

CS & IT ENGINEERING

Operating System

Deadlock

DPP 01 Discussion Notes

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#Q. Consider a system with 3 processes A, B and C. All 3 processes require 6 resources each to execute. The minimum number of resources the system should have such that deadlock can never occur, is _____?

	A	B	C	
Maximum req.	6	6	6	
	↓	↓	↓	
	5	5	5	+ <u>1</u>

$$\Rightarrow 5 + 5 + 5 + 1 \Rightarrow \underline{\underline{16}}$$

#Q.

Consider a system with 5 processes that share 15 instances of the same resource type. Each process can request a maximum of K instances. Resource instances can be requested and released only one at a time. The largest value of K that will always avoid deadlock is ____?

$$\text{No. of processes } (n) = 5$$

$$\text{Maximum resources} = 15$$

(N)

$$n(k-1) + 1 \leq 15$$

$$nk - n + 1 \leq 15$$

$$5k - 5 + 1 \leq 14$$

$$\Rightarrow 5k - 4 \leq 14$$

$$5k \leq 18$$

$$k \leq \frac{18}{5} = \lfloor 3.6 \rfloor$$

$$\boxed{k = 3}$$

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#Q.

Consider the following process scenario with 5 processes P1, P2, P3, P4 and P5; and 4 types of resources A, B, C and D. The system has total 3, 14, 11 and 12 instances of resources A, B, C and D respectively.

Process	Allocation				Max				Need			
	A	B	C	D	A	B	C	D	A	B	C	D
P1	0	0	0	2	0	3	1	2	0	3	1	0
P2	1	0	0	0	1	7	5	0	0	7	5	0
P3	<u>1</u>	3	5	4	2	3	5	6	1	0	0	<u>2</u>
P4	<u>0</u>	6	3	2	0	6	5	4	0	0	2	2
P5	0	0	1	4	0	6	5	6	0	6	4	2


Here allocation denotes the total allocated instances of each resource type. And Max denotes the maximum required instances of each resource type. Which of the following is true regarding the deadlock avoidance?

Available \Rightarrow

3	14	11	12
- 2	9	9	12
<hr/>			
1	5	2	0
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Current available

P_1 ✓



~~A~~

The system is in unsafe state

~~B~~

The system is in safe state and safe sequence is $\langle P_1, P_2, P_3, P_4, P_5 \rangle$

~~C~~

The system is in safe state and safe sequence is $\langle P_1, P_3, P_2, P_4, P_5 \rangle$

~~D~~

The system is in safe state and safe sequence is $\langle P_1, P_4, P_3, P_2, P_5 \rangle$

Current available P_1 ✓

=	1	5	2	0
+	0	0	0	2
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	1	5	2	2
<hr/>				

$P_1, P_3 (P_2, P_4, P_5)$

P_1, P_4

P_3

$$\begin{array}{r} 1522 \\ + 1354 \\ \hline 2876 \end{array} \quad \begin{array}{l} \checkmark \\ \checkmark \\ \checkmark \end{array} \quad \begin{array}{l} P_2 \\ P_4 \\ P_5 \end{array}$$

P_4

$$\begin{array}{r} 1522 \\ + 0632 \\ \hline 11154 \\ \hline \hline 11354 \end{array} \quad \begin{array}{l} \checkmark \\ 1002 < 11154 \end{array}$$

$P_3 + \begin{array}{r} 1354 \\ \hline 214108 \end{array}$



C, D.

#Q. Consider the following scenario:

Process	Max	Allocation
P1	5	0
P2	4	0
P3	6	0
P4	2	0

Minimum number of available resources required to have system deadlock free is ___?

$$\begin{array}{ccccccc}
 & P_1 & P_2 & P_3 & P_4 & & \\
 \text{Max. req.} \Rightarrow & 5 & 4 & 6 & 2 & \Rightarrow 4+3+5+1+1 & \\
 & \downarrow & \downarrow & \downarrow & \downarrow & \Rightarrow \underline{14} & \\
 & 4 & 3 & 5 & 1 & & \\
 & & & & & \textcircled{1} &
 \end{array}$$

#Q. Consider the following scenario:

Process	Max	Allocation	Need
P1	4	1	3
P2	8	3	5
P3	3	1	2
P4	4	0	4

Minimum number of not allocated available resources required to have system deadlock free is _____?

Need: .

P ₁	P ₂	P ₃	P ₄
3	5	2	4
↓	↓	↓	↓
2	4	1	3

+ (1)

Mini. no. of resources

$$\Rightarrow 2 + 4 + 1 + 3 + 1$$

$$\Rightarrow \underline{\underline{11}}$$

#Q.

A computer has 23 tape drives, with n number of processes competing for them. Each process may need 5 drives. The maximum value of n for the system to be deadlock free is _____?

$$R = 23$$

$$n(5-1) + 1 \leq R$$

$$n(4) + 1 \leq 23$$

$$4n \leq 22$$

$$n \leq \frac{22}{4} = \lfloor 5.5 \rfloor$$

$$n \leq 5$$



THANK - YOU

