Homework 9. (Due December 10, 2008)

Math 353 Section 12, Fall 2008, University of Delaware

MatLab Exercises

1. Exercise 7.1.1 (b). (Computer Problems)
2. Exercise 7.1.3 (b). (Computer Problems)
3. Exercise 7.2.1 (a). (Computer Problems)
4. Exercise 7.2.4 (a). (Computer Problems)

Exercises

1. Use
   (a) Forward difference method
   (b) Backward difference method

   to approximate the solution to the following parabolic partial differential equation

$$\frac{\partial u}{\partial t} - 2\frac{\partial^2 u}{\partial x^2} = 0, \;\; 0 < x < 2, \;\; 0 < t \leq 0.02;$$

   with initial and boundary conditions

$$u(x,0) = \sin\left(\frac{\pi}{2}x\right), \;\; 0 \leq x \leq 2.$$

$$u(0,t) = u(2,t) = 0, \;\; 0 < t,$$

   Take $\triangle x = 0.5$ and $\triangle t = 0.01$. Compare your results to the exact solution $u(x,t) = e^{-(\pi^2/4)t}\sin(\frac{\pi}{2}x)$ and plot them.

2. Approximate the solution of the following wave equation using the finite difference method with $\triangle x = 1/3$ and $\triangle t = 0.1$.

$$\frac{\partial^2 u}{\partial t^2} = 4\frac{\partial^2 u}{\partial x^2}, \;\; 0 < x < 1, \;\; 0 < t \leq 0.2;$$

   with initial and boundary conditions

$$u(x,0) = 1, \;\; \frac{\partial u}{\partial t}(x,0) = 2x, \;\; 0 \leq x \leq 1,$$

$$u(0,t) = 0, \;\; u(1,t) = 0, \;\; 0 < t.$$