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# MATH 546

## Numerical Analysis of Elliptic PDEs

### Homework assignment 2

*Date assigned:* October 3, 2008

*Due date:* **October 17, 2008**

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

#### **PROBLEM:**

Consider the following Dirichlet problem:

$$\begin{cases} -\Delta u = -\sin \pi x \sin 2\pi y & \text{in } \Omega \\ u = 0 & \text{on } \partial\Omega. \end{cases} \quad (1)$$

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

- Use Gauss-Seidel and SOR schemes to find an approximate solution of problem (1) with  $\Delta x = \Delta y = 1/10$ .
- Use two stopping criteria: difference of two successive iterations and residual in  $l_2$  and sup-norm with tolerance  $10^{-5}$ .
- What is the optimal value of  $\omega_b$  for the SOR method?
- For each scheme show the following information

Iteration number	$\ x^{k+1} - x^k\ _2$	$\ r^{k+1}\ _2$	$\ x^{k+1} - x^k\ _\infty$	$\ r^{k+1}\ _\infty$
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- Plot the solutions you obtained