MAPL 600 / CMSC 760 Fall 2007
Take-Home Exam 4
Show all work.
All work must be your own (i.e., no group efforts are allowed).
If you use a reference, cite it, or you will lose credit!

Work problems totaling 50 points.
(I’ll stop grading after that, so don’t hand in extra parts.)
Due: Friday Nov 16, 8am. (See late penalty policy on information sheet.)


3. (15) Modify the multigrid program at http://www.cs.umd.edu/users/oleary/SCSCwebpage/cs_multigrid to use the Richardson iteration (Saad p. 114) instead of Gauss-Seidel as a smoother. Compare the performance of the two methods on the sample problems, using various values of $\alpha$.

4. (5-35 points) Use GMRES to solve $Ax = b$ where $A$ is the matrix obtained from load west0479. Set the true solution to be the vector with every entry equal to 1. Use a restart parameter of 20 and a tolerance of $10^{-4}$. Experiment with various options for the preconditioner:

   • (5) luinc changing the drop tolerance.
   • (5) luinc using the modified version to preserve row sums.
   • (5) luinc using a matrix reordering before factorization.
   • (5) luinc using left, right, and two-sided preconditioning.
   • (15) approximate inverse preconditioning.

Compare the performance of the methods with the performance of no preconditioner. Discuss.