I asked Chonghao Bi for Q5 and Chuyun Zeng for Q3

Q1: $\vec{u}_1 = \begin{pmatrix} 1 \\ 1 \\ 0 \end{pmatrix}$

Q2: projection of v_2 onto v_1 =

$$\frac{\vec{v}_1 \cdot \vec{v}_2}{|\vec{v}_1|^2} \cdot \vec{v}_1 = \frac{5}{(\sqrt{2})^2}(1,1,0) = \left(\frac{5}{2}, \frac{5}{2}, 0\right)$$

$$\vec{u}_2 = (2,3,0) - (2.5, 2.5, 0) = (-0.5, 0.5, 0)$$

$$\vec{u}_2 = \begin{pmatrix} -0.5 \\ 0.5 \\ 0 \end{pmatrix}$$

Q3: $\vec{u}_1 \cdot \vec{u}_2$

$= (1,1,0) \cdot (-0.5, 0.5, 0)$

$= 1 \times (-0.5) + 1 \times 0.5 + 0 \times 0$

$= 0$

$\because \vec{u}_1 \cdot \vec{u}_2 = 0$

$\therefore \vec{u}_1 \perp \vec{u}_2$

Q4: Yes

Q5: $\{\vec{u}_1, \vec{u}_2\} = \begin{pmatrix} 1 & -0.5 \\ 1 & 0.5 \\ 0 & 0 \end{pmatrix}$

$$\hat{u}_1 = \frac{\vec{u}_1}{\|\vec{u}_1\|} = \frac{(1,1,0)}{\sqrt{2}} = \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}, 0\right)$$

$$\hat{u}_2 = \frac{\vec{u}_2}{\|\vec{u}_2\|} = \frac{(-0.5, 0.5, 0)}{\sqrt{\frac{1}{2}}} = \left(-\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}, 0\right)$$