

17/04/20

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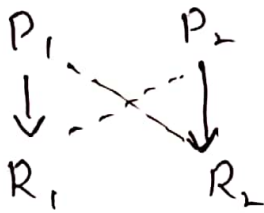
Deadlock

A system is in a deadlock state if there exists a set of transactions such that every transaction in the set is waiting for another transaction in the set.

Deadlock refers to a particular situation where two or more processes are each waiting for another to release a resource or more than two processes are waiting for resources in a circular chain.

Deadlock is a common problem in multiprocessing environment.

Ex:

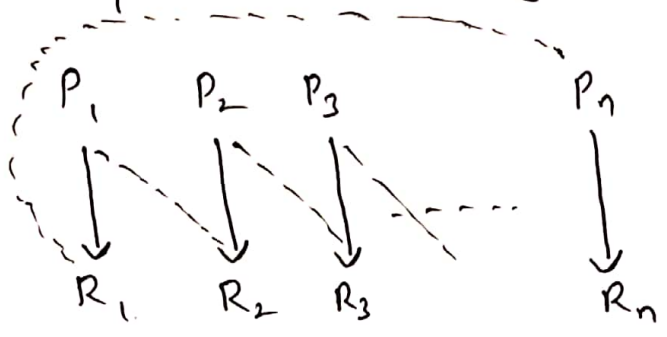


P_1 is holding Resource R_1 , and waiting for R_2 and P_2 is holding Resource R_2 and waiting for R_1 . One of them (either P_1 or P_2) has to release the resource, otherwise the situation is "Deadlock".

There are four conditions of Deadlock

- (i) Mutual Exclusion: There should be at least one resource which is not used or one resource shared by more than one process at a time.
- (ii) Hold and Wait: ~~can~~ A process ' P_1 ' holding a resource and waiting for another resource held by another process P_2 .
- (iii) No-Preemption: A resource cannot be forcibly taken from a process. Only the process can release a resource that is being held by it.

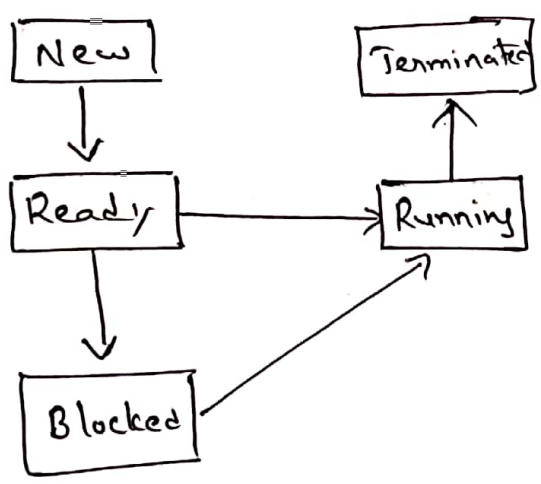
(iv) Circular wait: A condition where Process P_1 is waiting for the resource held by P_2 and P_2 is waiting for the resource held by P_3 and so on and the last process is waiting for the first process.



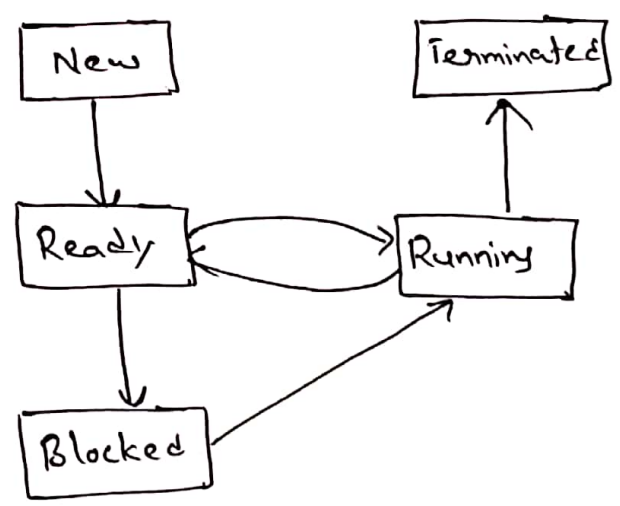
To avoid a deadlock, the above mentioned necessary conditions shouldn't occur.

Note: The DBMS inspects the operations and analyzes if they can create a deadlock situation. If it finds that a deadlock situation might occur, then that transaction is never allowed to be executed.

No-Preemption



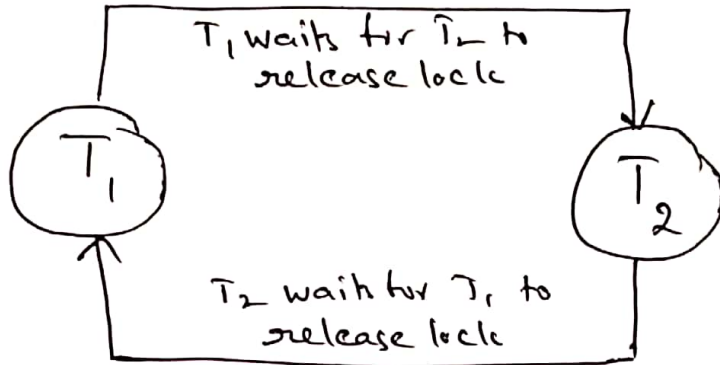
Preemption



A process going from Running state to Ready state is Preemption.

Deadlock Detection and Recovery:

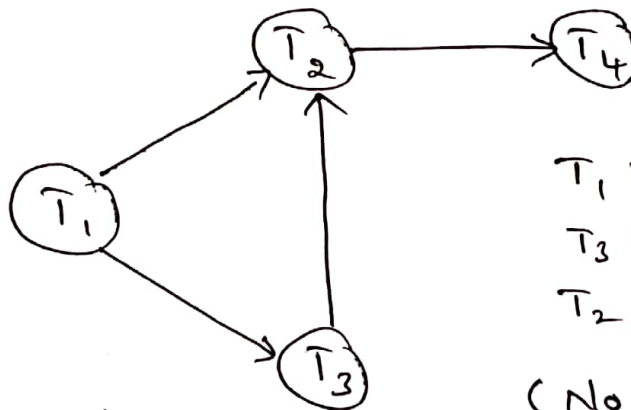
Wait-for-Graph is the best method for detecting the deadlock situation.



(Follows Directed Graph)

A deadlock occurs in a system if there exists a cycle in the wait for graph and each transaction involved in the cycle is said to be in a deadlock state.

Example: ①

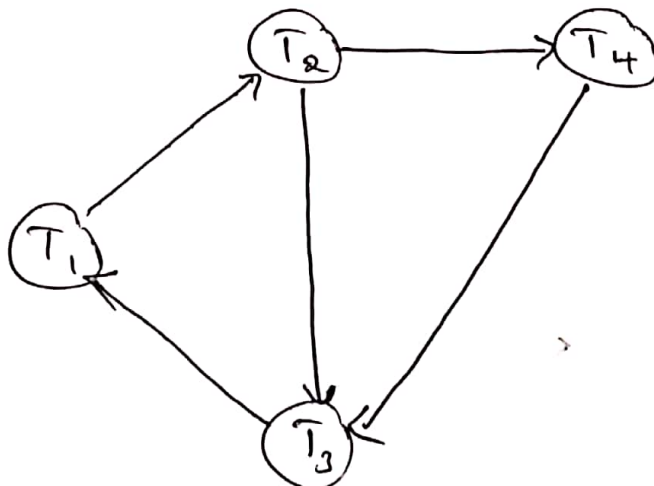


T_1 is waiting for T_2 & T_3
 T_3 is waiting for T_2
 T_2 is waiting for T_4

(No Deadlock)

There is no cycle in $EG(1)$, Hence No Deadlock occurs.

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$T_1 \rightarrow T_2 \rightarrow T_4 \rightarrow T_3 \rightarrow T_1$

$T_1 \rightarrow T_2 \rightarrow T_3$

(Deadlock occurs)

There is a cycle in $EG(2)$, Hence Deadlock occurs.

Recovery: Rollback one or more transactions until the system shows no more deadlock situation. Rollback the transactions which will incur minimum cost.

There are three steps to Recover

(i) Selection of Victim:

The transaction which has to be rolled back is called Victim.

(ii) Rollback: Simple solution is Total Rollback.

The another solution is Partial Rollback which rollbacks only specified transaction.

(iii) Starvation: Starvation is the situation when a transaction has to wait for a indefinite period of time to acquire a lock.

Starvation is the situation caused because of lack of resources.