

CSC338: Midterm Review

1. What is the smallest subnormal floating-point number in a system $F(\beta, p, L, U)$?

2. Assume that

$$A = \begin{bmatrix} 3 & -2 & 1 \\ -2 & 5 & -2 \\ 1 & -4.5 & -4 \end{bmatrix} \quad b = \begin{bmatrix} 3 \\ -5 \\ 1 \end{bmatrix}$$

What are the values of $\|x\|_1$, $\|x\|_2$, $\|x\|_\infty$, $\|A\|_1$, and $\|A\|_\infty$?

3. Consider the matrix A from the previous question. Bob thinks that in the decomposition $PA = LU$ of the matrix A , that $P = I$, the identity function. That is, no row exchanges will be performed as part of partial pivoting. The reason he believes so is because in A , the largest element in each row and each column is already on the diagonal. Is Bob right? Why or why not?

4. Compute the LU factorization of the below matrix, without using pivoting.

$$A = \begin{bmatrix} 4 & 8 & 4 \\ 2 & 6 & 8 \\ 1 & 3 & 5 \end{bmatrix}$$

5. Consider a real function $f(x)$, and the function $g(x) = \gamma f(x)$, where γ is a scalar. How does the condition number of g relate to the condition number of f ?
6. True or False: The conditioning of a problem depends on the algorithm used to solve it.
7. True or False: A symmetric positive definite matrix is always well-conditioned.
8. True or False: In a floating-point system, the smallest floating-point number is called the machine precision.
9. True or False: The product of two upper triangular matrices is upper triangular.