# MATH 546
# Numerical Analysis of Elliptic PDEs

**Homework assignment 3**
*Date assigned:* November 3, 2008
*Due date:* **November 14, 2008**

- Include a cover page and *this* problem sheet
- Include the printout of your program(s) (if any) for completeness

**PROBLEMS:**
Consider the following Neumann problem:

$$\begin{cases} -\Delta u = f \equiv e^{x+y} \text{ in } \Omega, \\ \frac{\partial u}{\partial n} = g \equiv \frac{1}{2} e^{x+y} \text{ on } \partial\Omega. \end{cases} \tag{1}$$

Let $\Omega$ be square $(0,1) \times (0,1)$.

1. Consider first order approximation of boundary conditions
   - Construct finite-difference approximation of problem (1) with $\Delta x = \Delta y = 1/4$
   - Build matrix $A$ corresponding to the approximate problem.
2. Consider second order approximation of boundary conditions
   - Construct finite-difference approximation of problem (1) with $\Delta x = \Delta y = 1/4$
   - Build matrix $A$ corresponding to the approximate problem.
3. Verify that (1) satisfies the compatability condition.
4. Calculate eigenvalues and eigenvectors associated with Jacobi iteration matrix for matrix $A$ computed in parts 1 and 2. Based on your result what can you say about convergence of Jacobi iteration applied to (1)?