignment 1

Fall 2013

Problem 1

Refreshing C++ basics: program structure, input-output, arithmetic operations

Write a program that asks the user to input two integers, say a and b. The program then swaps the values of these two integers. For example, if the user input is $a = 5$ and $b = 2$, then the output of your code should be $a = 2$ and $b = 5$. **Here is the tricky part:** write your code without defining any third variable other than a and b. Also, please use standard arithmetic operations (+, –, *, /) only.

Problem 2

Taylor series approximation of a function

Suppose we want to evaluate the function $f(x) = \dfrac{1}{x}$ around $x = 2$. There are two ways of doing this computation. First, **exact way**: if we know where exactly we want to evaluate, say at $x = 2.5$, then we can simply substitute $x = 2.5$ in the right-hand-side of $f(x)$ and get the *exact value* of $f(2.5)$. There is another **approximate way**: we can expand $f(x)$ about the point $x = 2$ in Taylor series up to first few terms, and then evaluate that Taylor series at $x = 2.5$. This will give you an *approximate value* of $f(2.5)$.

(a) Write a program that computes the *approximate value* of $f(2.5)$ by expanding $f(x) = \dfrac{1}{x}$ in Taylor series around $x = 2$. Keep only the first 4 terms in your Taylor series expansion.

(b) Using your code, also print the *exact value* of $f(2.5)$, the absolute error, and the relative error.