**Assignment 1**

**Q1:** A system has 5 processes {P0, P1, P2, P3, P4} and 3 resource types {A, B, C}. The total instances of each resource type are:

* A = 10, B = 5, C = 7

The following matrices represent the Allocation and Maximum demand for each process:

**Allocation Matrix**

|  |  |  |  |
| --- | --- | --- | --- |
| **Process** | **A** | **B** | **C** |
| **P0** | 0 | 1 | 0 |
| **P1** | 2 | 0 | 0 |
| **P2** | 3 | 0 | 2 |
| **P3** | 2 | 1 | 1 |
| **P4** | 0 | 0 | 2 |

**Maximum Matrix**

|  |  |  |  |
| --- | --- | --- | --- |
| **Process** | **A** | **B** | **C** |
| **P0** | 7 | 5 | 3 |
| **P1** | 3 | 2 | 2 |
| **P2** | 9 | 0 | 2 |
| **P3** | 2 | 2 | 2 |
| **P4** | 4 | 3 | 3 |

**Questions:**

1. Calculate the Available resources vector.
2. Compute the Need matrix.
3. Using the Banker’s Algorithm, determine whether the system is in a safe state.
4. If the system is safe, provide a safe sequence.

**Assignment 2**

Consider the following system with 4 processes {P1, P2, P3, P4} and 3 resource types {R1, R2, R3}. Each resource type has only one instance.

The current resource allocation and request state is as follows:

* P1 is holding R1 and is requesting R2
* P2 is holding R2 and is requesting R3
* P3 is holding R3 and is requesting R1
* P4 is not holding any resource and not requesting anything

**Questions**

1. Draw the Resource Allocation Graph (RAG) for the above situation. Use circles for processes and squares for resources. Use arrows from:
   * Process → Resource (for requests)
   * Resource → Process (for allocations)
2. Based on the graph, determine whether the system is in a deadlock state. Justify your answer.
3. If a deadlock exists, identify the set of processes involved in the deadlock.