

Step-1

Given that $U = \begin{bmatrix} 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 \end{bmatrix}$

The column space (in \mathbb{R}^2) of U is \mathbb{R}^2

$$\{(1,0), (0,1)\}, \{(2,3), (1,0)\}, \{(1,0), (1,2)\}$$

Are three different basis for \mathbb{R}^2 .

Therefore, the three different basis for \mathbb{R}^2 is $\boxed{\{(1,0), (0,1)\}, \{(2,3), (1,0)\}, \{(1,0), (1,2)\}}$.

Therefore, $\boxed{C(U) = \text{Any bases for } \mathbb{R}^2}$.

Step-2

The row space of U is the space spanned by $\{(1,0,1,0,1), (0,1,0,1,0)\}$

$$\{(2,0,2,0,2), (0,1,0,1,0)\}, \{(1,0,1,0,1), (0,3,0,3,0)\}$$

Be two different bases for the row space of U .

Therefore, $\boxed{N(U) = (\text{row 1 and row 2}) \text{ or } (\text{row 1 and row 1+row 2})}$.