I do want PDF so I can comment on it just as I am doing here. Images imbedded in a word Doc do not allow commenting on the image.

$\boxed{5.4}$ Topic 5 DQ #4

$\boxed{\#8\text{-})}$ Use gram-schmidt process to find an orthonormal basis for the subspace of R^4 spanned by $x_1 = (4,2,2,1)^T$, $x_2 = (2,0,0,2)^T$, $x_3 = (1,1,-1,1)^T$

$$A = \begin{bmatrix} 4 & 2 & 1 \\ 2 & 0 & 1 \\ 2 & 0 & -1 \\ 1 & 2 & 1 \end{bmatrix}$$
$$\quad\ \ a_1 \quad a_2 \quad a_3$$

$$r_{11} = \|a_1\| = \sqrt{4^2+2^2+2^2+1^2} = \sqrt{25} = \boxed{5 = r_{11}}$$

$$q_1 = \frac{1}{r_{11}} a_1 = \frac{1}{5}\begin{bmatrix} 4 \\ 2 \\ 2 \\ 1 \end{bmatrix} = \boxed{\cancel{(\tfrac{4}{5}, \tfrac{2}{5}, \tfrac{2}{5}, \tfrac{1}{5})}} = \boxed{q_1 = \begin{bmatrix} 4/5 \\ 2/5 \\ 2/5 \\ 1/5 \end{bmatrix}}$$

$$r_{12} = \langle a_2, q_1 \rangle = q_1^T a_2 = \left(\tfrac{4}{5}, \tfrac{2}{5}, \tfrac{2}{5}, \tfrac{1}{5}\right)^T \begin{bmatrix} 2 \\ 0 \\ 0 \\ 2 \end{bmatrix} = \boxed{2 = r_{12}}$$

$$p_1 = r_{12} q_1 = 2 \cdot \left(\tfrac{4}{5}, \tfrac{2}{5}, \tfrac{2}{5}, \tfrac{1}{5}\right) = \boxed{\left(\tfrac{8}{5}, \tfrac{4}{5}, \tfrac{4}{5}, \tfrac{2}{5}\right) = p_1}$$

$$r_{22} = \|a_2 - p_1\| = \begin{bmatrix} 2 \\ 0 \\ 0 \\ 2 \end{bmatrix} - \begin{bmatrix} 8/5 \\ 4/5 \\ 4/5 \\ 2/5 \end{bmatrix} = \left\| \begin{bmatrix} 2/5 \\ -4/5 \\ -4/5 \\ 8/5 \end{bmatrix} \right\| = \sqrt{\left(\tfrac{2}{5}\right)^2 + \left(-\tfrac{4}{5}\right)^2 + \left(-\tfrac{4}{5}\right)^2 + \left(\tfrac{8}{5}\right)^2}$$
$$= \sqrt{\tfrac{100}{25}} = \sqrt{4} = \boxed{2 = r_{22}}$$

$$q_2 = \frac{1}{r_{22}}(a_2 - p_1) = \frac{1}{2}\left(\begin{bmatrix} 2 \\ 0 \\ 0 \\ 2 \end{bmatrix} - \begin{bmatrix} 8/5 \\ 4/5 \\ 4/5 \\ 2/5 \end{bmatrix}\right) = \boxed{\begin{bmatrix} 1/5 \\ -2/5 \\ -2/5 \\ 4/5 \end{bmatrix} = q_2}$$

$$r_{13} = \langle a_3, q_1 \rangle = \begin{bmatrix} 1 \\ 1 \\ -1 \\ 1 \end{bmatrix} \cdot \begin{bmatrix} 4/5 \\ 2/5 \\ 2/5 \\ 1/5 \end{bmatrix} = \boxed{1 = r_{13}}$$

$$r_{23} = \langle a_3, q_2 \rangle = q_2^T a_3 = \begin{bmatrix} 1/5 & -2/5 & -2/5 & 4/5 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \\ -1 \\ 1 \end{bmatrix} = \boxed{1 = r_{23}}$$

If you create PDFs by taking images, then putting them into word docs, here are a few things to think about.

By the way this is not the preferred method, it is simplest to directly use a scanning app on your phone to produce a multi-page PDF.

This image has been pasted into word with no resizing. Do not do this.

5.4

Topic 5 DQ #4

#8-) Use gram-schmidt process to find an orthonormal basis for the subspace of $\mathbb{R}^4$ spanned by $x_1 = (4,2,2,1)^T$, $x_2 = (2,0,0,2)^T$, $x_3 = (1,1,-1,1)^T$

This is better, the image was resized until the margins were hit. The best option is on the next page.

$$A = \begin{array}{c} \begin{bmatrix} 4 & 2 & 1 \\ 2 & 0 & 1 \\ 2 & 0 & -1 \\ 1 & 2 & 1 \end{bmatrix} \\ \quad a_1 \quad a_2 \quad a_3 \end{array}$$

$$r_{11} = \|a_1\| = \sqrt{4^2+2^2+2^2+1^2} = \sqrt{25} = \boxed{5 = r_{11}}$$

$$q_1 = \frac{1}{r_{11}} a_1 = \frac{1}{5}\begin{bmatrix} 4 \\ 2 \\ 2 \\ 1 \end{bmatrix} = \boxed{\cancel{\left(\tfrac{4}{5}, \tfrac{2}{5}, \tfrac{2}{5}, \tfrac{1}{5}\right)}} = \boxed{q_1 = \begin{bmatrix} 4/5 \\ 2/5 \\ 2/5 \\ 1/5 \end{bmatrix}}$$

$$r_{12} = \langle a_2, q_1 \rangle = q_1^T a_2 = \left(\tfrac{4}{5}, \tfrac{2}{5}, \tfrac{2}{5}, \tfrac{1}{5}\right)^T \begin{bmatrix} 2 \\ 0 \\ 0 \\ 2 \end{bmatrix} = \boxed{2 = r_{12}}$$

$$p_1 = r_{12} q_1 = 2 \cdot \left(\tfrac{4}{5}, \tfrac{2}{5}, \tfrac{2}{5}, \tfrac{1}{5}\right) = \boxed{\left(\tfrac{8}{5}, \tfrac{4}{5}, \tfrac{4}{5}, \tfrac{2}{5}\right) = p_1}$$

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$$= \sqrt{\tfrac{100}{25}} = \sqrt{4} = \boxed{2 = r_{22}}$$

$$q_2 = \frac{1}{r_{22}}(a_2 - p_1) = \frac{1}{2}\left(\begin{bmatrix} 2 \\ 0 \\ 0 \\ 2 \end{bmatrix} - \begin{bmatrix} 8/5 \\ 4/5 \\ 4/5 \\ 2/5 \end{bmatrix}\right) = \boxed{\begin{bmatrix} \frac{1}{5} \\ -2/5 \\ -2/5 \\ 4/5 \end{bmatrix} = q_2}$$

$$r_{13} = \langle a_3, q_1 \rangle = \begin{bmatrix} 1 \\ 1 \\ -1 \\ 1 \end{bmatrix} \cdot \begin{bmatrix} 4/5 \\ 2/5 \\ 2/5 \\ 1/5 \end{bmatrix} = \boxed{1 = r_{13}}$$

$$r_{23} = \langle a_3, q_2 \rangle = q_2^T a_3 = \begin{bmatrix} 1/5 & -2/5 & -2/5 & 4/5 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \\ -1 \\ 1 \end{bmatrix} = \boxed{1 = r_{23}}$$

$\boxed{5.4}$

Topic 5 DQ #4

$\boxed{\#8.)}$ Use gram-schmidt process to find an orthonormal basis for the subspace of R^4 spanned by $x_1 = (4,2,2,1)^T$, $x_2 = (2,0,0,2)^T$, $x_3 = (1,1,-1,1)^T$

Set the margins to ALL be 0" so you can fill the page with the image.

$$A = \begin{bmatrix} 4 & 2 & 1 \\ 2 & 0 & 1 \\ 2 & 0 & -1 \\ 1 & 2 & 1 \end{bmatrix}$$
$$\quad a_1 \;\; a_2 \;\; a_3$$

$$r_{11} = \|a_1\| = \sqrt{4^2+2^2+2^2+1^2} = \sqrt{25} = \boxed{5 = r_{11}}$$

$$q_1 = \frac{1}{r_{11}} a_1 = \frac{1}{5}\begin{bmatrix}4\\2\\2\\1\end{bmatrix} = \boxed{q_1 = \begin{bmatrix}4/5\\2/5\\2/5\\1/5\end{bmatrix}}$$

$$r_{12} = \langle a_2, q_1 \rangle = q_1^T a_2 = \left(\frac{4}{5}, \frac{2}{5}, \frac{2}{5}, \frac{1}{5}\right)^T \begin{bmatrix}2\\0\\0\\2\end{bmatrix} = \boxed{2 = r_{12}}$$

$$p_1 = r_{12} q_1 = 2\cdot\left(\frac{4}{5}, \frac{2}{5}, \frac{2}{5}, \frac{1}{5}\right) = \boxed{\left(\frac{8}{5}, \frac{4}{5}, \frac{4}{5}, \frac{2}{5}\right) = p_1}$$

$$r_{22} = \|a_2 - p_1\| = \begin{bmatrix}2\\0\\0\\2\end{bmatrix} - \begin{bmatrix}8/5\\4/5\\4/5\\2/5\end{bmatrix} = \left\|\begin{bmatrix}2/5\\-4/5\\-4/5\\8/5\end{bmatrix}\right\| = \sqrt{\left(\frac{2}{5}\right)^2 + \left(-\frac{4}{5}\right)^2 + \left(-\frac{4}{5}\right)^2 + \left(\frac{8}{5}\right)^2}$$
$$= \sqrt{\frac{100}{25}} = \sqrt{4} = \boxed{2 = r_{22}}$$

$$q_2 = \frac{1}{r_{22}}(a_2 - p_1) = \frac{1}{2}\left(\begin{bmatrix}2\\0\\0\\2\end{bmatrix} - \begin{bmatrix}8/5\\4/5\\4/5\\4/5\end{bmatrix}\right) \boxed{\begin{bmatrix}\frac{1}{5}\\-2/5\\-2/5\\4/5\end{bmatrix} = q_2}$$

$$r_{13} = \langle a_3, q_1 \rangle = \begin{bmatrix}1\\1\\-1\\1\end{bmatrix}\cdot\begin{bmatrix}4/5\\2/5\\2/5\\1/5\end{bmatrix} = \boxed{1 = r_{13}}$$

$$r_{23} = \langle a_3, q_2 \rangle = q_2^T a_3 = \begin{bmatrix}1/5 & -2/5 & -2/5 & 4/5\end{bmatrix}\begin{bmatrix}1\\1\\-1\\1\end{bmatrix} = \boxed{1 = r_{23}}$$