Numerical Analysis – Lab 10
Equation editor

Goals

The goals of this lab are

1. to learn the skill of technical word processing with an equation editor
2. to give you a relatively easy task for the last lab.

Equation editor

MicroSoft Word usually comes with an equation editor. To insert an equation using equation editor, pres Alt-Insert –Object. Then, from the dialog box, scroll down to select Microsoft Equation 3.0, or whatever version is available on your machine.

Some machines have MathType installed as well. MathType is a "front end" for Equation Editor that gives you a better dialog box, but doesn't really let you construct any equations you can't also construct with Equation Editor.

You can do almost everything in Equation Editor using point-and-click. This gets tiresome after a while, so it is eventually useful to learn a few shortcut key sequences. Here are some I use a lot:

cntrl-F	fraction bar
cntrl-H	exponent or superscript (H for "high")
cntrl-L	subscript (L for "low")
cntrl-I	integral sign
cntrl-space	forces a space
cntrl-G	makes the next character Greek

What to do

Reproduce the following passages using Equation Editor.

Passage 1 – following page 145 of your text:

If $n = 3$, then the two equations $c_o = 0$ and $c_n = 0$ together with the equations in (3.21) produce a linear system described by the vector equation $A\mathbf{x} = \mathbf{b}$, where A is the 4x4 matrix

$$A = \begin{bmatrix} 1 & 0 & 0 & 0 \\ h_o & 2(h_o + h_1) & h_1 & 0 \\ 0 & h_1 & 2(h_1 + h_2) & h_2 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

and **b** and **x** are the vectors

$$\mathbf{b} = \begin{bmatrix} 0 \\ \frac{3}{h_1}(a_2 - a_1) - \frac{3}{h_0}(a_1 - a_o) \\ \frac{3}{h_2}(a_3 - a_2) - \frac{3}{h_1}(a_2 - a_1) \\ 0 \end{bmatrix} \text{ and } \mathbf{c} = \begin{bmatrix} c_0 \\ c_1 \\ c_2 \\ c_3 \end{bmatrix}$$

Passage 2 – following pages 166 and 167 of your text.

A sheet of corrugated roofing is constructed by pressing a flat sheet of aluminum into one whose cross section has the form of a sine wave.

A corrugated sheet 4 feet long is needed, the height of each wave is 1 in. from the center line, and each wave has a period of approximately $2p$ in. The problem of finding the length of the initial flat sheet is one of determining the length of the curve given by $f(x) = \sin x$ from $x = 0$ in. to $x = 48$ in. From calculus we know that this length is

$$L = \int_0^{48} \sqrt{1 + \left(f'(x)\right)^2}\, dx = \int_0^{48} \sqrt{1 + \left(\cos x\right)^2}\, dx$$

so the problem reduces to evaluating this integral.

Passage 3 – a monster from page 243

Example 1: We will use the composite Simpson's rule with $h = 0.25$ to approximate the value of the improper integral

$$\int_0^1 \frac{e^x}{\sqrt{x}}\, dx\,.$$

Since the fourth Taylor polymomial for e^x about $x = 0$ is

$$P_4(x) = 1 + x + \frac{x^2}{2} + \frac{x^3}{6} + \frac{x^4}{24},$$

we have

$$\begin{aligned} \int_0^1 \frac{P_4(x)}{\sqrt{x}}\, dx &= \int_0^1 \left(x^{-1/2} + x^{1/2} + \frac{1}{2}x^{3/2} + \frac{1}{6}x^{5/2} + \frac{1}{24}x^{7/2} \right) dx \\ &= \lim_{M \to 0^+} \left[2x^{1/2} + \frac{2}{3}x^{3/2} + \frac{1}{5}x^{5/2} + \frac{1}{21}x^{7/2} + \frac{1}{108}x^{9/2} \right]_M^1 \\ &= 2 + \frac{2}{3} + \frac{1}{5} + \frac{1}{21} + \frac{1}{108} \\ &\approx 2.9235450. \end{aligned}$$

Passage 4 – Design or copy a similar passage *that you understand* and that will show off your equation editing skills.

Hand it in.

This is due in lab on December 8, or sooner.