# Math 3013
## Problem Set 9

1. Find a basis for the orthogonal complement $W^{\perp}$ of each of the subspaces given below>

(a) $W = span\left([1,1,0],[1,0,1]\right)$ in $\mathbb{R}^3$

(b) $W =$ solution set of $x + y - z = 0$

2. For each vector $\mathbf{v}$ and subspace $W$ below, determine the othogonal decomposition $\mathbf{v} = \mathbf{v}_W + \mathbf{v}_{\perp}$ of $\mathbf{v}$ with respect to $W$.

(a) $\mathbf{v} = \begin{bmatrix} 3 \\ 1 \\ -2 \end{bmatrix}$, $W = span\left(\begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}, \begin{bmatrix} 1 \\ -1 \\ 0 \end{bmatrix}\right)$

(b) $\mathbf{v} = \begin{bmatrix} 2 \\ -1 \\ 5 \\ 6 \end{bmatrix}$, $W = span\left(\begin{bmatrix} 1 \\ 1 \\ 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 \\ 0 \\ -1 \\ 1 \end{bmatrix}\right)$

3. For each set of linearly independent vectors below, apply the Gram-Schmidt process to obtain an orthogonal basis for the subspace generated by the vectors.

(a) $\left\{\begin{bmatrix} 3 \\ -3 \end{bmatrix}, \begin{bmatrix} 3 \\ 1 \end{bmatrix}\right\}$

(b $\left\{\begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}\right\}$