

CS & IT ENGINEERING



2024

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 _____?

Maximum req.

A	B	C
6	6	6
↓	↓	↓
5	5	$5 + 1$ =

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

#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 ___?

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

$$\text{Maximum resources} = 15 \\ (N)$$

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

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

$$5k - 5 + 1 \leq 15$$

$$\Rightarrow 5k - 4 \leq 14 \\ 5k \leq 18$$

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

$$\boxed{k = 3}$$

= .

#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	1	3	5	4	2	3	5	6	1	0	0	2
P4	0	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?

P
W

Available \Rightarrow

$$\begin{array}{r}
 3 \quad 14 \quad 11 \quad 12 \\
 - \quad \underline{\begin{array}{r} 2 \quad 9 \quad 9 \quad 12 \\ \hline 1 \quad 5 \quad 2 \quad 0 \end{array}}
 \end{array}$$

$P_1 \checkmark$

- 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 $\langle P_1, P_4, P_3^o, P_2, P_5 \rangle$

Current available

$$\begin{array}{r}
 = \quad 1 \quad 5 \quad 2 \quad 0 \\
 P_1 \checkmark \quad + \quad \underline{\begin{array}{r} 0 \quad 0 \quad 0 \quad 2 \\ \hline 1 \quad 5 \quad 2 \quad 2 \end{array}}
 \end{array}$$

.....

$P_1 \quad P_3 \quad (P_2 \quad P_4 \quad P_5)$

$P_1 \quad P_4$

P_3

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

P_4

$$\begin{array}{r}
 1522 \\
 + 0632 \\
 \hline
 1154
 \end{array}
 \quad 1002 < 1154$$

$P_3 +$

$$\begin{array}{r}
 1324 \\
 + 214108 \\
 \hline
 \end{array}$$



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 __?

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

#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 Mimi. no. of resources
 ↓ ↓ ↓ ↓ $\Rightarrow 2+4+1+3$
 3 5 2 4 +1
 ↓ ↓ ↓ ↓ $\Rightarrow 11$
 2 4 1 3 + $\boxed{1}$ \equiv

#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

