

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

Assignment #3
Due Thursday, February 19, 2015

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

1. Friedman & Littman, p.34, Problem **2.4.1**

For this problem use $dt = 0.001$ and $dx = 0.1$ in order to guarantee stability and convergence of the method. For the spatial interval use $[-2, 200]$, fix the y axis in your plots to $[0, 5]$, and create a 5×1 matrix of plots on the same figure using the `subplot(m,n,position)` command.

2. Friedman & Littman, p.34, Problem **2.4.2**

Again, use $dt = 0.001$ and $dx = 0.1$, but for the spatial interval use $[-5, 15]$, fix the y axis in your plots to $[0, 0.5]$, and create a 5×2 matrix of plots on the same figure using the `subplot(m,n,position)` command.

3. Friedman & Littman, p.34, Problem **2.4.4**

Use $dt = 0.001$ and $dx = 0.1$, but for the spatial interval use $[-2, 15]$, fix the y axis in your plots to $[0, 5]$, and create a 5×2 matrix of plots for times $t = 1, \dots, 10$ on the same figure using the `subplot(m,n,position)` command.

4. Friedman & Littman, p.35, Problem **2.5.2**

You should produce a plot that looks similar to those in the text (p. 36), so define $c_0(x)$ as on p. 35. We will change a few details, though. Use $dx = dy = 0.1$, $dt = 0.01$ and fix the x - y plane to $[-20, 20] \times [-20, 20]$. The MATLAB commands

```
z = squeeze(c(n,:,:));  
surf(x,y,z', 'EdgeColor', 'none');
```

may be helpful to plot a 3D graph. Finally, compute the maximum concentration at time $t = 3$.

5. Friedman & Littman, p.37, Problem **2.6.1**

In order to reduce the computational time in producing the graphs, use $dx = 0.5$ and $dt = 0.01$. Instead of generating 2D plots as in Problem 1, generate a 2×3 (with one entry empty) matrix of 3D plots on the coordinate system defined by $(x, t, c(t, x))$ as in Fig. 2.6. Using `surf` will help with this, and to get time in the same direction as the book use

```
set(gca, 'YDir', 'reverse');
```

Additionally, be sure to answer the questions stated within the problem.