

Exam 2: Banker's (Q15 - Q18)

$$C = \begin{bmatrix} 1 & 1 & 1 \\ 2 & 2 & 4 \\ 2 & 0 & 2 \\ 3 & 3 & 4 \end{bmatrix} \quad A = \begin{bmatrix} 1 & 0 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 2 \\ 0 & 3 & 1 \end{bmatrix} \quad R = [3 \ 5 \ 6]$$

3 4 4

$$V = R - A$$

$$Q = C - A$$

$$V = R - A = [3 \ 5 \ 6] - [3 \ 4 \ 4] \\ = [0 \ 1 \ 2]$$

$$Q = C - A = \begin{bmatrix} 1 & 1 & 1 \\ 2 & 2 & 4 \\ 2 & 0 & 2 \\ 3 & 3 & 4 \end{bmatrix} - \begin{bmatrix} 1 & 0 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 2 \\ 0 & 3 & 1 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 1 & 1 & 4 \\ 1 & 0 & 0 \\ 3 & 0 & 3 \end{bmatrix}$$

- Initial $V = [0 \ 1 \ 2]$
- Final $V = [3 \ 5 \ 6]$
- Safe state? Yes, I was able to save all processes!

• $Q(P1) = [0 \ 1 \ 0], V = [0 \ 1 \ 2]$

$$\begin{array}{l} 0 \ 1 \ 0 \quad A(P1) + V = \\ 0 \ 1 \ 2 \quad [1 \ 0 \ 1] + [0 \ 1 \ 2] = [1 \ 1 \ 3] \\ \checkmark \quad \quad \quad = \text{New } V \end{array}$$

• $Q(P2) = [1 \ 1 \ 4], V = [1 \ 1 \ 3]$

$$\begin{array}{l} 1 \ 1 \ 4 \\ 1 \ 1 \ 3 \end{array} \quad \times \quad Q(P2) > V$$

• $Q(P3) = [1 \ 0 \ 0], V = [1 \ 1 \ 3]$

$$\begin{array}{l} 1 \ 0 \ 0 \\ 1 \ 1 \ 3 \end{array} \quad A(P3) + V = [1 \ 0 \ 2] + [1 \ 1 \ 3] \\ \checkmark \quad \quad \quad = [2 \ 1 \ 5] = \text{New } V$$

• $Q(P4) = [3 \ 0 \ 3], V = [2 \ 1 \ 5]$

$$\begin{array}{l} 3 \ 0 \ 3 \\ 2 \ 1 \ 5 \end{array} \quad \times$$

Attempting to save P2 and P4

• $Q(P2) = [1 \ 1 \ 4], V = [2 \ 1 \ 5]$

$$\begin{array}{l} 1 \ 1 \ 4 \\ 2 \ 1 \ 5 \end{array} \quad Q(P2) < V$$

$$V + A(P2) = [2 \ 1 \ 5] + [1 \ 1 \ 0] = [3 \ 2 \ 5] \\ \checkmark \quad \quad \quad = \text{New } V$$

• $Q(P4) = [3 \ 0 \ 3], V = [3 \ 2 \ 5]$

$$\begin{array}{l} 3 \ 0 \ 3 \\ 3 \ 2 \ 5 \end{array} \quad Q(P4) < V$$

$$V + A(P4) = [3 \ 2 \ 5] + [0 \ 3 \ 1] \\ = [3 \ 5 \ 6]$$