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.)

1. (15) Saad p.447, problem 3.

2. (15) Saad p. 448, problem 15 See Saad p. 114 for the Richardson iteration.

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 α.

4. (5-35 points) Use GMRES to solve $\mathbf{Ax} = \mathbf{b}$ where $\mathbf{A}$ 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.