CS & IT ENGINEERING

2024

Operating System

Deadlock

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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

$\Rightarrow$ $5 + 5 + 5 + 1 \Rightarrow 16$

[NAT]

#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 ___?

No. of processes (n) = 5

Maximum resources = 15
                    (N)

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

$nk - n + 1 \leq 15$

$5k - 5 + 1 \leq 14$

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

$5K \leq 18$

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

$$\boxed{K = 3}$$

#Q. Consider the following process scenario with 5 processes P1, P2, P3, P4 and P5; and 4 types of recourses 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?

Available $\Rightarrow$ 3 14 11 12

$-$ 2 9 9 12 $\quad$ P_1 ✓

$\overline{}$

1 5 2 0

Current available

A. The system is in unsafe state

B. The system is in safe state and safe sequence is <P1, P2, P3, P4, P5>

C. The system is in safe state and safe sequence is <P1, P3, P2, P4, P5>

D. The system is in safe state and safe sequence is <P1, P4, P3, P2, P5>

Current available $=$ 1 5 2 0 $\quad$ P_1 P_3 (P_2 P_4 P_5)

P_1 ✓ $\quad$ + 0 0 0 2 $\quad$ P_1 P_4

$\overline{}$

1 5 2 2

P_3

$$\begin{array}{r} 1522 \\ +\ 1354 \\ \hline \boxed{2876} \end{array}$$

P_2 ✓ P_4 ✓ P_5 ✓

P_4
$$\begin{array}{r} 1522 \\ +\ 0632 \\ \hline 11154 \end{array}$$ $1002 < 11154$ ✓

$P_3 +$
$$\begin{array}{r} 1324 \\ \hline \boxed{214108} \end{array}$$

$\underline{\underline{C,D}}$.

#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 ___?

$$P_1 \qquad P_2 \qquad P_3 \qquad P_4$$

$$\Rightarrow 4+3+5+1+1$$

$$\Rightarrow \underline{14}$$

$$\text{Max. req.} \Rightarrow \quad 5 \qquad 4 \qquad 6 \qquad 2$$

$$\downarrow \qquad \downarrow \qquad \downarrow \qquad \downarrow$$

$$4 \qquad 3 \qquad 5 \qquad 1 \qquad \boxed{1}$$

#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
3
↓
2

P_2
5
↓
4

P_3
2
↓
1

P_4
4
↓
3 + ①

Mini. no. of resources

⇒ 2 + 4 + 1 + 3
+ 1

⇒ 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 ____?

$$R = 23$$

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

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

$$4n \leq 22$$

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

$$\boxed{n \leq 5}$$

THANK - YOU