
🟢 Beginner MongoDB Topics

📘 MongoDB Fundamentals

- What is MongoDB?
- BSON vs JSON (Advantages of BSON)
- Collections, Documents, and Databases
- Embedded Documents
- Embedded Documents vs References
- CRUD Operations (insert, find, update, delete)
- updateMany Syntax
- Removing a Field from a Document ($unset)
- upsert Query
- distinct()
- pretty() Command
- Query Operators ($exists, $inc, $in, $gt, $lte, $regex)
- $inc (Increment/Decrement Query)
- $pop vs $pull vs $pullAll
- $addToSet Operator
- $elemMatch
- $expr Usage
- $cond, $let Operators
- Referential Equality (Data Reference Concept)

🔢 Query Practice Examples

- Query: Average Marks in Class 10
- Query: Student Names Where Marks > Passmark
- Query: Student Names Not Ending with a Vowel

🟡 Intermediate MongoDB Topics

⚙️ Data Modeling

- Embedded Documents vs Referenced Documents

- Normalization & Denormalization
- Aliases in MongoDB
- Materialized Views
- Views and How to Create Views
- GridFS (Handling Large Files)
- Covered Query
- Data Redundancy Concepts

💾 **Indexing**

- What is Indexing in MongoDB?
- Types of Indexing
    - Single Field Index
    - Compound Index
    - Multikey Index
    - Text Index (Full-Text Search)
    - Hashed Index
    - Geospatial Index
    - Wildcard Index
    - Clustered Index
- Clustered Collection
- Clustered Indexing
- Index Drawbacks (Storage, Write Overhead, RAM Usage)
- Data Structures Used in Indexing (B-Tree)
- Covered Query (Revisited)
- How to Optimize MongoDB Query Apart from Indexing

🧩 **Aggregation Framework**

- Aggregation Pipeline
- $group with $sum Query
- $facet
- $out

- $merge
- $addToSet
- $cond
- $expr
- $let
- Distinct Aggregation vs Distinct Command

⚡ **Write Operations**

- Bulk Write (bulkWrite())
- Batch Sizing
- Journaling
- Write Concern
- Durability, Consistency (ACID Properties)
- Atomicity
- Transactions (Basic Concept)
- session.startTransaction() Method
- How to Implement Transactions in MongoDB

🔵 **Advanced MongoDB Topics**

🧠 **Advanced Data Handling**

- Partition Tolerance (CAP Theorem)
- Consistency, Availability, and Partition Tolerance (CAP)
- Durability in Write Operations
- $out and $merge Stages (Aggregation Output)
- $facet (Multi-Stage Aggregation)
- bulkWrite Advanced Scenarios

🧩 **Replication & High Availability**

- What is Replication?
- Primary, Secondary, Arbiter
- Replica Set Architecture

- What is Voting in Replication?
- Write Concern and Acknowledgments
- Journaling in Replica Sets
- Failover Mechanism in Replication
- Consistency in Replication
- Redundancy
- mongorestore and mongodump

🌐 **Sharding & Scaling**

- What is Sharding?
- Difference Between Replication and Sharding
- Horizontal Sharding
- Vertical Sharding
- Shard Key
- Config Servers & Mongos Router
- Partition Tolerance and Data Distribution
- Balancing Shards in a Cluster
- Namespace Concept in MongoDB

🧰 **Performance Optimization**

- Covered Queries
- Query Optimization Strategies
- Using Explain Plans (.explain("executionStats"))
- Index Coverage & Filtering
- Batch Size Optimization
- Query Caching
- Avoiding Index Overuse
- Reducing Disk I/O
- Query Patterns for High Throughput

📦 **Backup & Restore**

- mongodump
- mongorestore
- Backup Strategies in Replica Sets
- Hot Backup vs Cold Backup
- Restore from Backup in Clustered Environment

🔴 **Expert MongoDB Topics**

🔁 **Transactions & Concurrency Control**

- Multi-Document Transactions
- ACID Compliance in MongoDB
- Transaction Internals (Session, Start, Commit, Abort)
- Retryable Writes
- Write Concern Levels
- Distributed Transactions
- Conflict Resolution in Replication
- Atomic Operations at Document Level
- $merge vs $out in Transaction Context

🧬 **Advanced Indexing & Query Engine**

- Wildcard Index Deep Dive
- Geospatial Query Optimization
- Text Search Internals
- Index Intersection
- Index Hints & Index Selectivity
- Covered Queries (Engine Optimization)
- Query Planner & Execution Engine
- Namespace Internals

🧠 **Advanced Cluster Management**

- Clustered Collection Concepts
- Clustered Indexing Advantages

- Config Server Internals
- Replica Set Election Algorithm (Voting System)
- Handling Failovers
- Read/Write Concerns in Replica Environments
- Shard Balancing & Rebalancing Internals

💡 **Advanced Operations**

- Journaling Deep Dive
- Write Concern Tuning
- MongoDB Consistency Guarantees
- Partition Tolerance in CAP Theorem Context
- Durability Guarantees (WiredTiger Storage Engine)
- Query Optimizer Statistics Collection

🧱 **Advanced Aggregation Techniques**

- $facet Advanced Pipeline Design
- $merge for ETL Pipelines
- $out for Data Export
- $group, $project, $unwind Complex Pipelines
- $expr, $cond, $let Conditional Expressions
- $addToSet, $push Advanced Use Cases

🟣 **Miscellaneous / Supporting Topics**

🧩 **Tools & Utilities**

- Mongo Shell vs MongoDB Compass
- Mongosh (New Shell)
- GridFS for Large Files
- BSON Format Deep Dive
- Materialized Views
- Aliases in Collections
- Distinct vs Aggregation Distinct

- Full-Text Search Configuration

🧰 Admin & Infrastructure

- Cluster Monitoring Tools
- Replica Set Configuration Commands
- Profiling MongoDB Queries
- Backup & Recovery Tools
- Storage Engine (WiredTiger)
- Command-Line Utilities (mongoimport, mongoexport)
- Index Statistics (collStats, indexStats)
