

Step 0 From page 66, originally, we have the following resource allocation.

	<u>Allocation</u>	<u>Max</u>
	A B C	A B C
P ₀	0 1 0	7 5 3
P ₁	2 0 0	3 2 2
P ₂	3 0 2	9 0 2
P ₃	2 1 1	2 2 2
P ₄	0 0 2	4 3 3

<u>Available</u>
A B C
3 3 2

Step 0 is safe or not??

$$\text{Allocation} = \begin{matrix} & A & B & C \\ \begin{matrix} P_0 \\ P_1 \\ P_2 \\ P_3 \\ P_4 \end{matrix} & \begin{bmatrix} 0 & 1 & 0 \\ 2 & 0 & 0 \\ 3 & 0 & 2 \\ 2 & 1 & 1 \\ 0 & 0 & 2 \end{bmatrix} \end{matrix}, \quad \text{Max} = \begin{matrix} & A & B & C \\ \begin{matrix} P_0 \\ P_1 \\ P_2 \\ P_3 \\ P_4 \end{matrix} & \begin{bmatrix} 7 & 5 & 3 \\ 3 & 2 & 2 \\ 9 & 0 & 2 \\ 2 & 2 & 2 \\ 4 & 3 & 3 \end{bmatrix} \end{matrix}, \quad \text{Need} = \begin{matrix} & A & B & C \\ \begin{matrix} P_0 \\ P_1 \\ P_2 \\ P_3 \\ P_4 \end{matrix} & \begin{bmatrix} 7 & 4 & 3 \\ 1 & 2 & 2 \\ 6 & 0 & 0 \\ 0 & 1 & 1 \\ 4 & 3 & 1 \end{bmatrix} \end{matrix}$$

$$\text{Available} = \begin{matrix} & A & B & C \\ & \begin{bmatrix} 3 & 3 & 2 \end{bmatrix} \end{matrix}$$

$$\text{Request}_1 = \begin{matrix} & A & B & C \\ & \begin{bmatrix} 1 & 0 & 2 \end{bmatrix} \end{matrix} \text{ is safe or not??}$$

✓

✓

Step 3 Assume that the OS grants Request₁ to P₁.

a) As a result, we update the following variables.

$$\begin{aligned}\text{Available} &= \text{Available} - \text{Request}_1 \\ &= [3 \ 3 \ 2] - [1 \ 0 \ 2] \\ &= [2 \ 3 \ 0]\end{aligned}$$

$$\begin{aligned}\text{Allocation}_1 &= \text{Allocation}_1 + \text{Request}_1 \\ &= [2 \ 0 \ 0] + [1 \ 0 \ 2] \\ &= [3 \ 0 \ 2]\end{aligned}$$

$$\begin{aligned}\text{Need}_1 &= \text{Need}_1 - \text{Request}_1 \\ &= [1 \ 2 \ 2] - [1 \ 0 \ 2] \\ &= [0 \ 2 \ 0]\end{aligned}$$

an update variable which always
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Define variable
risk

work
and finish



② check P_2 ; $j = 2$

Finish[2] = F ✓

Need₂ ≤ Work

[6 0 0] ≤ [5 3 2] X

② check P_3 , $j = 3$

Finish[3] = F ✓

Need₃ ≤ Work

[0 1 1] ≤ [5 3 2] ✓

③ P_3 finishes.

$$\text{Finish}[3] = T$$

$$\text{Work} = \text{Work} + \text{Allocation}_3$$

$$= [5 \quad 3 \quad 2] + [2 \quad 1 \quad 1]$$

$$= [7 \quad 4 \quad 3]$$

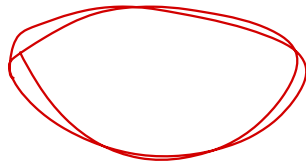
② check P_4 , i.e. 4

$$\text{Finish}[4] = F \checkmark$$

$$\text{Need}_4 \leq \text{Work}$$

$$[4 \quad 3 \quad 1] \leq [7 \quad 4 \quad 3] \checkmark$$





② check p_2 , $j = 2$

$$\text{Finish}[2] = F \checkmark$$

$$\text{Need}_2 \leq \text{work}$$

$$[6 \ 0 \ 0] \leq [7 \ 5 \ 5] \checkmark$$

③ p_2 finishes.

$$\text{Finish}[2] = T$$

$$\begin{aligned} \text{work} &= \text{work} + \text{Allocation}_2 \\ &= [7 \ 5 \ 5] + [3 \ 0 \ 2] \\ &= [10 \ 5 \ 7] \end{aligned}$$
