2018 Fall EECS205003 Linear Algebra - Quiz 7

Name: ID:

1. (a) $S = Span[v_1, v_2, v_3]$

$$u_1 = v_1 = \begin{bmatrix} 1 \\ 3 \\ 1 \\ 1 \end{bmatrix}$$

$$u_2 = v_2 - \frac{<v_2, u_1>}{\|u_1\|^2} u_1 = v_2 - \frac{6}{12} u_1 = \frac{1}{2} \begin{bmatrix} 1 \\ -1 \\ 1 \\ 1 \end{bmatrix}$$

$$u_3 = v_3 - \frac{<v_3, u_1>}{\|u_1\|^2} u_1 - \frac{<v_3, u_2>}{\|u_2\|^2} u_2 = v_3 - \frac{18}{12} u_1 - \frac{-1}{1} u_2 = \begin{bmatrix} -2 \\ 0 \\ 1 \\ 1 \end{bmatrix}$$

$$\phi_1 = \frac{1}{\sqrt{12}} \begin{bmatrix} 1 \\ 3 \\ 1 \\ 1 \end{bmatrix}, \phi_2 = \frac{1}{2} \begin{bmatrix} 1 \\ -1 \\ 1 \\ 1 \end{bmatrix}, \phi_3 = \frac{1}{\sqrt{6}} \begin{bmatrix} -2 \\ 0 \\ 1 \\ 1 \end{bmatrix},$$

(b) $Proj, s(b) = <b, \phi_1> \phi_1 + <b, \phi_2> \phi_2 + <b, \phi_3> \phi_3$

$$= \frac{7}{12} \begin{bmatrix} 1 \\ 3 \\ 1 \\ 1 \end{bmatrix} + \frac{11}{4} \begin{bmatrix} 1 \\ -1 \\ 1 \\ 1 \end{bmatrix} + \frac{-1}{3} \begin{bmatrix} -2 \\ 0 \\ 1 \\ 1 \end{bmatrix} = \begin{bmatrix} 4 \\ -1 \\ 3 \\ 3 \end{bmatrix} = p$$