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①

∴ Assignment #03

	Allocation	Max	Available	Required	
	A B C D	A B C D	A B C D	A B C D	
P0	0 0 1 2	0 0 1 2	1 5 2 0	0 0 0 0	
P1	1 0 0 0	1 7 5 0		0 7 5 0	
P2	1 3 5 4	2 3 5 6		1 0 0 2	
P3	0 6 3 2	0 6 5 2		0 0 2 0	
P4	0 0 1 4	0 6 5 6		0 6 4 2	

② By using System Safety algorithms

If

need \leq available

then

Execute Process

New Available = Available + Allocation

else

don't execute move forward.

P0 \rightarrow need \leq available

0 0 0 0 \leq 1 5 2 0

Execute P0

New Available = Available + Allocation

= 1 5 2 0 + 0 0 1 2

= 1 5 3 2

(2)

P₁ → need > available (NEW AVAILABLE)
don't execute P₁

P₂ → need ≤ available
1002 ≤ 1532

Execute P₂

$$\begin{aligned}\text{new available} &= \text{Available} + \text{Allocation (P}_2\text{)} \\ &= 1532 + 1354 \\ &= 2886\end{aligned}$$

P₃ → need ≤ available

$$0020 \leq 2886$$

Execute P₃

$$\begin{aligned}\text{new available} &= \text{Available} + \text{Allocation (P}_3\text{)} \\ &= 2886 + 0632 \\ &= 2949,8\end{aligned}$$

$$\text{new available} = \begin{matrix} A & B & C & D \\ \downarrow & \downarrow & \downarrow & \downarrow \\ 2 & 11 & 11 & 8 \end{matrix}$$

P₄ → need ≤ available
0642 ≤ 2949,8

Execute P₄

(3)

$$\begin{aligned}\text{New Available} &= \text{Available} + \text{Allocation}(P_4) \\ &= 2, 14, 16, 8 + 0, 0, 14 = 2, 14, 12, 12\end{aligned}$$

$$\begin{aligned}\text{New Available} &= A \quad B \quad C \quad D \\ &\quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \\ &2 \quad 14 \quad 12 \quad 12\end{aligned}$$

$P_1 \rightarrow \text{need} \leq \text{available}$

$$0, 7, 15, 0 \leq 2, 14, 12, 12$$

Execute P_1

$$\begin{aligned}\text{New available} &= \text{Available} + \text{Allocation}(P_1) \\ &= 2, 14, 12, 12 + 1, 0, 0, 0\end{aligned}$$

$$\begin{array}{cccc} \xrightarrow{\hspace{1cm}} & A & B & C \quad D \\ & 3 & 14 & 12 & 12 \end{array}$$

* System is in safe state. Sequence:

$$= P_0, P_2, P_3, P_1, P_4$$

④

c) The process's request (P)

A	B	C	D
0	4	2	0

* Check whether the request is granted.

* Using Resource Request Algorithm:

① Request(P) \leq Need(P)
0420 \leq 0750

② Request(P) \leq Available
0420 \leq 1520

③ Availables Available - Request(P)
 $= 1520 - 0420$
 $= 1100$

Allocation(P) = Allocation(P) + Request(P)
 $= 1000 + 0420$
 $= 1420$

Need(P) = Need(P, old proc) - Request(P)
 $= 0750 - 0420$
 $= 0330$

(5)

* Using Algorithm

	Allocation	Need	Available
	A B C D	A B C D	A B C D
P ₀	0 0 0 1	0 0 0 0	1 1 0 0
P ₁	1 4 2 0	0 3 3 0	0 0 0 0
P ₂	1 3 5 4	1 0 0 2	0 0 0 0
P ₃	0 6 3 2	0 0 2 0	0 0 0 0
P ₄	0 0 1 4	0 6 4 2	0 0 0 0

$$P_0 \rightarrow \text{need} \leq \text{Available}$$

$$0000 \leq 1100$$

Execute P₀

$$\text{new available} = \text{Available} + \text{Allocation}(P_0)$$

$$= 1100 + 0012$$

$$= 1112$$

$$P_1 \rightarrow \text{need} > \text{Available}$$

Don't execute P₁

$$P_2 \rightarrow \text{need} \leq \text{Available}$$

$$1002 \leq 1112$$

Execute P₂

⑥

$$\begin{aligned}\text{new Available} &= \text{Available} + \text{Allocation}(P_2) \\ &= 1112 + 1354 \\ &= 2466\end{aligned}$$

$$\begin{aligned}P_3 \rightarrow \text{Need} &\leq \text{available} \\ 0020 &\leq 2466\end{aligned}$$

Execute P₃ (executed)

$$\begin{aligned}\text{new available} &= \text{available} + \text{allocation}(P_3) \\ &= 2466 + 0632 \\ &= 3109,8\end{aligned}$$



A	B	C	D
2	10	9	8

$$\begin{aligned}P_4 \rightarrow \text{Need} &\leq \text{available} \\ 0642 &\leq 3109,8\end{aligned}$$

Executed (P₄)

$$\begin{aligned}\text{new av.} &= \text{av.} + \text{all.}(P_4) \\ &= 3109,8 + 0014 \\ &= 3110,12\end{aligned}$$

new available	A	B	C	D
	2	10	10	12

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$P_1 \rightarrow need \leq Available$

$$0, 3, 3, 0 \leq 2, 10, 10, 12$$

Execute P_1

$$\begin{aligned} New\ Available &= Available + allocation(P_1) \\ &= 2, 10, 10, 12 + 1, 4, 2, 0 \\ &= 3, 14, 12, 12 \end{aligned}$$

New Available	A	B	C	D
	3	14	12	12

∴ System is in safe state even after the
execution of P_1 .

The sequence is:

$\langle P_0, P_2, P_3, P_4, P_1 \rangle$