Department of Applied Mathematics and Statistics
COLORADO SCHOOL OF MINES
MATH484: Capstone - Mathematical and Computational Modeling

Assignment #6
Due Tuesday, April 7, 2015

For problems which require computational simulation, please print and submit both your code and results (e.g., pictures).

1. Let $\eta = \frac{1}{4}, \alpha = \frac{2}{10}$, and $\beta = 2$. Use Fourier Series with $N = 15$ to solve the inverse Electron Beam Lithography problem (i.e., find and plot $D_{15}(x)$) on the spatial interval $[-1, 1]$ with $dx = 10^{-3}$ and

$$E(x) = \begin{cases} 1 & \text{if } |x| < \frac{1}{2} \\ 0 & \text{else.} \end{cases}$$

In the same figure as $D_{15}(x)$, plot $E(x)$, and compute and plot $E_{15}(x)$ - the approximation to $E(x)$ given by the first 15 terms of the Fourier Series expansion. Use a solid blue line (default) for $E(x)$, a dashed red line for $E_{15}(x)$, and a dot-dashed black line for $D_{15}(x)$.
Hint: To check your code for $D_{15}(x)$, try it with $N = 10$ and compare to Figure 3.9.

2. Do the same as for Problem 1, but use the Fejer sums (i.e. $\tilde{D}_{15}(x)$ and $\tilde{E}_{15}(x)$) instead. Compare the new dosing function approximation to the old one - how are they different and why is one better?

3. Friedman & Littman, p.82, Problem **4.6.1**
Use the implicit finite difference method included on p.82 above the problem statement with step sizes $dt = 1$ sec and $dx = 500\mu$m, and the stopping time $T = 180$ sec. After computing the solutions create two figures - one with $A(0, x)$, $A(90, x)$, and $A(180, x)$ and another with $B(0, x)$, $B(90, x)$, and $B(180, x)$. Within each of these figures, use a solid blue line (default) for the $t = 0$ solution, a dashed red line for the $t = 90$ solution, and a dot-dashed black line for the $t = 180$ solution.