

$$A = \begin{bmatrix} 1 & 1 & 2 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \end{bmatrix} = [v_1 \ v_2 \ v_3]$$

4.1: $C_3 = C_1 + C_2 \therefore$ **Yes**, it is a linear combination of first 2 col.

4.2: Basis vectors: v_1, v_2
 $\begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$ | Yes, the drone is restricted to a subspace
 It can freely move in a 2D plane, which exists in a 3D space.

4.3: $\vec{b} = \begin{bmatrix} 0 \\ 0 \\ 5 \end{bmatrix} \rightarrow$ To see if this lies in column space of 'A'.

$$k_1 \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix} + k_2 \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 5 \end{bmatrix} \left\{ \begin{array}{l} k_1 + k_2 = 0 \text{ --- ①} \\ k_1 + 0 = 0 \Rightarrow \boxed{k_1 = 0} \\ 0 + k_2 = 5 \Rightarrow \boxed{k_2 = 5} \end{array} \right.$$

3 scalars

Plugging values into ① $\rightarrow 0 + 5 = 0 \Rightarrow \boxed{5 \neq 0}$ System is inconsistent

\therefore The drone cannot fly directly upwards with this thruster config.