CogniWeb SOLUTIONS
Empowering the Next Generation of Developers with Future-ready Solutions

DATABASE MANAGEMENT SYSTEM (DBMS) COMPLETE LEARNING PATH

(FROM ZERO TO ADVANCED-LEVEL MASTERY)

MODULE 1: INTRODUCTION TO DBMS

- What is a Database?
- Database vs File System
- Characteristics of DBMS
- Advantages and Disadvantages
- Users of DBMS (DBA, Developer, End Users)
- DBMS Architecture (1-tier, 2-tier, 3-tier)

MODULE 2: DATA MODELS & DBMS ARCHITECTURE

- Data Models:
  - Network
  - Relational (RDBMS)
  - Object-Oriented
- Schemas: External, Conceptual, Internal
- Instances vs Schemas
- Data Independence (Logical & Physical)
- DBMS Components (Query Processor, Storage Manager, etc.)

MODULE 3: RELATIONAL MODEL

- Concepts: Tables, Tuples, Attributes
- Keys:
  - Primary Key
  - Foreign Key
  - Candidate Key
  - Super Key
- Integrity Constraints:
  - Domain, Entity, Referential
- Relational Algebra (Selection, Projection, Join, Union, etc.)

MODULE 4: SQL (STRUCTURED QUERY LANGUAGE)

- DDL (Data Definition Language)
  - CREATE, DROP, ALTER, TRUNCATE
- DML (Data Manipulation Language)
  - INSERT, UPDATE, DELETE
- DQL (Data Query Language)
  - SELECT with conditions, joins, group by, having
- DCL/TCL
  - COMMIT, ROLLBACK, SAVEPOINT, GRANT, REVOKE
- Subqueries & Nested Queries
- Joins:
  - INNER, LEFT, RIGHT, FULL, CROSS JOIN
- Views, Indexes, Sequences, Synonyms

MODULE 5: ENTITY-RELATIONSHIP (ER) MODEL

- Entities and Attributes
- Entity Sets and Relationships
- Types of Attributes:
  - Simple, Composite, Derived, Multi-valued
- Mapping Cardinalities (1:1, 1:N, M:N)
- Generalization, Specialization, Aggregation
- ER to Relational Mapping

MODULE 6: NORMALIZATION

- Functional Dependencies
- 1NF, 2NF, 3NF, BCNF, 4NF
- Anomalies in DB Design (Insertion, Deletion, Update)
- Decomposition: Lossless Join and Dependency Preservation

MODULE 7: TRANSACTION MANAGEMENT

- What is a Transaction?
- ACID Properties
- Serializability (Conflict & View)
- Schedules (Recoverable, Cascadeless)
- Concurrency Control:
  - Lock-based Protocols
  - Two-Phase Locking (2PL)
  - Deadlock Detection & Prevention

MODULE 8: FILE ORGANIZATION & STORAGE

- Storage Hierarchies
- File Organization Techniques:
  - Heap, Sequential, Hashing, Indexed
- Indexing:
  - Single-level, Multi-level
  - B+ Tree, Hash Indexing

MODULE 9: DATABASE RECOVERY AND BACKUP

- Types of Failures
- Recovery Techniques:
  - Log-based Recovery
  - Checkpoints
  - Shadow Paging
- Backup Methods:
  - Full, Incremental, Differential

MODULE 10: DISTRIBUTED & NOSQL DATABASES (INTRO)

- Distributed DBMS basics
- Fragmentation and Replication
- CAP Theorem
- NoSQL Concepts:
  - Document, Column, Key-Value Stores (MongoDB, Cassandra, etc.)
- Differences: RDBMS vs NoSQL

MODULE 11: REAL-TIME IMPLEMENTATION

- Hands-on with MySQL / PostgreSQL / Oracle / MongoDB
- Performance Optimization Techniques

FINAL DELIVERABLES

- Mini Project (Basic Level)
- Capstone Project (Expert Level)
- GitHub Portfolio
- Resume Building
- Certificate from **CogniWeb**

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