Math 265 Summer 2018 - Quiz 10
7/24/2018 - 10 Minutes **Name:**

Remember that your work is graded on the quality of your writing and explanation as well as the validity of the mathematics.

(1) (10 Points) Determine the unknow values a, b, c such that the three vectors are orthogonal

$$\begin{bmatrix} 3 \\ 2 \\ -5 \\ 0 \end{bmatrix}, \begin{bmatrix} -4 \\ a \\ -2 \\ 6 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \\ b \\ c \end{bmatrix}$$

Answe: If these vectors are orthogonal, we get

$$\begin{cases} -12 + 2a + 10 = 0 \\ 3 + 2 - 5b = 0 \\ -4 + a - 2b + 6c = 0 \end{cases} \Rightarrow \begin{cases} a = 1 \\ b = 1 \\ c = \frac{5}{6} \end{cases}$$

(2) (10 Points) Let $\mathbf{y} = \begin{bmatrix} 2 \\ 6 \end{bmatrix}$ and $\mathbf{u} = \begin{bmatrix} 7 \\ 1 \end{bmatrix}$. Write $\mathbf{y}$ as the sum of a vector in Span$\{\mathbf{u}\}$ and a vector orthogonal to $\mathbf{u}$.

Answer:

$$\mathbf{y} = \mathbf{y}_1 + \mathbf{y}_2$$

here $\mathbf{y}_1$ is the orthogonal projection $\mathbf{y}$ onto the line through $\mathbf{u}$ and the origin, and $\mathbf{y}_2$ is orthogonal to $\mathbf{u}$. Therefore,

$$\mathbf{y}_1 = \frac{\mathbf{y} \cdot \mathbf{u}}{\mathbf{u} \cdot \mathbf{u}}\mathbf{u} = \frac{20}{50}\mathbf{u} = \begin{bmatrix} 14/5 \\ 2/5 \end{bmatrix}$$

and

$$\mathbf{y}_2 = \mathbf{y} - \mathbf{y}_1 = \begin{bmatrix} -4/5 \\ 28/5 \end{bmatrix}$$