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Banker's Algorithm

Consider the following snapshot of a system:

Process	Allocation			Max			Available		
	A	B	C	A	B	C	A	B	C
P_0	1	1	2	4	3	3	2	1	0
P_1	2	1	2	3	2	2			
P_2	4	0	1	9	0	2			
P_3	0	2	0	7	5	3			
P_4	1	1	2	1	1	2			

a) Calculate the content of the need matrix
b) Is the system in safe mode
c) Determine the total amount of resources of each type.

(a) Need = max - allocation

Process	Need		
	A	B	C
P_0	3	2	1
P_1	1	1	0
P_2	5	0	1
P_3	7	3	3
P_4	0	0	0

(b) No. of processes = 5
No. of resources = 3
work = available

I) for P_0,
need = 3, 2, 1 & work = 2, 1, 0
since need > work, P_0 must wait

II) for P_1,
need = 1,1,0 & work = 2, 1, 0
since need < work, P_1 must be kept in safe sequence.

new allocation = allocation + need
= (2, 1, 2) + (1, 1, 0)
= (3, 2, 2)

∴ available = available - need
= (2, 1, 0) - (1, 1, 0)
= (1, 1, 0)

III) for P_2,
need = (5, 0, 1) & work = 4, 2, 2
since need > work, P_2 must wait.

IV) for P_3,
need = 7, 3, 3 & work = 4, 2, 2
since need > work, P_3 must wait.

V) for P_4,
need = 0, 0, 0 & work = 4, 2, 2
since need ≤ work, P_4 must be kept in safe sequence.

available = available − need
= (4, 2, 2) − (0, 0, 0)
= (4, 2, 2)

available for next process after execution of P_4 is,
new allocation + available
= (1, 1, 2) + (4, 2, 2)
= (5, 3, 4)

VI) for P_0,
need = 3, 2, 1 & work = 5, 3, 4
since need < work, P_0, must be kept in safe sequence.

new allocation = allocation + need
= (1, 1, 2) + (3, 2, 1)
= (4, 3, 3)
available = available − need
= (5, 3, 4) − (4, 3, 3)
= (1, 0, 1)

Available for next process after P_0 execution is,
= (4, 3, 3) + (1, 0, 1)
= (5, 3, 4)

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VII) for P_2,

need = 5, 0, 1 & work = 5, 3, 4

since need < work, P_2 must be kept in safe sequence.

new allocation = allocation + need
= (4, 0, 1) + (5, 0, 1)
= (9, 0, 2)

available = available - need
= (5, 3, 4) - (5, 0, 1)
= (0, 3, 3)

Available for next process after P_2 execution,
= new allocation + available
= (9, 0, 2) + (0, 3, 3)
= (9, 3, 5)

VIII) for P_3,

need = 7, 3, 3 and work = 9, 3, 5

since need < work, P_3 must be kept in safe sequence.

Thus, the safe sequence is $P_1 \rightarrow P_4 \rightarrow P_0 \rightarrow P_2 \rightarrow P_3$

The given system is in safe state.

#: c) Total resources = allocated resources + available
= (8, 5, 7) + (2, 1, 0)
= (10, 6, 7)