

Here's a comprehensive list of topics for learning MongoDB from scratch to an advanced level:

Part 1: MongoDB Fundamentals (Scratch)

- 1. Introduction to NoSQL and MongoDB**
 - What is NoSQL?
 - Why NoSQL? Relational vs. NoSQL.
 - Types of NoSQL databases (Key-Value, Document, Column-Family, Graph).
 - What is MongoDB? Key features and advantages.
 - Use cases for MongoDB.
- 2. Setting Up MongoDB**
 - Installation (Community Edition).
 - MongoDB Shell (mongosh).
 - MongoDB Compass (GUI Tool).
 - MongoDB Atlas (Cloud Service - overview).
- 3. Core Concepts**
 - Database.
 - Collection.
 - Document (JSON/BSON).
 - Fields.
 - Embedded Documents.
 - Arrays.
 - _id Field.
- 4. Basic CRUD Operations (Create, Read, Update, Delete)**
 - **Create:**
 - insertOne()
 - insertMany()
 - **Read (Querying):**
 - find() (basic queries, projection).
 - Query Operators (\$eq, \$gt, \$gte, \$lt, \$lte, \$ne, \$in, \$nin).
 - Logical Operators (\$and, \$or, \$not, \$nor).
 - Element Operators (\$exists, \$type).
 - Array Operators (\$all, \$size, \$elemMatch).
 - Regular Expressions (\$regex).
 - Text Search (\$text).
 - Sorting (sort()).
 - Limiting (limit()).
 - Skipping (skip()).
 - **Update:**
 - updateOne()
 - updateMany()

- replaceOne()
- Update Operators (\$set, \$unset, \$inc, \$mul, \$push, \$pull, \$addToSet, \$pop, \$rename).
- **Delete:**
 - deleteOne()
 - deleteMany()
 - drop() (collection and database).

Part 2: Intermediate MongoDB

5. Data Modeling

- Schema Design Principles (denormalization, normalization trade-offs).
- Embedding vs. Referencing.
- One-to-One Relationships.
- One-to-Many Relationships.
- Many-to-Many Relationships.
- Tree Structures (Parent References, Child References, Materialized Paths, Nested Sets).

6. Indexing

- What are Indexes? Why use them?
- Types of Indexes:
 - Single Field Indexes.
 - Compound Indexes.
 - Multikey Indexes (for arrays).
 - Text Indexes.
 - Geospatial Indexes (2dsphere, 2d).
 - Unique Indexes.
 - Partial Indexes.
 - TTL (Time-To-Live) Indexes.
- Creating Indexes (createIndex()).
- Managing Indexes (getIndexes(), dropIndex(), dropIndexes()).
- explain() method for query optimization.

7. Aggregation Framework

- What is Aggregation?
- The Aggregation Pipeline concept.
- Common Aggregation Stages:
 - \$match (filter documents).
 - \$project (reshape documents, select fields).
 - \$group (group by and aggregate data).
 - \$sort (sort results).
 - \$limit (limit results).
 - \$skip (skip results).

- \$unwind (deconstruct array fields).
- \$lookup (perform left outer join - for joins across collections).
- \$addFields (add new fields).
- \$out (write results to a new collection).
- \$merge (merge results into an existing collection).
- Aggregation Operators (\$sum, \$avg, \$min, \$max, \$count, \$first, \$last).

Part 3: Advanced MongoDB

8. Replication (Replica Sets)

- What is a Replica Set?
- Why use Replica Sets? (High Availability, Data Redundancy).
- Primary and Secondary Nodes.
- Election Process.
- Read Preferences.
- Write Concerns.
- Setting up a Replica Set (local and cloud).

9. Sharding

- What is Sharding?
- Why use Sharding? (Horizontal Scaling, Large Datasets).
- Components of a Sharded Cluster (Shard, Config Server, Mongos).
- Shard Key Selection.
- Chunk Migration.
- Setting up a Sharded Cluster.
- Balancing.

10. Security

- Authentication (SCRAM-SHA-1, SCRAM-SHA-256).
- Role-Based Access Control (RBAC).
- Users and Roles.
- Authorization.
- Encryption (TLS/SSL).
- Auditing.
- Network Security (Firewalls, IP Whitelisting).

11. Performance Tuning and Monitoring

- Query Optimization (using explain()).
- Indexing Strategies.
- Schema Design for Performance.
- Hardware Considerations.
- Monitoring Tools (MongoDB Cloud Manager/Ops Manager, mongostat, mongotop).
- Caching Strategies.

12. Transactions (Multi-Document ACID Transactions)

- What are Transactions?

- When to use Transactions.
- Syntax and Usage.
- Limitations and Best Practices.

13. GridFS

- Storing large files in MongoDB.
- Use cases.

14. Change Streams

- Real-time data changes.
- Use cases (e.g., real-time dashboards, microservices communication).

15. Integration with Programming Languages (e.g., Node.js/Mongoose, Python/PyMongo)

- Connecting to MongoDB.
- Performing CRUD operations.
- Using ODM/ORM libraries.

16. Backup and Restore

- mongodump and mongorestore.
- Snapshot backups.
- Point-in-time recovery.

17. Advanced Aggregation Topics

- Graph Lookup (\$graphLookup).
- Facet (\$facet).
- Window Operators (\$window).

18. MongoDB Atlas Specifics (if focusing on cloud)

- Cluster Deployment.
- Security Features.
- Performance Advisor.
- Backup and Restore.
- Atlas Search.
- Atlas Data Lake.
- Atlas App Services (Functions, Triggers, GraphQL API).

This list provides a comprehensive path from foundational knowledge to advanced administration and optimization techniques in MongoDB.