CSE3241: Operating System and System Programming

Class-13

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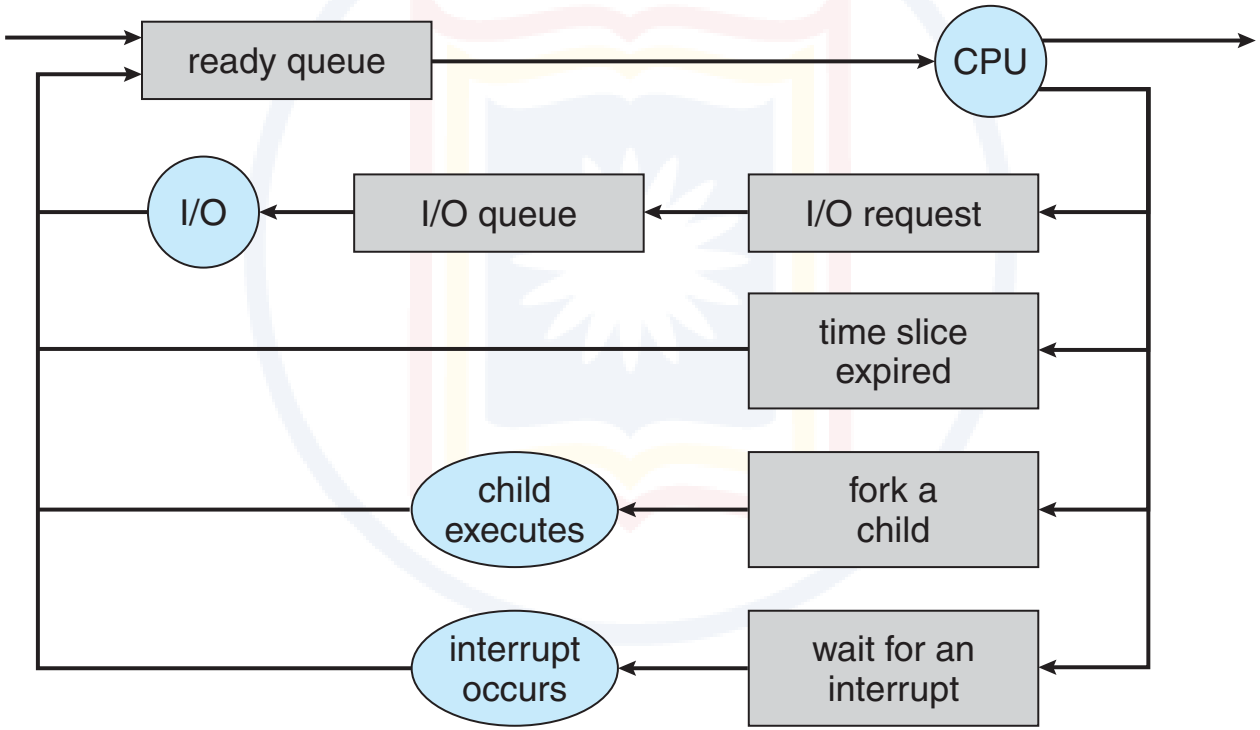
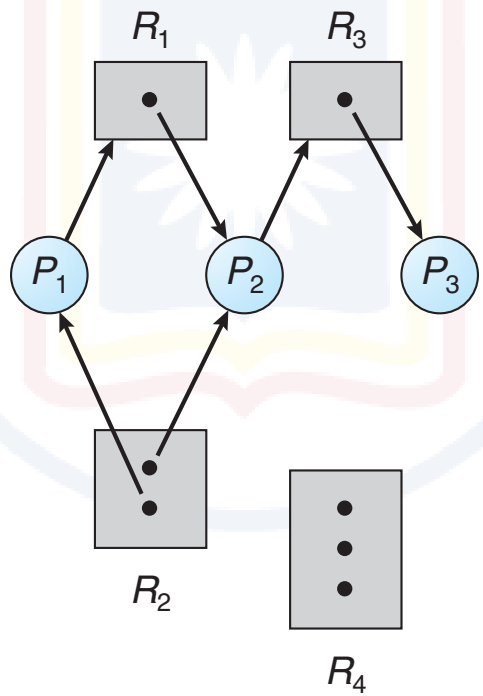
What is Deadlock?

- Deadlock is the situation when a process cannot come back to ready state from its waiting stack



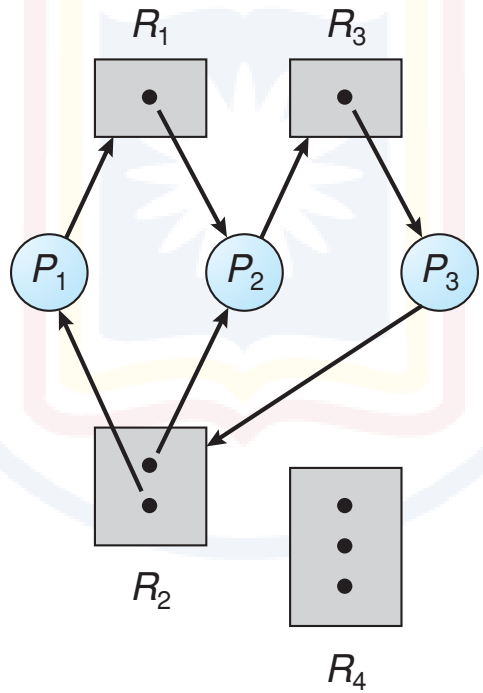
Resource Allocation Graph

- Notations:
  - P: a set of processes in memory.
  - R: a set of resources (e.g., regular file, pipe, device files).
  - P: directed edge indicates that P_i has requested for R_j.



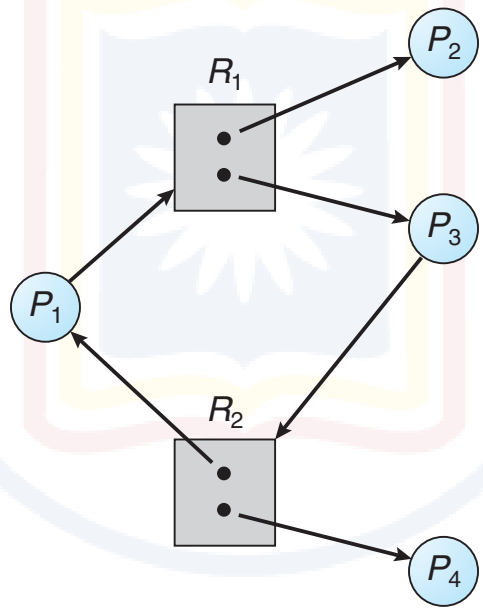
Resource Allocation Graph with Deadlock

- A cycle must need to be exist in a deadlock graph:
  - $P_1 -- > R_1 -- > P_2 -- > R_3 -- > P_3 -- > R_2 -- > P_1$
  - $P_2 -- > R_3 -- > P_3 -- > R_2 -- > P_2$



Resource Allocation Graph without Deadlock

- A cycle does not ensure deadlock situation:
  - $P_1 - - > R_1 - - > P_3 - - > R_2 - - > P_1$

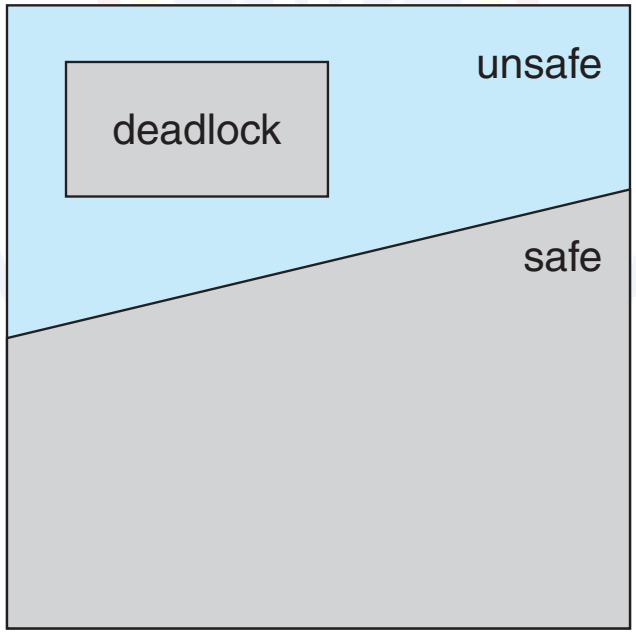


Methods of Handling Deadlock

- Deadlock can be handled by one of three ways:
  - **Prevent or Avoid**: Take precautions.
  - **Detect and Recover**: Let system to enter deadlocked state and then take action.
  - **Pretend**: Pretend deadlock will never happen.

State of System

- A cycle does not ensure deadlock situation:
  - Safe State: OS can allocate resources to each process in some order and still avoid a deadlock.
  - Unsafe State: Opposite of safe state. Not All unsafe states are deadlocks.



References