Atomicity, Consistency, Isolation, and Durability (ACID)

ACID is an acronym that refers to the set of 4 key properties that define a database transaction. ACID transaction ensures the highest level of data integrity in databases.

Atomicity

- Atomicity ensures that all operations within a transaction are treated as a single, indivisible unit, meaning they either all succeed together or all fail together.

Consistency

- Consistency ensures that changes made within a transaction are consistent with database constraints which includes all rules, constraints, and triggers.

Isolation

- Isolation ensures that all transactions run in an isolated environment. This enables running transactions concurrently because transactions don't interfere with each other.

Durability

- Durability ensures that once the transaction completes and changes are written to the database, they become permanent even in the event of a power outage or system failures.

Example: Funds Transfer Transaction

Imagine Jake wants to transfer $100 from his account to Jill's account.
This transaction involves two main steps:

- Deducting $100 from Jake's account.
- Adding $100 to Jill's account.

ACID Properties:

- **Atomicity:** This ensures that all steps in the transaction are treated as a single unit. So here, either both steps happen or neither happens.

- **Consistency:** After the transaction, the total amount of money in the system remains the same. If the transfer is $100, Jake's account decreases by $100, and Jill's account increases by $100, maintaining overall consistency.

- **Isolation**: This ensures that transactions occur independently without interference. If another transaction is happening simultaneously (e.g., Jill is transferring money to Johnny), it won't affect Jake's transaction. Each transaction appears to run in isolation.

- **Durability**: Once a transaction is committed, it remains in the system even in the case of a power failure. After Jake's transfer is complete and committed, the changes to both accounts become permanent, ensuring the transaction's results are not lost.