Math 341 - Winter 2014	**Final**	**Name: ____________________**
Randall Paul	**Part II**	**No Calculators (120 minutes)**

1. Find an orthogonal basis for the span of the vectors below using the Gram-Schmidt process.

$$\left\{ \begin{bmatrix} 1 \\ -1 \\ 0 \\ 1 \\ 1 \end{bmatrix}, \begin{bmatrix} 3 \\ -3 \\ 2 \\ 5 \\ 5 \end{bmatrix}, \begin{bmatrix} 5 \\ 1 \\ 3 \\ 2 \\ 8 \end{bmatrix} \right\}$$

2. Write the vector form of the solution to the system:

$$\begin{array}{rrrl} x & +3y & -2z & = 1 \\ 2x & +5y & -z & = 5 \end{array}$$

3. Let $W \subset \mathbb{R}^3$ be the subspace with orthogonal basis

$$W = \text{span}\left\{ \begin{bmatrix} 3 \\ -1 \\ 2 \end{bmatrix}, \begin{bmatrix} 1 \\ 5 \\ 1 \end{bmatrix} \right\} \qquad \vec{v} = \begin{bmatrix} 1 \\ 1 \\ 3 \end{bmatrix}$$

(a) Find the projection of $\vec{v}$ onto W.

(b) Write the standard matrix for the linear transformation: $\text{proj}_W(\vec{u})$.

4. Find the LU decomposition of the matrix A.

$$A = \begin{bmatrix} 1 & -2 & -2 & -3 \\ 3 & -9 & 0 & -9 \\ -1 & 2 & 4 & 7 \\ -3 & -6 & 26 & 2 \end{bmatrix}$$

5. Let B be the matrix $\begin{bmatrix} 9 & -10 \\ 5 & -5 \end{bmatrix}$

(a) Find the eigenvalues of B.

(b) Find matrix P and matrix $C = \begin{bmatrix} a & -b \\ b & a \end{bmatrix}$ so that $B = PCP^{-1}$.