
Unit I

Introduction, Distributed DBMS Architecture, Data Fragmentation,
Replication and Allocation Techniques for Distributed Database Design.

Chapter 1 : Distributed Database	1-1 to 1-10
1.1 Distributed Databases System Concepts.....	1-1
1.2 Concept of Distributed Computing System	1-2
1.3 Advantages of Distributed Databases.....	1-2
1.4 Features of Distributed Database System	1-3
1.5 Design Issues of Distributed Database System.....	1-4
1.6 Types of Distributed Databases	1-5
1.7 Distributed DBMS Architectures	1-6
1.8 Advantages and Disadvantages of Distributed DBMS.....	1-10
Chapter 2 : Distributed Database Design	2-1 to 2-28
2.1 Objectives of Data Distribution	2-1
2.2 Top-Down Distributed Database Design	2-2
2.3 Data Fragmentation.....	2-3
2.3.1 Introduction.....	2-3
2.3.2 Fragmentation Schema.....	2-3
2.3.3 Types of Data Fragmentation.....	2-3
2.3.3(A) Horizontal Fragmentation	2-3
2.3.3(B) Vertical Fragmentation.....	2-6
2.3.3(C) Mixed (Hybrid) Fragmentation	2-8
2.3.4 Bond Energy Algorithm.....	2-15
2.5 Data Replication for Distributed Database Design.....	2-18
2.5.1 Introduction	2-18
2.5.2 Goals	2-18
2.5.3 Types	2-18

2.6	Allocation Techniques for Distributed Database Design	2-20
2.7	Transparencies in Distributed Database Design.....	2-21
2.7.1	Distribution Transparency	2-21
2.7.2	Performance Transparency	2-23
2.7.3	DBMS Transparency	2-23
2.8	Design Problems	2-24

Unit II

Distributed Transaction Management : Definition, properties, types, architecture

Distributed Query Processing : Characterization of Query Processors, Layers/ phases of query processing.

Distributed Concurrency Control : Taxonomy, Locking based, Basic TO algorithm,

Recovery in Distributed Databases : Failures in distributed database, 2PC and 3PC protocol.

Chapter 3 : Distributed Transaction Management 3-1 to 3-18

3.1	Distributed Transaction Management	3-1
3.2	Distributed Database Transaction Processing.....	3-3
3.3	Transaction Properties (ACID Properties)	3-4
3.4	Model for Distributed Transaction Processing.....	3-6
3.5	Transaction Types.....	3-7
3.5.1	Serial Transactions / Schedules / Executions.....	3-8
3.5.2	Concurrent Transactions / Schedules / Executions.....	3-9
3.6	Transaction Management Architecture	3-11
3.7	Distributed Databases Query Processing.....	3-12
3.7.1	Objectives of Distributed Databases Query Processing	3-13
3.8	Architecture of Distributed Query Processing : Characterization of Query Processors.....	3-14
3.9	Layers / Phases of Distributed Query Processing.....	3-16

Chapter 4 : Distributed Concurrency Control 4-1 to 4-14

4.1	Distributed Concurrency Control : Taxonomy	4-1
4.2	Failure in Distributed Databases.....	4-1
4.3	Solutions for Concurrency Problems in Distributed Databases.....	4-2

4.3.1	Maintaining a Distinguished Copy of a Data Item	4-2
4.3.2	Voting Method.....	4-4
4.4	Concurrency Control Schemes.....	4-5
4.5	Locking Based Concurrency Control	4-5
4.5.1	Types of Locks	4-5
4.5.2	Two Phase Locking.....	4-6
4.5.3	Distributed Two Phase Locking	4-7
4.6	Timestamp Based Concurrency Control	4-8
4.6.1	Centralised Timestamp - Ordering Protocol (Basic TO Algorithm).....	4-9
4.6.2	Distributed Timestamp - Ordering Protocol.....	4-10
4.7	Commit Protocol	4-11
4.7.1	Two Phase Commit Protocol.....	4-11
4.7.2	Three Phase Commit Protocol	4-12

Unit III

XML Databases: Document Type Definition, XML Schema, Querying and Transformation: XPath and XQuery.

Basic JSON syntax, (Java Script Object Notation),JSON data types, Stringifying and parsing the JSON for sending & receiving, JSON Object retrieval using key-value pair and JQuery, XML Vs JSON

Chapter 5 : XML Databases 5-1 to 5-28

5.1	Introduction to XML Documents.....	5-1
5.2	Well Formed and Valid XML Documents	5-1
5.2.1	Well Formed Document	5-2
5.2.2	Valid XML Documents	5-2
5.3	Structure of XML Data – Tree Data Model	5-3
5.3.1	Types of XML Documents.....	5-4
5.3.2	XML – Structured Data.....	5-5
5.4	XML Document Type Definition (DTD)	5-5
5.5	XML Document Schema	5-8
5.5.1	Introduction.....	5-8

5.5.2	Types of XML Documents.....	5-8
5.5.3	An XML Schema Defines.....	5-8
5.5.4	XML Schemas as the Replacement to DTDs.....	5-8
5.5.5	XML Schema Features and Key Elements.....	5-9
5.6	XML Transformation to Relational Model.....	5-15
5.6.1	Other Steps for Extracting XML Documents from Databases.....	5-17
5.7	XML Querying.....	5-18
5.7.1	XPath : Specifying Path Expression.....	5-18
5.7.2	XQuery : Specifying Queries.....	5-21
5.8	XML Applications.....	5-23

Chapter 6 : JSON**6-1 to 6-8**

6.1	Introduction to JSON (Java Script Object Notion).....	6-1
6.2	Comparison JSON and XML (XML vs JSON).....	6-1
6.2.1	JSON Data Types.....	6-2
6.3	JSON Schema.....	6-4
6.4	Stringify and Parsing JSON for sending and receiving.....	6-6
6.5	JSON Object Retrieval using key value pair and JQuery.....	6-7

Unit IV

NoSQL database concepts: NoSQL data modeling, Benefits of NoSQL, comparison between SQL and NoSQL database system.

Replication and sharding, Distribution Models Consistency in distributed data, CAP theorem, Notion of ACID Vs BASE, handling Transactions, consistency and eventual consistency

Types of NoSQL databases: Key-value data store, Document database and Column Family Data store, Comparison of NoSQL databases w.r.t CAP theorem and ACID properties.

Chapter 7 : NoSQL Database**7-1 to 7-15**

7.1	Introduction to NoSQL Database.....	7-1
7.2	NoSQL Data modeling.....	7-2
7.2.1	Benefits of Data Modeling.....	7-3
7.2.2	NoSQL of Data Modeling.....	7-3
7.3	Types of NoSQL Databases.....	7-4

7.3.1	Key-Value Data Store Databases.....	7-4
7.3.2	Column Family Data Store Database.....	7-5
7.3.3	Document Database (Document Store).....	7-5
7.3.4	Graph Database (Distributed Document Store).....	7-6
7.3.5	Comparison of NoSQL Databases w.r.t. CAP Theorem and ACID.....	7-7
7.3.6	Benefits of NoSQL.....	7-7
7.4	Comparative between SQL and NoSQL Database systems (SQL vs NoSQL).....	7-8
7.4.1	Business Drivers of NoSQL.....	7-9
7.5	Distribution Models: Master-Slave versus Peer-to-Peer	7-10
7.6	CAP Theorem (Brewer's Theorem)	7-11
7.7	Database Replication and Sharding.....	7-11
7.8	Database Consistency Models	7-13
7.8.1	ACID vs Base Notion	7-13
7.8.2	ACID Consistency Model.....	7-13
7.8.3	BASE Consistency Model	7-15

Unit V

NoSQL using MongoDB: Introduction to MongoDB Shell, Running the MongoDB shell, MongoDB client, Basic operations with MongoDB shell, Basic Data Types, Arrays, Embedded Documents

Querying MongoDB using find() functions, advanced queries using logical operators and sorting, simple aggregate functions, saving and updating document.

MongoDB Distributed environment: Concepts of replication and horizontal scaling through sharding in MongoDB

Chapter 8 : NoSQL using MongoDB 8-1 to 8-29

8.1	Introduction to MongoDB Shell.....	8-1
8.1.1	JSON and BSON.....	8-2
8.1.1(A)	Binary JSON (BSON).....	8-3
8.1.1(B)	The Identifier (_id).....	8-3
8.1.1(C)	Capped Collection	8-3
8.1.1(D)	Polymorphic Schemas.....	8-4
8.2	Running the MongoDB shell	8-4

8.2.1	Installing MongoDB on Ubuntu	8-4
8.2.2	Installing MongoDB on Windows	8-5
8.2.3	How to Verify the Installation is successful.....	8-6
8.3	MongoDB client	8-6
8.4	Basic operations with MongoDB shell	8-7
8.4.1	MongoDB Help.....	8-7
8.4.2	MongoDB Statistics.....	8-7
8.4.3	The use Command.....	8-7
8.4.4	The dropDatabase() Method	8-8
8.4.5	The createCollection() Method.....	8-8
8.4.6	The drop() Method.....	8-10
8.5	Basic Data Types	8-10
8.6	Arrays.....	8-11
8.6.1	Various Array Operators in MongoDB.....	8-12
8.7	Embedded Documents.....	8-13
8.7.1	Creating Embedded Documents	8-13
8.8	MongoDB CRUD Operations.....	8-13
8.8.1	Create Operations	8-13
8.8.2	Insert Operation.....	8-14
8.8.2(A)	The insertOne() method	8-14
8.8.2(B)	The insertMany() method.....	8-15
8.9	Querying MongoDB using find () functions	8-16
8.9.1	The find() Method.....	8-16
8.9.2	The pretty() Method	8-18
8.9.3	The findOne() method	8-19
8.9.4	MongoDB and RDBMS where clause Equivalents	8-19
8.10	Advanced queries using logical operators.....	8-20
8.10.1	AND in MongoDB.....	8-20

8.10.2	OR in MongoDB	8-20
8.10.3	Using AND and OR Together.....	8-21
8.10.4	NOT in MongoDB	8-22
8.11	Saving and Updating Document	8-22
8.11.1	Update Document	8-22
8.11.2	MongoDB Save() Method.....	8-23
8.11.3	Delete Document	8-23
8.11.4	The Limit () Method.....	8-24
8.11.5	MongoDB Skip() Method	8-24
8.12	Sorting.....	8-25
8.13	Simple Aggregate Functions	8-25
8.14	MongoDB Distributed environment.....	8-27
8.14.1	Replication.....	8-27
8.14.2	Replication in MongoDB	8-27
8.14.3	Asynchronous Replication	8-28
8.15	Sharding in MongoDB	8-28

Unit VI

Temporal database : Concepts, time representation, time dimension, incorporating time in relational databases.

Graph Database: Introduction, Features, Transactions, consistency, Availability, Querying, Case Study Neo4J

Spatial database: Introduction, data types, models, operators and queries

Chapter 9 : Trends in Advance Database

9-1 to 9-10

9.1	Temporal Database Concept	9-1
9.2	Temporal (Time)Representation.....	9-2
9.3	Time Dimensions in Relational Data.....	9-2
9.3.1	Valid Time Temporal Database	9-2
9.3.1(A)	Transaction Time Temporal Database.....	9-3
9.3.1(B)	Bi-temporal Database Schema.....	9-3
9.4	Incorporating Time in relational Databases.....	9-4

9.4.1	Temporal Query Language	9-4
9.5	Graph Database Concept	9-5
9.5.1	Performance comparison of Data Models vs graph database	9-6
9.5.2	Graph Mining.....	9-6
9.5.3	Neo4j Graph Databases	9-7
9.5.4	Consistency and Availability.....	9-8
9.6	Spatial Databases Introduction	9-8
9.6.1	Spatial Data types.....	9-8
9.6.2	Spatial Database Queries and Operators.....	9-9
9.6.3	Spatial Database Applications.....	9-9

