Gate Questions:

Q A system requires 2 units of resources having 3 process. The min. no. of units of 'R' such that no deadlock will occur.

a) 3 b) 5 c) 6 d) 4

Let's ass. 3 resources P_1, P_2, P_3 each req. 2 resources

∴ Total resources = $3 \times 2 = 6$

For e.g. consider R = 2

C-I

P_1	P_2	P_3
R	R	

C-II

P_1	P_2	P_3
2R		

Firstly give 2 units to P_1, then after it completes execution give them to P_2 & then to P_3.
But after exec. of P_1 if P_2 gets one resource & then P_3 gets another, then deadlock would occur
∴ 2 not a right answer

consider R=3
C-I

P_1	P_2	P_3
2R	R	

After P_1 completes execution

P_2	P_3
2R	R

∴ After P_2, P_3 can complete execution

C-II

P_1	P_2	P_3
R	R	R

∴ In this case, there's a deadlock
∴ R≠3

Consider R=4
C-I

P_1	P_2	P_3
2R	R	R

After P_1 completes execution:

P_2	P_3
2R	2R

∴ In this case, there won't be any deadlock.

To avoid deadlock ~~If no. of res. of req = 2 min.~~

∴ ~~give~~ $$\text{Total resources} = n \times (\text{min. req.} - 1) + 1$$

n → No. of resources; min. req. → min. requirement

Max. process allocated still deadlock.

if all process have same min. req.

$$\text{Total resources} = n \times (\text{min. req.} - 1)$$

~~For~~

Another E.g.

P_1	P_2	P_3	
3	4	5	
2	3	4	→ Always give 1 res. less than required

∴ 9 max. res. still deadlock

Q. Consider a system with 3 processes that share 4 instances of same resource type. Each process can request a max of 'k' instances. The largest value of k that will always avoid deadlock is?

Consider 3 processes, P_1, P_2, P_3.

$R = 4$

P_1	P_2	P_3
1	1	1

$K = 1$ but not max.

$K = 2$

P_1	P_2	P_3
$2R$	R	R

After P_1 completes

P_2	P_3
$2R$	$2R$

$K = 3$ ($K \rightarrow$ Need of every proc.)

C-I

P_1	P_2	P_3
$3R$	R	

After P_1 completes exect.

P_2	P_3
$3R$	R

C-II

P_1	P_2	P_3
$2R$	R	R

∴ Dead lock occurred

∴ 2 is the answer

Another method

'R' resources
'n' processes

P_1	P_2	P_3	P_4	----	P_n
d_1	d_2	d_3	d_4	----	d_n

P_1	P_2	P_3	
2	2	2	= 6
1	1	1	

Actually given $(d_1 - 1)$ $(d_2 - 1)$ ---------- $(d_n - 1)$

$$R \leq \sum_{i=1}^{n} d_i - n$$ ⇒ still a deadlock

If $$R > \sum_{i=1}^{n} d_i - n$$ ⇒ Deadlock free

∴ Total res. + Total processes > Total demand

∴ For this question

$4 + 3 > 3 \times 2$

↑ Total proc. ↑ Max. demand

$7 > 6$ ∴ True