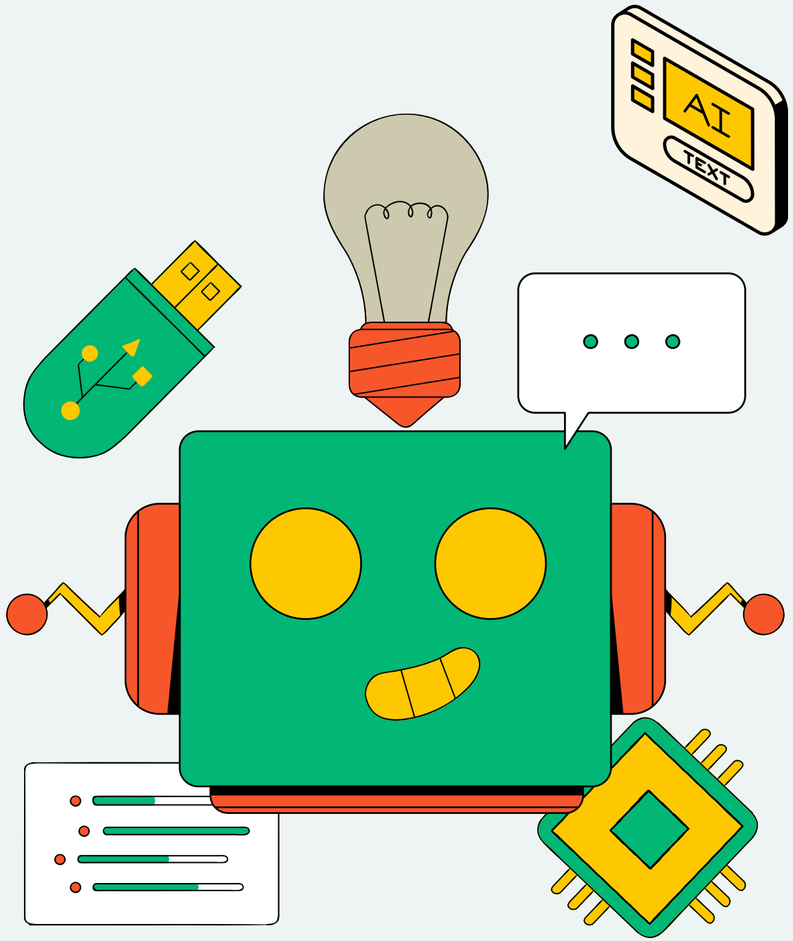
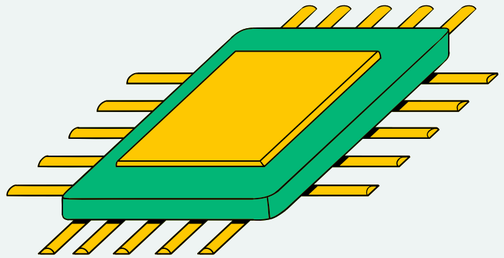


DATA INTEGRITY AND TRANSACTIONS IN DBMS

ENSURING RELIABLE AND ACCURATE DATA MANAGEMENT WITHIN DATABASE SYSTEMS.



UNDERSTANDING TRANSACTIONS AND DATA INTEGRITY

- **Transaction**

A logical unit of work, comprising one or more database operations.

- **Data Integrity**

Maintaining accuracy, consistency, and reliability of data over its lifecycle.

- **ACID Properties**

Atomicity, Consistency, Isolation,Durability

ATOMICITY

Complete or Rollback

Every operation within a transaction either completes successfully, or the entire transaction is aborted.

- No partial updates
- Ensures data coherence

CONSISTENCY: VALID STATE TRANSITIONS

Rules and Constraints:

A transaction takes the database from one valid state to another, adhering to all defined rules and constraints.

- Maintains data invariants
- Prevents invalid data

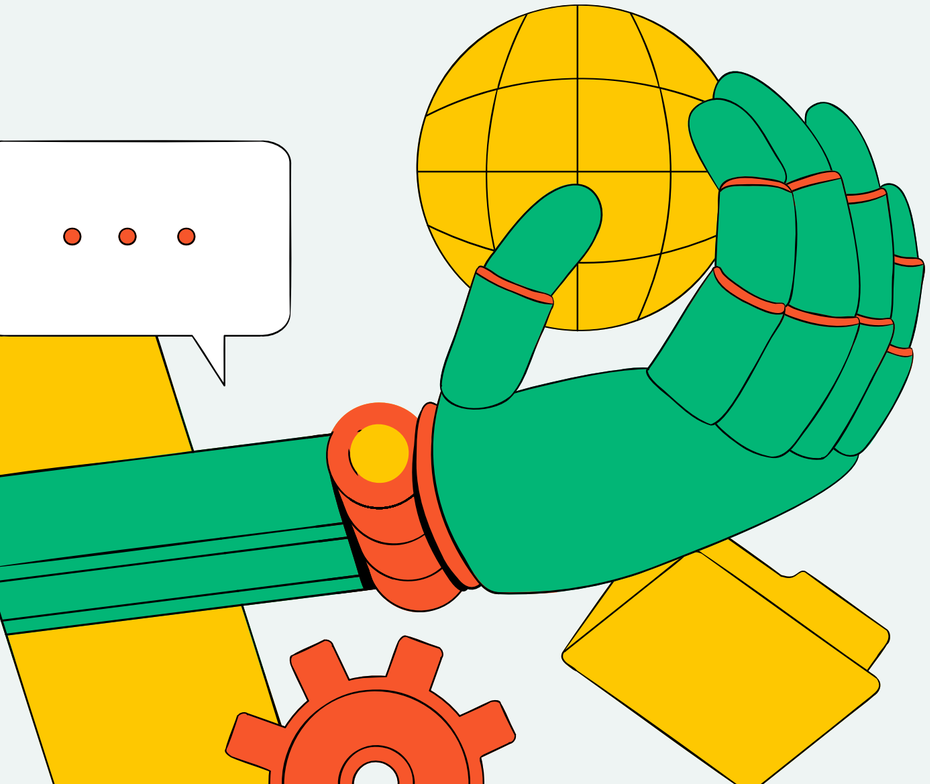
ISOLATION: INDEPENDENT TRANSACTIONS

Concurrency Control

Concurrent transactions execute in such a way that the outcome is as if they were executed sequentially.

- **Prevents interference**
- **Maintains data accuracy**

DURABILITY: PERMANENT CHANGES



Committed Data Persistence

Once a transaction is committed, its changes are permanently stored and survive any subsequent system failures.

- Power outages
- System crashes

Concurrency Anomalies: Risks of Poor Isolation

Dirty Read

Reading uncommitted changes from another transaction. If the other transaction rolls back, the read data becomes invalid.

Phantom Read

A query within a transaction returns a different set of rows when executed multiple times because another committed transaction inserted or deleted rows.

Non-Repeatable Read

Reading the same data twice within a transaction yields different results because another committed transaction modified it in between.

ISOLATION LEVELS: CONTROLLING CONCURRENCY

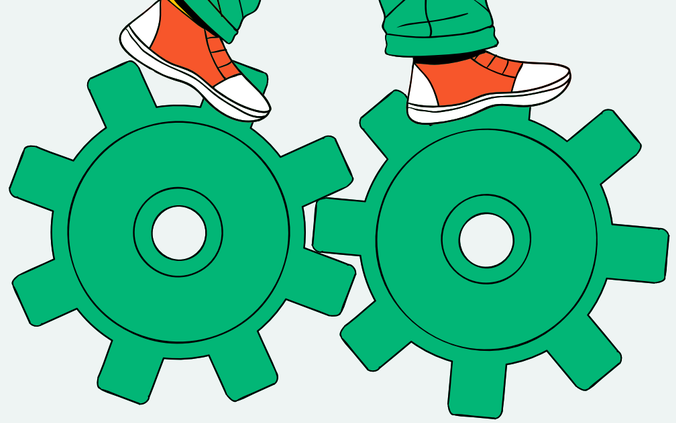
- Read Uncommitted
- Read Committed
- Serializable
- Repeatable Read

ISOLATION LEVELS AND ANOMALY PREVENTION

SQL Transaction Isolation Levels			
Isolation Level	Dirty Read	Non-Repeatable Read	Phantom Read
Read Uncommitted	⚠ Possible	⚠ Possible	⚠ Possible
Read Committed	✓ Prevented	⚠ Possible	⚠ Possible
Repeatable Read	✓ Prevented	✓ Prevented	⚠ Possible
Serializable	✓ Prevented	✓ Prevented	✓ Prevented

Higher isolation levels offer greater data consistency but typically incur higher performance overhead due to increased locking.

WHY ACID COMPLIANCE IS CRITICAL



FINANCIAL SYSTEMS

Ensures monetary transactions are always accurate and reliable, preventing fraud and errors.

HEALTHCARE

Guarantees patient data, such as medical histories and prescriptions, remains consistent and available.
s.

E-COMMERCE

Secures order processing, inventory updates, and payment handling for a seamless customer experience.

THANK YOU