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CSC332-Activity 4

Let N = 5 because there are 5 processes and M = 4 because there are 4 resources. As well as Work = Availability.
From using the banker's algorithm, we can solve if the state is safe or not by using Need = Max – Allocation. Thus,
T_0 => 2 4 3 1 - 0 1 2 0 = 2 3 1 1
T_1 => 2 4 2 4 - 0 1 1 2 = 2 3 1 2
T_2 => 3 6 5 1 - 1 2 4 0 = 2 4 1 1
T_3 => 1 2 6 2 - 3 1 2 0 = 1 8 5 8
T_4 => 3 1 1 2 - 1 0 0 1 = 2 1 1 1

	Allocation Matrix	Max	Need
	A B C D	A B C D	A B C D
T_0	0 1 2 0	2 4 3 1	2 3 1 1
T_1	0 1 1 2	2 4 2 4	2 3 1 2
T_2	1 2 4 0	3 6 5 1	2 4 1 1
T_3	3 1 2 0	1 2 6 2	1 8 5 8
T_4	1 0 0 1	3 1 1 2	2 1 1 1

A) Available = 2223
Now we check if Need <= Availability, then available = available + allocation.

We will start with T_4 -> 2223 – 2111 = 0112 remaining.
T4 will release all resources to T_0 -> 3112 + 0112 = 3224
Then, we will subtract T_0 to available -> 3224 – 2311 = 0913
Then, we add T_0 will release all resources -> 0913 + 2431 = 3344
Then, we subtract T_1 to the current available resources -> 3344 – 2312 = 1032
Then, T_1 will release all its resources -> 1032 + 2424 = 3456
Then, its T_2 time-> 3456 – 2411 = 1045
Now, we release T_2 ->1045 +3651 = 4696
Finally, its T_3 time -> 4696 – 1858 = 2838
And now we release T_3 -> 2838 + 1262 = 4100
So, we get a safe state and the order of execution is T_4, T_0, T_1, T_2, T_3

It is taking way too long to type everything, so I have decided to do the rest by handwriting the rest.

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B) Available = (4,4,1,1)

add allocation of T_4 to current available

Available = (4,4,1,1) + (1,0,0,1) = (5,4,1,2)

This satisfy the need of T_1 so we can add the allocation of T_1 to current Available

$(5,4,1,2) + (0,1,1,2) = (5,5,2,4)$

This satisfy the need of T_0, so lets add the allocation of T_0 to current available

$(5,5,2,4) + (0,1,2,0) = (5,6,6,4)$

because the above available, we know it can satisfy T_2 and T_3 so we can say we have a safe sequence, and the safe sequence is

T_4, T_1, T_0, T_2, T_3

C) Available = (3,0,1,4)

we cannot satisfy the need of any thread so the state is unsafe.

d.) Available = (1,5,2,2)

add allocation of T_3 to Available resources

$(1,5,2,2) + (3,1,2,0) = (4,6,4,2)$

This satisfy the need of T_4 to available resources, now we can add the allocation of T_4

$(4,6,4,2) + (1,0,0,1) = (5,6,4,3)$

This can satisfy the need of T_0 and T_1 and T_2 which means it is in a safe state. and the sequence can be T_3, T_4, T_0, T_1, T_2