

Math 5600 Homework # 2 (due February 18)

Note: For computational problems include the detailed output of your computations (always choose the option with all intermediate data). For theoretical problems show your work. No credit will be awarded if the work is not shown.

1 (c, 10 points)

Solve the system 5(d) on page 369 using Maple with three-digit rounding arithmetic and:

- (a) Gaussian elimination;
 - (b) Gaussian elimination with partial pivoting;
 - (c) Gaussian elimination with scaled partial pivoting.
- Comment on the results.

Hint: Add an operator

$$\text{Digits} := 3;$$

at the beginning of the Maple file.

2 (c, 10 points)

Solve the system 1(c) on page 451 with:

- (a) Jacobi method;
- (b) Gauss-Seidel method.

How many iterations do you need in each case to achieve a tolerance of $1.E - 3$ in l_∞ norm?

3 (th, 10 points)

Prove Theorem 6.29, page 409.

Hint: Use the formulas on page 408 and induction on i to show that

$$|u_{i-1,i}| < 1, \quad i = 2, 3, \dots, n,$$

$$|a_{i,i}| - |a_{i,i-1}| < |l_{i,i}| < |a_{i,i}| + |a_{i,i-1}|, \quad i = 2, 3, \dots, n.$$

Explain why these formulas imply that $l_{i,i} \neq 0$ for all $i = 1, 2, \dots, n$.

4 (th, 10 points)

Problem 7, page 464.

5 (c, 10 points)

Use the conjugate gradient method (no pre-conditioning) to solve the linear system 1(c) on Page 451. Use the vector $(0, 0, 0, 0)^t$ as an initial guess. How many iterations do you need to achieve a tolerance of $1.E - 3$ in l_∞ norm? Compare the results to those you got for problem # 2.