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Operating System

Lab: 13 (Question)

Question: 1

Consider the following system snapshot using the data structure in the Banker's algorithm, with resources A, B, C and D, and processes P_0 to P_4.

	Max				Allocation				Need				Available			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
P_0	7	0	2	1	4	0	0	1					3	2	2	1
P_1	1	6	5	0	1	1	0	0								
P_2	3	3	4	6	1	0	4	5								
P_3	1	5	6	2	0	4	2	1								
P_4	2	4	3	2	0	3	1	2								

using the Banker's Algorithm, answer the following questions. while executing the Banker's algorithm, if there are multiple processes that may complete on a given cycle. Please choose the one with the lowest index.

a) How many resources of type A, B, C, D are there?

Answer:

Resources of type A = 9

Resources of type B = 10

Resources of type C = 9

Resources of type D = 10

b) What are the contents of the Need matrix ?

	Max				Allocation				Need			
	A	B	C	D	A	B	C	D	A	B	C	D
P_0	7	0	2	1	4	0	0	1	3	0	2	0
P_1	1	6	5	0	1	1	0	0	0	5	5	0
P_2	3	3	4	6	1	0	4	5	2	3	0	1
P_3	1	5	6	2	0	4	2	1	1	1	4	1
P_4	2	4	3	2	0	3	1	2	2	1	2	0

c) Is the system in a safe state ? why ?

m = available = 4

n = process = 5

Available = (3, 2, 2, 1)

Finish =	False	False	False	False	False
	0	1	2	3	4

For i = 0

$Need_0$ = 3, 0, 2, 0

Finish [0] is false and $Need_0 < Available$

(3, 0, 2, 0) (3, 2, 2, 1)

So P_0 must be kept in safe state

Available = Available + $Allocation_0$

= (3, 2, 2, 1) (4, 0, 0, 1)

Available = (7, 2, 2, 2)

Finish =	True	False	False	False	False

For i = 1

$Need_1$ = 0, 5, 5, 0

Finish [1] is false and $Need_1 < Available$

(0, 5, 5, 0) (7, 2, 2, 2)

So P_1 must be kept in safe state.

Available = Available + Allocation$_1$

(7,2,2,2) (1,1,0,0)

= (8, 3, 2, 2)

Finish =

True	True	False	False	False
0	1	2	3	4

For i = 2

Need$_2$ = 2, 3, 0, 1

Finish [2] is false and Need$_2$ < Available

(2, 3, 0, 1) (8, 3, 2, 2)

So P_2 must be kept in safe state

Available = Available + Allocation$_2$

(8, 3, 2, 2) (1, 0, 4, 5)

= (9, 3, 6, 7)

Finish =

True	True	True	False	False

For i = 3

Need$_3$ = 1, 1, 4, 1

Finish [3] is false and Need$_3$ < Available

(1, 1, 4, 1) (9, 3, 6, 7)

So P_3 must be kept in safe state

Available = Available + Allocation$_3$

(9, 3, 6, 7) (0, 4, 2, 1)

= (9, 7, 8, 8)

Finish =

True	True	True	True	False

For i = 4

Need$_4$ = 2, 1, 2, 0

Finish [4] is false and Need$_4$ < Available

(2, 1, 2, 0) (9, 7, 8, 8)

So P_4 must be kept in safe state

Available = Available + Allocation$_4$

(9, 7, 8, 8) (0, 3, 1, 2)

= (9, 10, 9, 10) , Yes it is safe state. and

Safe sequence will be : P_0, P_1, P_2, P_3, P_4

d) if a request from process P_2 arrives for additional resources of (0, 2, 0, 0) can the Banker's algorithm grant the request immediately? why? show the new system state & other criteria.

	Max				Allocation				Need				Available			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
P_0	7	0	2	1	4	0	0	1	3	0	2	0	3	0	2	1
P_1	1	6	5	0	1	1	0	0	0	5	5	0				
P_2	3	3	4	6	1	2	4	5	2	1	0	1				
P_3	1	5	6	2	0	4	2	1	1	1	4	1				
P_4	2	4	3	2	0	3	1	2	2	1	2	0				

Step 1:

Available = 3, 0, 2, 1

Finish =

False	False	False	False	False
0	1	2	3	4

step : 2

For i = 0

$Need_0$ = 3, 0, 2, 0

Finish [0] is false and $Need_0 \leq Available$

(3, 0, 2, 0) (3, 0, 2, 1)

So P_0 must be kept in safe state

Available = Available + $Allocation_0$

(3, 0, 2, 1) (4, 0, 0, 1)

= (7, 0, 2, 2) → True

For i = 1

$Need_1$ = 0, 5, 5, 0

Finish [1] is false and $Need_1 \leq Available$

(0, 5, 5, 0) (7, 0, 2, 2)

so P_1 must be kept in safe state

Available = Available + Allocation$_1$

(7,0,2,2) (1,1,0,0)

= (8,1,2,2) → True

For i = 2

Need$_2$ = 2,1,0,1

Finish [2] is false and Need$_2$ < Available

(2,1,0,1) (8,1,2,2)

so P_2 must be kept in safe state

Available = Available + Allocation$_2$

(8,1,2,2) (1,2,4,5)

= (9,3,6,7) → True

For i = 3

Need$_3$ = 1,1,4,1

Finish [3] is false and Need$_3$ < Available

(1,1,4,1) (9,3,6,7)

so P_3 must be kept in safe state

Available = Available + Allocation$_3$

(9,3,6,7) (0,4,2,1)

= (9,7,8,8) → True

For i = 4

Need$_4$ = 2,1,2,0

Finish [4] is false and Need$_4$ < Available

(2,1,2,0) (9,7,8,8)

so P_4 must be kept in safe state

Available = Available + Allocation$_4$

(9,7,8,8) (0,3,12)

= (9,10,9,10) → True

New system is also in safe state.

So P_0, P_1, P_2, P_3, P_4

e) Given the original state, if a process P_4 arrives for additional resources of (0,2,0,0). can Banker's algorithm grant the request immediately? why?

	Max				Allocation				Need				Available			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
P_0	7	0	2	1	4	0	0	1	3	0	2	0	3	0	2	1
P_1	1	6	5	0	1	1	0	0	0	5	5	0				
P_2	3	3	4	6	1	0	4	5	2	3	0	1				
P_3	1	5	6	2	0	4	2	1	1	1	4	1				
P_4	2	4	3	2	0	5	1	2	2	1	2	0				

Safe sequence will be :- P_0, P_1, P_2, P_3, P_4