

# ECE 3340 Numerical Methods

## Homework 9: Properties of Linear Systems

Name:

ID:

### Problem 1: LUP Decomposition

Calculate the LUP decomposition of the following matrix:

$$\mathbf{A} = \begin{bmatrix} -4 & -2 & 0 \\ 6 & -6 & -7 \\ -4 & 2 & -7 \end{bmatrix}$$

$\mathbf{L} =$

$\mathbf{U} =$

$\mathbf{P} =$

### Problem 2: Matrix Inversion

Calculate the empty column of  $\mathbf{A}^{-1}$  using your previous LUP decomposition.

$$\mathbf{A}^{-1} = \begin{bmatrix} -2/13 & \boxed{\phantom{00}} & -1/26 \\ -5/26 & \boxed{\phantom{00}} & 1/13 \\ 3/91 & \boxed{\phantom{00}} & -9/91 \end{bmatrix}$$

### Problem 3: Condition Numbers

The condition number of a Hilbert matrix scales as  $O\left(\frac{(1+\sqrt{2})^{4n}}{\sqrt{n}}\right)$ . What is the largest Hilbert matrix that can be numerically solved using IEEE octuple (256-bit) precision (1 signed bit, 236-bit mantissa, 19-bit exponent) while still providing at least a 32 bits of precision?

$n =$