**Math 1553 Worksheet §6.1, §6.2**

**1.** True/False

(1) If $u$ is in subspace $W$, and $u$ is also in $W^{\perp}$, then $u = 0$.

(2) If $y$ is in subspace $W$, the orthogonal projection of $y$ onto $W$ is $y$.

(3) If $x$ is orthogonal to $v$ and $w$, then $x$ is also orthogonal to $v - w$.

**2.** Give examples

(1) two linearly independent vectors that are orthogonal to $\begin{pmatrix} 2 \\ 0 \\ -1 \end{pmatrix}$.

(2) a subspace of $\mathbf{R}^3$, $S$, such that $\dim(S^{\perp}) = 2$.

**3.** **a)** Compute dot product of every pair of two vectors from $u = \begin{pmatrix} 1/\sqrt{2} \\ 1/\sqrt{2} \\ 1 \end{pmatrix}$, $v = \begin{pmatrix} 1/\sqrt{2} \\ -1/\sqrt{2} \\ 0 \end{pmatrix}$ and $w = \begin{pmatrix} 1/\sqrt{2} \\ 1/\sqrt{2} \\ -1 \end{pmatrix}$.

**b)** What are the eigenvalues and eigenvectors of the $3 \times 3$ matrix $A = vv^T$?

**c)** What is the column space and null space of the matrix $A = vv^T$?