1. Define Dead lock. List necessary and sufficient conditions to occur deadlock. Apply Bankers algorithm for dead lock avoidance for the following data and conclude whether system is in safe state or not?

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Allocation** | | | | **Max** | | | | **Available** | | | |
|  | **A** | **B** | **C** | **D** | **A** | **B** | **C** | **D** | **A** | **B** | **C** | **D** |
| **P0** | 2 | 0 | 0 | 1 | 4 | 2 | 1 | 2 | 3 | 3 | 2 | 1 |
| **P1** | 3 | 1 | 2 | 1 | 5 | 2 | 5 | 2 |  |  |  |  |
| **P2** | 2 | 1 | 0 | 3 | 2 | 3 | 1 | 6 |  |  |  |  |
| **P3** | 1 | 3 | 1 | 2 | 1 | 4 | 2 | 4 |  |  |  |  |
| **P4** | 1 | 4 | 3 | 2 | 3 | 6 | 6 | 5 |  |  |  |  |

If a request from the process P1 arrives for (1,1,0,0), Can the request be granted immediately?

If a request from the process P4 arrives for (0,0,2,0), Can the request be granted immediately?

1. Consider the following threads T1,T2 and T3 executing on a single processor, synchronized using three binary variables, S1, S2 and S3, Operated upon using standard wait() and signal() . If the initial values are S1 = 1, S2 = 0 ,S3 = 0 , Compute the output sequence.