ASSIGNMENT 4 - Solution

Problem 4 - Solution

A MATLAB program for this homework is posted at the course website. The results are shown in the following table.

ϵ	Error w/o Pivoting	Error Iterative Refinement	Error w. Pivoting
1e-002	6.6613e-016	2.2204e-016	0.0000e+000
1e-004	1.1058e-013	0.0000e+000	0.0000e+000
1e-006	2.8755e-011	2.4825e-016	0.0000e+000
1e-008	6.0775e-009	1.1102e-016	0.0000e+000
1e-010	8.2740e-008	2.2204e-016	0.0000e+000
1e-012	1.3314e-004	0.0000e+000	3.1402e-016
1e-014	7.9928e-004	1.1102e-016	0.0000e+000
1e-016	1.0000e+000	2.4825e-016	1.1102e-016
1e-018	1.0000e+000	0.0000e+000	0.0000e+000
1e-020	1.0000e+000	0.0000e+000	0.0000e+000

Comments on the results:

1. When LU factorization without pivoting is used to solve the linear system, the resulting solution begins to deteriorate when ϵ is smaller than about $1e - 012$.

2. When one step of iterative refinement is performed on the solution obtained from LU factorization without pivoting, the resulting solution is accurate to within machine epsilon.

3. Solution is always accurate, with errors less than the machine epsilon, if LU factorization with row pivoting is used.