Numerical Partial Differential Equations 1
Homework 2

(Due: Dec. 8, 2005)

1. Problem 1

   Chapter 2, page 37, Exercise 2.2 of the "LeVeque notes."

2. Problem 2

   Chapter 2, page 37, Exercise 2.3 of the "LeVeque notes."

3. Problem 3

   Use (2.10) to write a program to solve the boundary value problem using the direct solver, cg method and inverse matrix:

$$u''(x) = f(x) \qquad \text{for } -1 < x < 1 \tag{1}$$

$$u(-1) = \alpha, \qquad u(1) = \beta. \tag{2}$$

   Solve the problem with various grid sizes and the conditions below

   - $f(x) = 2$, $\alpha = \beta = 1$
   - $f(x) = 12x^2$, $\alpha = \beta = 1$
   - $f(x) = e^x$, $\alpha = e^{-1}$, $\beta = e^1$

   Discuss the results.

4. Problem 4

   Use (3.10) to write a program to solve the boundary value problem using the direct solver, cg method and inverse matrix

$$\triangle u = f(x, y) \quad \text{for } (x, y) \in \Omega = [-1, 1] \times [-1, 1] \tag{3}$$

$$u_{\partial\Omega} = g(x, y) \tag{4}$$

   Solve the problem with various grid sizes and the conditions below

   - $f(x) = 4$, $g(x, y) = x^2 + y^2$
   - $f(x) = 2e^{x+y}$, $g(x, y) = e^{x+y}$

   Discuss the results.