SOS IN COMPUTER SCIENCE AND APPLICATIONS

BCA-205 DBMS

UNIT-5

TOPIC: ACID PROPERTIES OF TRANSACTION

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Concurrency in Transaction

- A database is a shared resource accessed.
- It is used by many users and processes concurrently.
- For example, the banking system, railway, and air reservations systems etc.
- Process of managing simultaneous transactions in a shared database at the same time is known as **concurrency control.**

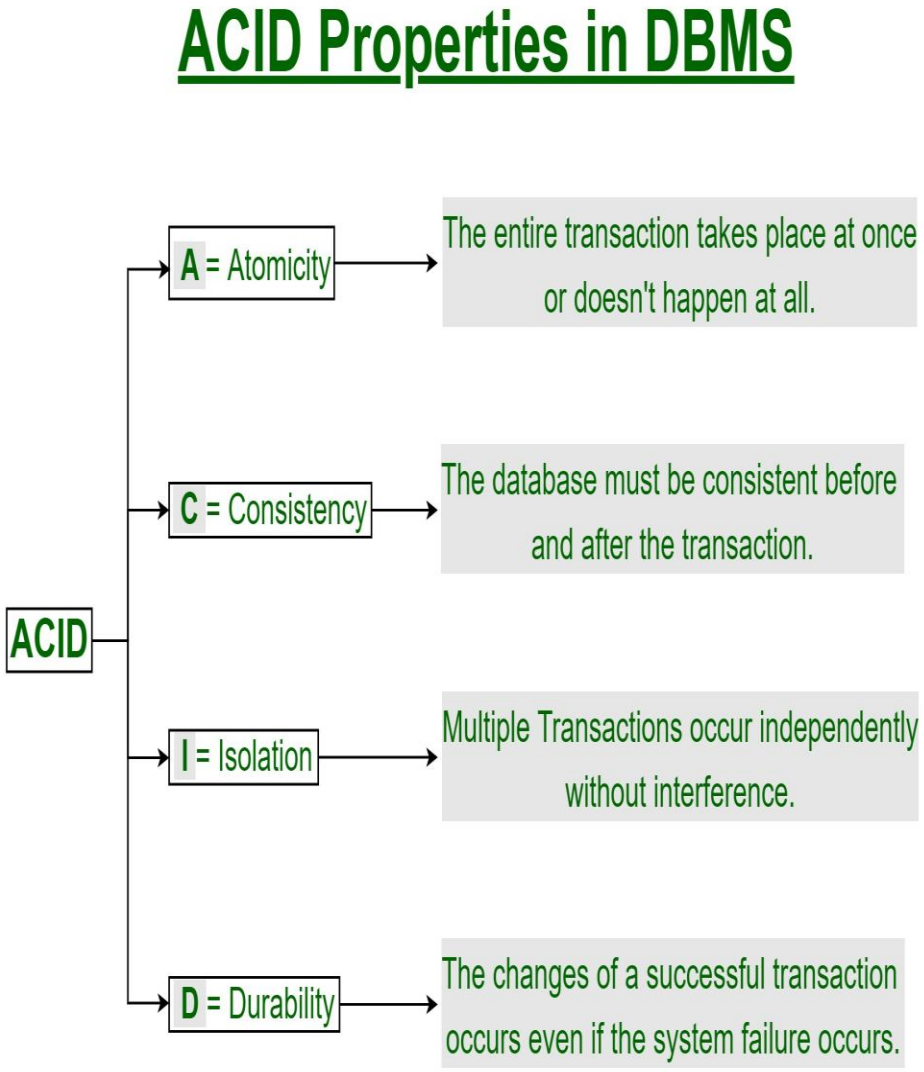
Need of Concurrency Control

- Simultaneous execution of transactions over a shared database can create data integrity and consistency problems.

1. Hardware failure and system crashes.
2. Concurrent execution of the same transaction, deadlock, or slow performance.

ACID PROPERTIES

- Transactions access data using read and write operations.
- In order to maintain consistency in a database, before and after the transaction, certain properties are followed.
- These are called **ACID** properties.



ATOMICITY

- Atomicity mean that either the entire transaction takes place at once or doesn't happen at all.
- There is no midway i.e. transactions do not occur partially.
- Each transaction is considered as one unit and either runs to completion or is not executed at all.
- It involves the following two operations.
  —**Abort**: If a transaction aborts, changes made to database are not visible.
  —**Commit**: If a transaction commits, changes made are visible.
  Atomicity is also known as the '**All or nothing rule'**.

ATOMICITY

- If the transaction fails after completion of **T1** but before completion of **T2**.(say, after **write(X)** but before **write(Y)**), then amount has been deducted from **X** but not added to **Y**.

- This results in an inconsistent database state. Therefore, the transaction must be executed in entirety in order to ensure correctness of database state.

Consider the following transaction **T** consisting of **T1** and **T2**: Transfer of 100 from account **X** to account **Y**.

Before: X : 500	Y: 200
Transaction T	
T1	T2
Read (X) X: = X − 100 Write (X)	Read (Y) Y: = Y + 100 Write (Y)
After: X : 400	Y : 300

CONSISTENCY

- Consistency means that integrity constraints must be maintained so that the database is consistent before and after the transaction.
- It refers to the correctness of a database.
- The table shown (RHS):→
- The total amount before and after the transaction must be maintained.

Total **before T** occurs = **500 + 200 = 700**.
Total **after T occurs** = **400 + 300 = 700**.

Therefore, database is **consistent**.
Inconsistency occurs in case **T1** completes but **T2** fails. As a result T is incomplete.

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ISOLATION

- This property ensures that multiple transactions can occur concurrently without leading to the inconsistency of database state.
- Transactions occur independently without interference.
- Changes occurring in a particular transaction will not be visible to any other transaction until that particular change in that transaction is written to memory or has been committed.
- This property ensures that the execution of transactions concurrently will result in a state that is equivalent to a state achieved these were executed serially in some order.

ISOLATION

- Suppose **T** has been executed till **Read (Y)** and then **T''** starts.
- As a result , interleaving of operations takes place due to which **T''** reads correct value of **X** but incorrect value of **Y** and sum computed by

T'': (X+Y = 50, 000+500=50, 500)
is thus not consistent with the sum at end of transaction:

T: (X+Y = 50, 000 + 450 = 50, 450).

- This results in database inconsistency, due to a loss of 50 units.
- Hence, transactions must take place in isolation and changes should be visible only after they have been made to the main memory.

Let **X**= 500, **Y** = 500. T and T'' are two transactions

T	T''
Read (X)	Read (X)
X: = X*100	Read (Y)
Write (X)	Z: = X + Y
Read (Y)	Write (Z)
Y: = Y – 50	
Write	

DURABILITY

- This property ensures that once the transaction has completed execution, the updates and modifications to the database are stored in and written to disk and they persist even if a system failure occurs.

- These updates now become permanent and are stored in non-volatile memory. The effects of the transaction, thus, are never lost.