AMSC/CMSC 660 Quiz 5 , Fall 2009

Show all work. You may leave arithmetic expressions in any form that a calculator could evaluate. By putting your name on this paper, you agree to abide by the university's code of academic integrity in completing the quiz. Use no books, calculators, cellphones, other electronic devices, communication with others, scratchpaper, etc.

Name _____

1. (10) Recall our error bound for $\boldsymbol{x}_c$ as an approximate solution to $\boldsymbol{A}\boldsymbol{x}_{true} = \boldsymbol{b}$:

$$\frac{\|\boldsymbol{x}_c - \boldsymbol{x}_{true}\|}{\|\boldsymbol{x}_{true}\|} \leq \|\boldsymbol{A}\|\|\boldsymbol{A}^{-1}\|\frac{\|\boldsymbol{b} - \boldsymbol{A}\boldsymbol{x}_c\|}{\|\boldsymbol{b}\|}.$$

Apply this result to bound the relative error in $\boldsymbol{x}_c = [1.1, 3.2]^T$ as an approximate solution to

$$\begin{bmatrix} 2 & 0 \\ 0 & 5 \end{bmatrix} \boldsymbol{x}_{true} = \begin{bmatrix} 2 \\ 15 \end{bmatrix}.$$

Use the 1-norm:

$$\|\boldsymbol{x}\|_1 = \sum_{i=1}^{n} |x_i|, \quad \|\boldsymbol{A}\|_1 = \max_j \sum_{i=1}^{n} |a_{ij}|.$$

2. (10) Let $\boldsymbol{A}$ be an $n \times n$ matrix, and consider the following code segment:

```
for i=1:n-1,
    mult = a(i+1:n,i)/a(i,i);
    a(i+1:n,i+1:n) = a(i+1:n,i+1:n) - mult * a(i,i+1:n);
end
```

2a. (5) Show that the resulting entries in the upper triangular portion of $\boldsymbol{A}$ are the same as in the $\boldsymbol{U}$ matrix obtained from Gauss elimination (LU factorization) without pivoting.

2b. (5) Is this algorithm column oriented? Explain.