Q1 : Consider the following snapshot of a system:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Allocation** | **Max** | **Available** |
|  | **ABCD** | **ABCD** | **ABCD** |
| **P0** | 0012 | 0012 | 1520 |
| **P1** | 1000 | 1750 |  |
| **P2** | 1354 | 2356 |  |
| **P3** | 0632 | 0652 |  |
| **P4** | 0014 | 0656 |  |

Answer the following questions using the banker’s algorithm:  
a. What is the content of the matrix Need?  
b. Is the system in a safe state?

1. What is the content of the matrix Need?

The matrix Need can be calculated as Max - Allocation:

Need = 0012 0012 0012

0750 0606 1002

002 002 022

020 020 020

0002 0642 0642

1. Is the system in a safe state?

To check if the system is in a safe state, we can use the banker's algorithm.

First, we need to calculate the Available resources by summing up the Allocation matrix and subtracting it from the Max matrix:

Available = Max - Allocation =

= 1520-0012 1750-0012 2356-0012 0652-0012 0656-0012

= 1508 1738 2344 0640 0644

Then, we can start by assuming that all the processes can run to completion, and check if we can find a sequence of processes that can run without the system entering an unsafe state.

We can use the following algorithm:

1.Initialize Work = Available and Finish[i] = false for all i.

2.Find an i such that both:

a. Finish[i] = false

b. Need[i] <= Work

If no such i exists, go to step 4.

3.Execute process i by adding its Allocation to Work:

Work = Work + Allocation[i]

Finish[i] = true

Go to step 2.

4. If all processes were finished, the system is in a safe state. Otherwise, it is not.

Using this algorithm, we can start with any process that satisfies the above conditions, and check if we can find a sequence that allows all processes to finish. If we find such a sequence, the system is in a safe state.

In this case, we can start with P0, since its Need is already satisfied. Then, we can move on to P2, P3, and P1. Finally, we can execute P4. The resulting sequence is:

P0 -> P2 -> P3 -> P1 -> P4

Since all processes finish, the system is in a safe state.