Database Engineering

DIG DEEP INTO THE DATABASE WORLD

ENG/AHMED AMEN

Road Map

- ❖ **What is Database**
- ❖ **ACID**
  - o **Transaction**
  - o **Atomicity**
  - o **Isolation**
  - o **Consistency**
  - o **Durability**
  - o **Eventual Consistency**
  - o **Practice (Examples)**
  - o **Phantom Reads**
  - o **Serializable and Repeatable Reads**
- ❖ **Database I/O**
  - o **DBMS Architecture**
    - ▪ **Transport**
      - • **Cluster Communication**
      - • **Client Communication**
    - ▪ **Query Processor**
      - • **Query Parser**
      - • **Query Optimizer**
    - ▪ **Execution Engine**
      - • **Remote Execution**
      - • **Local Execution**
    - ▪ **Storage Engine**
      - • **Transaction Manager**
      - • **Lock Manager**
      - • **Access Methods**
      - • **Buffer Manager**
      - • **Recovery Manager**
  - o **How tables and indexes are stored on disk**
    - ▪ **Table**
    - ▪ **ROW ID**
    - ▪ **Row Page**
    - ▪ **IO Stream**
    - ▪ **Heap Data Structure**
    - ▪ **Index Data Structure b-tree**
  - o **Row-Based vs Column-Based Databases**
    - ▪ **Row-Oriented Database (Row store)**

- ▪ **Column-Oriented Database (Column store)**
- ▪ **Pros & Cons**
  - o **Primary Key vs Secondary Key**
- ❖ **Indexing**
  - o **Intro**
  - o **Query Planner, Optimizer**
  - o **Index Scan vs Index Only Scan**
  - o **Indexes Performance**
  - o **Database Optimizers**
  - o **Bitmap Index Scan vs Index Scan vs Table Scan**
  - o **Index Concurrently Blocking Production**
  - o **Bloom Filters**
- ❖ **B-Tree and B+Tree in Database Systems**
- ❖ **Distributed Systems**
- ❖ **Database Sharding**
- ❖ **Database Partitioning**
- ❖ **Database Replication**
- ❖ **Database Engines**
- ❖ **Concurrency Control**
- ❖ **Database System Design (Practical)**
  - o **Design UBER Database**
- ❖ **Database Cursor**
- ❖ **Database Security**
- ❖ **Database Encryption**
  - o **Homomorphic Encryption**
- ❖ **............To Be Continue**