

T.E. (Computer Engg./Artificial Intelligence & Data Science)

DATABASE MANAGEMENT SYSTEM

(2019 Pattern) (Semester - I)

UNIT 3: RELATIONAL DATABASE DESIGN

1. HIGHEST IMPORTANCE TOPICS

a) Normalization (2NF, 3NF, BCNF)

• Questions Asked:

- Explain 3NF and BCNF with example. Enlist their differences (Multiple papers)
- Explain 2NF, 3NF and BCNF with examples (Multiple papers)
- Convert schema into 3NF with justification
- Impact of normalization on database

b) Anomalies (Insert, Update, Delete)

• Questions Asked:

- What is the impact of insert, update & delete anomaly on overall design of database? How normalization is used to remove these anomalies? (Appeared in 5+ papers)
- What is anomaly in relational model. Explain how normalization can be used to reduce the anomalies

c) Functional Dependencies

• Questions Asked:

- What is functional dependency? Explain its use in database design (2 papers)
- Identify functional dependencies from given schema/instance
- Explain partial and transitive dependencies with example (2 papers)
- Explain partial, full and transitive dependency with examples

d) CODD's 12 Rules

- **Questions Asked:**
 - Elaborate the significance of CODD's rule. Explain 12 rules proposed by CODD's (Appeared in 5+ papers)
 - Explain specific rules: Guaranteed Access Rule, Comprehensive Data Sub-Language Rule, Integrity Independence, Physical Data Independence, Systematic Treatment of NULL Values, High-Level Insert/Update/Delete Rule

e) Decomposition

- **Questions Asked:**
 - What are the desirable properties of decomposition? Explain with example (3 papers)
 - Check decomposition is lossless or lossy (2 papers)
 - What is decomposition with example

2. MEDIUM IMPORTANCE TOPICS

a) Features of Good Relational Database Design

- **Questions Asked:**
 - Explain different features of good relational database design (1 paper)

b) Relational Integrity Constraints

- **Questions Asked:**
 - Explain entity and referential integrity constraints used in SQL (1 paper)
 - What are relational integrity constraints. Explain Domain constraints, Referential-Integrity and enterprise constraints (1 paper)

c) Atomic Domains and First Normal Form (1NF)

- **Questions Asked:**
 - Explain requirements of different normal forms like 1NF, 2NF and 3NF (1 paper)

d) Algorithms for Decomposition

- No direct questions, but indirectly tested through lossless/lossy decomposition problems

3. LEAST/NOT APPEARED TOPICS

- **Relational Model: Basic concepts, Attributes and Domains** (Basic theory, not directly asked)
- **Domain Integrity, Enterprise Constraints** (Mentioned briefly in 1 question only)
- **Specific algorithms for decomposition** (Not asked directly)

UNIT 4: DATABASE TRANSACTION MANAGEMENT

1. HIGHEST IMPORTANCE TOPICS

a) ACID Properties

- **Questions Asked:**
 - State and explain the ACID Properties (Appeared in 4+ papers)
 - Combined with transaction states question

b) Transaction States

- **Questions Asked:**
 - During its execution, a transaction passes through several states. List all possible sequences of states. Explain when each state transition occurs (Appeared in 5+ papers)
 - Always combined with ACID properties

c) Conflict Serializability

- **Questions Asked:**
 - What is conflict serializability? How to check schedule is conflict serializable (Appeared in 4+ papers)
 - Explain the concept with suitable example

- Since every conflict-serializable schedule is view serializable, why do we emphasize conflict serializability rather than view serializability? (2 papers)
- Check given schedule for conflict serializability

d) Two-Phase Locking Protocol

- **Questions Asked:**
 - Add lock and unlock instructions to transactions T1 and T2, so that they observe two phase locking protocol. Can execution result in deadlock? (Appeared in 3 papers)
 - Explain two-phase lock protocol. Also explain strict and rigorous two-phase lock protocol (2 papers)
 - Problem: A transaction may be waiting for X lock while sequence of others get S lock - what is this problem? How is it solved? (1 paper)
 - What is need of lock in DBMS? Explain shared lock and exclusive lock (1 paper)

e) Log-Based Recovery

- **Questions Asked:**
 - To ensure atomicity despite failures we use Recovery Methods. Explain in detail log based recovery method (Appeared in 3 papers)
 - Explain Deferred Database Modifications and Immediate Database Modifications (2 papers)
 - How to ensure the atomicity using Recovery Methods (2 papers)

f) Timestamp-Based Protocol

- **Questions Asked:**
 - What is R-timestamp(Q) and W-timestamp(Q). Explain the necessary condition used by time stamp ordering protocol to execute for read/write operation (Appeared in 4 papers)
 - How time-stamp based protocol decides whether to allow the operation to be executed or not (2 papers)

2. MEDIUM IMPORTANCE TOPICS

a) View Serializability

- **Questions Asked:**
 - Check whether schedule is view serializable or not. Explain concept of view equivalent schedules (1 paper)

b) Deadlock Handling

- **Questions Asked:**
 - When do deadlocks happen, how to prevent them, and how to recover if deadlock takes place? (Appeared in 2 papers)

c) Shadow-Paging Recovery

- **Questions Asked:**
 - Write a short note on Shadow Paging (2 papers)
 - Always asked with log-based recovery

d) Recoverable and Non-recoverable Schedules

- **Questions Asked:**
 - What is recoverable schedule? Why is recoverability of schedule desirable? Are there any circumstances under which it could be desirable to allow non recoverable schedules? (1 paper)

e) Checkpoints

- **Questions Asked:**
 - Mentioned in syllabus but no direct dedicated question

3. LEAST/NOT APPEARED TOPICS

- **Introduction to Database Transaction** (Basic concept, not directly asked)
- **Concept of Schedule, Serial Schedule** (Mentioned but not separately asked)
- **Cascaded Aborts** (Not asked separately)

UNIT 5: NOSQL DATABASES

1. HIGHEST IMPORTANCE TOPICS

a) CAP Theorem

- Questions Asked:**
 - Explain CAP theorem and BASE properties (Appeared in 3 papers)
 - Explain the CAP theorem referred during the development of any distributed application (Appeared in 4+ papers)
 - State and Explain CAP Theorem (2 papers)

b) BASE Properties

- Questions Asked:**
 - Explain CAP theorem and BASE properties (3 papers)
 - Explain BASE Properties of NOSQL Database (2 papers)
 - What is soft state of any system, how it is dependent on Eventual consistency property? (2 papers)

c) Types of NoSQL Databases (Key-value, Document, Column, Graph)

- Questions Asked:**
 - Explain following NOSQL database types with examples: Column-oriented, Graph, Document-oriented (Appeared in 5+ papers)
 - List the different NOSQL data models. Explain document store NOSQL data model with example (3 papers)
 - Describe in detail the key value store NOSQL data model with example (2 papers)
 - Explain Document Based and Key value data model (1 paper)

d) Types of Data (Structured, Semi-structured, Unstructured)

- Questions Asked:**
 - Explain Structured, Semi-structured and Unstructured data types with examples (Appeared in 5+ papers)
 - What is structured and unstructured data. Explain with example (1 paper)

e) Distributed Database System

- Questions Asked:**

- Draw and explain architecture of Distributed database system. State the reasons for building distributed database systems (Appeared in 3 papers)
- Describe distributed database. Explain System architecture of distributed transaction (1 paper)

f) SQL vs NoSQL / RDBMS vs NoSQL

- **Questions Asked:**

- Explain how NOSQL databases are different than relational databases (3 papers)
- Compare SQL and NOSQL Database (1 paper)
- Explain the difference between SQL and NOSQL database (1 paper)
- Analyze the use of NOSQL databases in current social networking environment, explain need of NOSQL over RDBMS (1 paper)

2. MEDIUM IMPORTANCE TOPICS

a) MongoDB Operations

- **Questions Asked:**

- Describe following operations with MongoDB syntax: Map-Reduce, Aggregation pipeline (1 paper)
- Explain the CRUD operations used in MongoDB with example (1 paper)
- Explain Map Reduce with example (1 paper)

b) ACID vs BASE

- **Questions Asked:**

- Mentioned in syllabus but mostly asked as part of BASE properties question

c) Data Consistency Model

- **Questions Asked:**

- Covered indirectly through BASE properties questions

3. LEAST/NOT APPEARED TOPICS

- **Introduction to Distributed Database System** (Basic intro, covered in architecture question)
- **Advantages, disadvantages of distributed systems** (Asked but as part of architecture question)
- **Need, Features of NoSQL** (Basic theory, not separately asked)
- **MongoDB: Indexing, Replication, Sharding** (Not asked in any paper)

UNIT 6: ADVANCES IN DATABASES

1. HIGHEST IMPORTANCE TOPICS

a) XML Databases

- **Questions Asked:**
 - What is the significance of XML databases? Explain with proper example when to use XML database (Appeared in 5+ papers)
 - What is the significance of XML databases? Explain with example the use of XML databases (2 papers)

b) JSON (Nested Data Types)

- **Questions Asked:**
 - Explain how encoding and decoding of JSON object is done in JAVA with example (Appeared in 5+ papers)
 - Describe the significance of JSON data type and object. Discuss with syntax all JSON data types with suitable example (1 paper)

c) Semi-Structured Data and Features

- **Questions Asked:**
 - Write a short note on complex data types: Semi-structured data, Features of semi-structured data models (Appeared in 5+ papers)

d) Active and Deductive Databases

- **Questions Asked:**
 - Write short note on: Active database, Deductive database (Appeared in 4 papers)

- What is Deductive Database. Explain its features and state its advantages over traditional database (3 papers)

e) Spatial Data (Geographic and Geometric)

- **Questions Asked:**

- Write short note on: Geometric data, Geographic data (2 papers)
- What are spatial data? Explain Geographic and Geometric data (Appeared in 3 papers)

f) Object-Relational Database System

- **Questions Asked:**

- What is object relational database? What are its advantages and disadvantages? (Appeared in 3 papers)
- What is object relational database system. Explain Table inheritance with example (3 papers)
- Difference between relational databases and object relational databases with example (1 paper)

2. MEDIUM IMPORTANCE TOPICS

a) Main Memory Databases

- **Questions Asked:**

- Write a short note on emerging databases: Main Memory Databases (2 papers)

b) Table Inheritance

- **Questions Asked:**

- Always asked with Object-Relational Database System question

c) Object-Relational Mapping

- **Questions Asked:**

- Mentioned in syllabus but not asked separately

3. LEAST/NOT APPEARED TOPICS

- **Semantic Databases** (Not asked in any paper)
- **Complex Data Types introduction** (Basic theory)
- **Nested Data Types general theory** (JSON and XML asked specifically, but not general nested types)



Youtube Channel Link:

https://youtube.com/@thevijayacademy?si=e_kcIN7pJfRbZt0R

Telegram Channel Link For Notes And Updates:

<https://t.me/+TMT8hrQRdEYyMDY1>



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