DEPARTMENT OF
COMPUTER SCIENCE & ENGINEERING

CU CHANDIGARH UNIVERSITY

Discover. Learn. Empower.

Experiment - 10

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1. Aim:

To study and perform basic CRUD (Create, Read, Update, Delete) operations in **MongoDB**, a NoSQL document-based database, and understand its key commands, such as creating databases, collections, inserting, updating, deleting records, and grouping data using aggregation.

2. Objective:

- To understand the concept of NoSQL and document-based databases.
- To learn how to create and manage databases and collections in MongoDB.
- To perform CRUD operations — Create, Read, Update, and Delete — on MongoDB collections.
- To use operators like $push, $pull, $unset, and $upsert for document updates.
- To execute conditional queries and retrieve nested document data using find().
- To perform grouping and aggregation operations using $sum and other aggregation operators.
- To compare SQL and NoSQL databases in terms of structure, performance, and use cases.
- To apply MongoDB commands on a practical dataset (e.g., car dealership data) for handson understanding.

3. Theory:

MongoDB is a NoSQL document-oriented database that stores data in JSON-like documents instead of tables and rows. It is designed for handling large, unstructured, or semi-structured data with flexibility and scalability.

A **MongoDB database** contains **collections**, and each collection holds multiple **documents** made up of key-value pairs. Unlike SQL databases, MongoDB allows documents in the same collection to have different structures, making it ideal for applications with changing data requirements.

Basic Operations:

- **Create:** use db_name, db.createCollection()
- **Insert:** insertOne(), insertMany()
- **Read:** find(), findOne()
- **Update:** updateOne(), updateMany() with $set, $push, $pull, $upsert
- **Delete:** deleteOne(), deleteMany()

MongoDB also supports **aggregation** (e.g., $sum, $group) for analyzing and summarizing data.

Advantages:

- Flexible and schema-less structure
- High performance and scalability
- Easy integration with modern applications

In short, MongoDB is preferred for applications requiring **speed, flexibility, and scalability**, while SQL remains suited for **structured and relational data**.

4. Procedure:

- Start the MongoDB server and open the Mongo shell or MongoDB Compass.
- Create or switch to a new database.
- Create a new collection to store data.
- Insert one or more documents into the collection.
- Retrieve data from the collection using read operations.
- Apply filters or conditions to view specific data.
- Update existing records in the collection as required.
- Delete one or multiple records from the collection.
- Perform grouping or aggregation operations to analyze data.
- Drop collections or the entire database if no longer needed.

5. Code:

```
C:\Users\Armaa>mongosh
Current Mongosh Log ID: 690a30cdd72ea166af63b111
Connecting to:
      mongodb://127.0.0.1:27017/?directConnection=true&serverSelectionTimeoutMS=2000&appName=mongosh+2.5.9
Using MongoDB:          8.2.1
Using Mongosh:          2.5.9
```

For mongosh info see: https://www.mongodb.com/docs/mongodb-shell/

To help improve our products, anonymous usage data is collected and sent to MongoDB periodically (https://www.mongodb.com/legal/privacy-policy).
You can opt-out by running the disableTelemetry() command.

  The server generated these startup warnings when booting
  2025-11-04T22:18:13.154+05:30: Access control is not enabled for the database. Read and write access to data and configuration is unrestricted
---

```
test> db.createCollection("cars")
{ ok: 1 }
test> db.cars
test.cars test>
{
...  "maker": "Tata",
...  "model": "Nexon",
...  "fuel_type": "Petrol",
...  "transmission": "Automatic",
...  "engine": {
...  "type": "Turbocharged",
...  "cc": 1199,
...  "torque": "170 Nm"
...  },
...  "features": [
...  "Touchscreen",
...  "Reverse Camera",
...  "Bluetooth Connectivity"
...  ],
...  "sunroof": false,
...  "airbags": 2
...  } ...
...
test> db.cars.insertOne ()
MongoshInvalidInputError: [COMMON-10001] Missing required argument at position 0 (Collection.insertOne) test>
db.cars.insertOne(
... {
...  "maker": "Tata",
...  "model": "Nexon",
...  "fuel_type": "Petrol",
...  "transmission": "Automatic",
...  "engine": {
...  "type": "Turbocharged",
...  "cc": 1199,
...  "torque": "170 Nm"
...  },
...  "features": [
...  "Touchscreen",
...  "Reverse Camera",
...  "Bluetooth Connectivity"
...  ],
...  "sunroof": false,
...  "airbags": 2
...  })
{   acknowledged:
true,
  insertedId: ObjectId('690a31c2d72ea166af63b112')
} test>
db.cars.insertMany(
... [
```

```
...  {
...  "maker": "Hyundai",
...  "model": "Creta",
...  "fuel_type": "Diesel",
...  "transmission": "Manual",
...  "engine": {
...  "type": "Naturally Aspirated",
...  "cc": 1493,
...  "torque": "250 Nm"
...  },
...  "features": [
...  "Sunroof",
...  "Leather Seats",
...  "Wireless Charging",
... "Ventilated Seats",
... "Bluetooth"
...  ],
...  "sunroof": true,
...  "airbags": 6
...  },
...  {
...  "maker": "Maruti Suzuki",
...  "model": "Baleno",
...  "fuel_type": "Petrol",
...  "transmission": "Automatic",
...  "engine": {
...  "type": "Naturally Aspirated",
...  "cc": 1197,
...  "torque": "113 Nm"
...  },
...  "features": [
...  "Projector Headlamps",
...  "Apple CarPlay",
...  "ABS"
...  ],
...  "sunroof": false,
...  "airbags": 2
...  },
...  {
...  "maker": "Mahindra",
...  "model": "XUV500",
...  "fuel_type": "Diesel",
...  "transmission": "Manual",
...  "engine": {
...  "type": "Turbocharged",
...  "cc": 2179,
...  "torque": "360 Nm"
...  },
...  "features": [
...  "All-Wheel Drive",
...  "Navigation System",
...  "Cruise Control"
...  ],
...  "sunroof": true,
...  "airbags": 6
...  },
...  {
...  "maker": "Honda",
...  "model": "City",
...  "fuel_type": "Petrol",
...  "transmission": "Automatic",
...  "engine": {
...  "type": "Naturally Aspirated",
...  "cc": 1498,
```

```
...  "torque": "145 Nm"
...  },
...  "features": [
...  "Keyless Entry",
...  "Auto AC",
...  "Multi-angle Rearview Camera"
...  ],
...  "sunroof": false,
...  "airbags": 4
...  }
... ])
{   acknowledged:
true,   insertedIds: {
    '0': ObjectId('690a31e6d72ea166af63b113'),
    '1': ObjectId('690a31e6d72ea166af63b114'),
    '2': ObjectId('690a31e6d72ea166af63b115'),
    '3': ObjectId('690a31e6d72ea166af63b116')
  } }
test> db.cars.find()
[
  {
    _id: ObjectId('690a31c2d72ea166af63b112'),
    maker: 'Tata',     model: 'Nexon',     fuel_type: 'Petrol',     transmission:
'Automatic',     engine: { type: 'Turbocharged', cc: 1199, torque: '170 Nm'
},     features: [ 'Touchscreen', 'Reverse Camera', 'Bluetooth
Connectivity' ],     sunroof: false,     airbags: 2
  },
  {
    _id: ObjectId('690a31e6d72ea166af63b113'),
    maker: 'Hyundai',     model: 'Creta',     fuel_type: 'Diesel',
transmission: 'Manual',     engine: { type: 'Naturally Aspirated', cc:
1493, torque: '250 Nm' },     features: [       'Sunroof',
      'Leather Seats',
      'Wireless Charging',
      'Ventilated Seats',
      'Bluetooth'
    ],
    sunroof: true,
airbags: 6
  },
  {
    _id: ObjectId('690a31e6d72ea166af63b114'),
    maker: 'Maruti Suzuki',     model: 'Baleno',     fuel_type: 'Petrol',
transmission: 'Automatic',     engine: { type: 'Naturally Aspirated',
cc: 1197, torque: '113 Nm' },     features: [ 'Projector Headlamps',
'Apple CarPlay', 'ABS' ],
    sunroof: false,
airbags: 2
  },
  {
    _id: ObjectId('690a31e6d72ea166af63b115'),
maker: 'Mahindra',
    model: 'XUV500',     fuel_type: 'Diesel',     transmission: 'Manual',
engine: { type: 'Turbocharged', cc: 2179, torque: '360 Nm' },
features: [ 'All-Wheel Drive', 'Navigation System', 'Cruise Control' ],
sunroof: true,     airbags: 6
  },
  {
    _id: ObjectId('690a31e6d72ea166af63b116'),
    maker: 'Honda',     model: 'City',     fuel_type: 'Petrol',     transmission:
'Automatic',     engine: { type: 'Naturally Aspirated', cc: 1498, torque:
'145 Nm' },     features: [ 'Keyless Entry', 'Auto AC', 'Multi-angle
Rearview Camera' ],     sunroof: false,     airbags: 4
  }
]
```

```
test> db.cars.findOne()
{
  _id: ObjectId('690a31c2d72ea166af63b112'),
  maker: 'Tata',   model: 'Nexon',   fuel_type: 'Petrol',   transmission:
'Automatic',   engine: { type: 'Turbocharged', cc: 1199, torque: '170
Nm' },   features: [ 'Touchscreen', 'Reverse Camera', 'Bluetooth
Connectivity' ],   sunroof: false,   airbags: 2 }
test> db.cars.find({},{model:1})
[
  { _id: ObjectId('690a31c2d72ea166af63b112'), model: 'Nexon' },
  { _id: ObjectId('690a31e6d72ea166af63b113'), model: 'Creta' },
  { _id: ObjectId('690a31e6d72ea166af63b114'), model: 'Baleno' },
  { _id: ObjectId('690a31e6d72ea166af63b115'), model: 'XUV500' },
  { _id: ObjectId('690a31e6d72ea166af63b116'), model: 'City' }
]
test> db.cars.find({},{model:1,_id:0})
[
  { model: 'Nexon' },
  { model: 'Creta' },
  { model: 'Baleno' },
  { model: 'XUV500' },
  { model: 'City' }
]
test> db.cars.find({},{model:1,maker:1,_id:0})
[
  { maker: 'Tata', model: 'Nexon' },
  { maker: 'Hyundai', model: 'Creta' },
  { maker: 'Maruti Suzuki', model: 'Baleno' },
  { maker: 'Mahindra', model: 'XUV500' },
  { maker: 'Honda', model: 'City' }
]
test> db.cars.find(fuel_type:"Petrol") Uncaught:
SyntaxError: Unexpected token, expected "," (1:22)

> 1 | db.cars.find(fuel_type:"Petrol")
    |                      ^
  2 |

test> db.cars.find("fuel_type":"Petrol") Uncaught:
SyntaxError: Unexpected token, expected "," (1:24)

> 1 | db.cars.find("fuel_type":"Petrol")
    |                        ^
  2 |

test> db.cars.find({"fuel_type":"Petrol"})
[
  {
    _id: ObjectId('690a31c2d72ea166af63b112'),
    maker: 'Tata',     model:
'Nexon',     fuel_type:
'Petrol',     transmission:
'Automatic',
    engine: { type: 'Turbocharged', cc: 1199, torque: '170 Nm' },
features: [ 'Touchscreen', 'Reverse Camera', 'Bluetooth Connectivity' ],
sunroof: false,     airbags: 2
  },
  {
    _id: ObjectId('690a31e6d72ea166af63b114'),
    maker: 'Maruti Suzuki',     model: 'Baleno',     fuel_type: 'Petrol',
transmission: 'Automatic',     engine: { type: 'Naturally Aspirated',
cc: 1197, torque: '113 Nm' },     features: [ 'Projector Headlamps',
'Apple CarPlay', 'ABS' ],
```

```
    sunroof: false,
airbags: 2
  },
  {
    _id: ObjectId('690a31e6d72ea166af63b116'),
    maker: 'Honda',     model: 'City',     fuel_type: 'Petrol',     transmission:
'Automatic',     engine: { type: 'Naturally Aspirated', cc: 1498, torque:
'145 Nm' },     features: [ 'Keyless Entry', 'Auto AC', 'Multi-angle
Rearview Camera' ],     sunroof: false,     airbags: 4
  }
]
test> db.cars.updateOne( ...
{ model: "Nexon" },
...   { $set: { color: "Red" } }
... ) ...
{   acknowledged:
true,   insertedId:
null,
matchedCount: 1,
modifiedCount: 1,
upsertedCount: 0
} test>
db.cars.updateOne(
...   { model: "Nexon" },
...   { $push: { features: "Heated Seats" } }
... ) ...
{   acknowledged:
true,   insertedId:
null,
matchedCount: 1,
modifiedCount: 1,
upsertedCount: 0
} test>
db.cars.updateOne(
...   { model: "Nexon" },
...   { $pull: { features: "Heated Seats" } }
... )
...
{   acknowledged:
true,   insertedId:
null,
matchedCount: 1,
modifiedCount: 1,
upsertedCount: 0
}
test> db.cars.updateMany( ...
{ fuel_type: "Diesel" },
...   { $set: { alloys: "yes" } }
... ) ...
{   acknowledged:
true,   insertedId:
null,
matchedCount: 2,
modifiedCount: 2,
upsertedCount: 0
}
test> db.cars.updateOne(
...   { model: "Creta" },
...   { $set: { "engine.torque": "270 Nm" } }
... ) ...
{   acknowledged:
true,   insertedId:
null,
matchedCount: 1,
```

```
modifiedCount: 1,
upsertedCount: 0
} test>
db.cars.updateOne(
...   { model: "Nexon" },
...   { $push: { features: "Heated Steering Wheel" } }
... ) ...
{   acknowledged:
true,   insertedId:
null,
matchedCount: 1,
modifiedCount: 1,
upsertedCount: 0
} test>
db.cars.updateOne(
...   { model: "Nexon" },
...   { $pull: { features: "Bluetooth Connectivity" } }
... ) ...
{   acknowledged:
true,   insertedId:
null,
matchedCount: 1,
modifiedCount: 1,
upsertedCount: 0
} test>
db.cars.updateOne(
...   { model: "Nexon" },
...   { $push: { features: { $each: ["Wireless charging", "Voice Control"] } } }
... ) ...
{   acknowledged:
true,   insertedId:
null,
matchedCount: 1,
modifiedCount: 1,
upsertedCount: 0
}
test> db.cars.updateOne( ...
{ model: "Nexon" },
...   { $unset: { color: "" } }
... ) ...
{   acknowledged:
true,   insertedId:
null,
matchedCount: 1,
modifiedCount: 1,
upsertedCount: 0
}
test> db.cars.updateMany(
...   {},
...   { $set: { color: "Blue" } }
... ) ...
{   acknowledged:
true,   insertedId:
null,
matchedCount: 5,
modifiedCount: 5,
upsertedCount: 0
}
test> db.cars.aggregate([
...   {
...     $group: {
...       _id: "$maker",
...       TotalCars: { $sum: 1 }
...     }
```

```
...   }
...   ])
...
[
  { _id: 'Maruti Suzuki', TotalCars: 1 },
  { _id: 'Tata', TotalCars: 1 },
  { _id: 'Hyundai', TotalCars: 1 },
  { _id: 'Honda', TotalCars: 1 },
  { _id: 'Mahindra', TotalCars: 1 }
]
test> db.cars.aggregate([
...   {
...     $group: {
...       _id: "$fuel_type",
...       TotalCars: { $sum: 1 }
...     }
...   }
...   ])
...
[ { _id: 'Petrol', TotalCars: 3 }, { _id: 'Diesel', TotalCars: 2 } ]
test> db.collection.aggregate([
...   {
...     $group: {
...       _id: "$category",
...       totalAmount: { $sum: "$amount" },
...       averageAmount: { $avg: "$amount" },
...       minAmount: { $min: "$amount" },
...       maxAmount: { $max: "$amount" },
...       amountsList: { $push: "$amount" },
...       uniqueAmounts: { $addToSet: "$amount" }
...     }
...   }
...   ])
...

      test>
```

6. Output:

```
test> db.createCollection("cars")
{ ok: 1 }
test> db.cars
test.cars
test> {
...   "maker": "Tata",
...   "model": "Nexon",
...   "fuel_type": "Petrol",
...   "transmission": "Automatic",
...   "engine": {
...   "type": "Turbocharged",
...   "cc": 1199,
...   "torque": "170 Nm"
...   },
...   "features": [
...   "Touchscreen",
...   "Reverse Camera",
...   "Bluetooth Connectivity"
...   ],
...   "sunroof": false,
...   "airbags": 2
...   }
...
...
```

```
test> db.cars.insertOne(
... {
...  "maker": "Tata",
...  "model": "Nexon",
...  "fuel_type": "Petrol",
...  "transmission": "Automatic",
...  "engine": {
...  "type": "Turbocharged",
...  "cc": 1199,
...  "torque": "170 Nm"
...  },
...  "features": [
...  "Touchscreen",
...  "Reverse Camera",
...  "Bluetooth Connectivity"
...  ],
...  "sunroof": false,
...  "airbags": 2
...  })
{
  acknowledged: true,
  insertedId: ObjectId('690a31c2d72ea166af63b112')
}
```

```
test> db.cars.insertMany(
... [
...  {
...  "maker": "Hyundai",
...  "model": "Creta",
...  "fuel_type": "Diesel",
...  "transmission": "Manual",
...  "engine": {
...  "type": "Naturally Aspirated",
...  "cc": 1493,
...  "torque": "250 Nm"
...  },
...  "features": [
...  "Sunroof",
...  "Leather Seats",
...  "Wireless Charging",
... "Ventilated Seats",
... "Bluetooth"
...  ],
...  "sunroof": true,
...  "airbags": 6
...  },
...  {
...  "maker": "Maruti Suzuki",
...  "model": "Baleno",
...  "fuel_type": "Petrol",
...  "transmission": "Automatic",
...  "engine": {
...  "type": "Naturally Aspirated",
...  "cc": 1197,
...  "torque": "113 Nm"
...  },
...  "features": [
...  "Projector Headlamps",
...  "Apple CarPlay",
...  "ABS"
...  ],
...  "sunroof": false,
...  "airbags": 2
```

```
{
  acknowledged: true,
  insertedIds: {
    '0': ObjectId('690a31e6d72ea166af63b113'),
    '1': ObjectId('690a31e6d72ea166af63b114'),
    '2': ObjectId('690a31e6d72ea166af63b115'),
    '3': ObjectId('690a31e6d72ea166af63b116')
  }
}
```

```
test> db.cars.find()
[
  {
    _id: ObjectId('690a31c2d72ea166af63b112'),
    maker: 'Tata',
    model: 'Nexon',
    fuel_type: 'Petrol',
    transmission: 'Automatic',
    engine: { type: 'Turbocharged', cc: 1199, torque: '170 Nm' },
    features: [ 'Touchscreen', 'Reverse Camera', 'Bluetooth Connectivity' ],
    sunroof: false,
    airbags: 2
  },
  {
    _id: ObjectId('690a31e6d72ea166af63b113'),
    maker: 'Hyundai',
    model: 'Creta',
    fuel_type: 'Diesel',
    transmission: 'Manual',
    engine: { type: 'Naturally Aspirated', cc: 1493, torque: '250 Nm' },
    features: [
      'Sunroof',
      'Leather Seats',
      'Wireless Charging',
      'Ventilated Seats',
      'Bluetooth'
    ],
    sunroof: true,
    airbags: 6
  },
```

```
test> db.cars.findOne()
{
  _id: ObjectId('690a31c2d72ea166af63b112'),
  maker: 'Tata',
  model: 'Nexon',
  fuel_type: 'Petrol',
  transmission: 'Automatic',
  engine: { type: 'Turbocharged', cc: 1199, torque: '170 Nm' },
  features: [ 'Touchscreen', 'Reverse Camera', 'Bluetooth Connectivity' ],
  sunroof: false,
  airbags: 2
}
test> db.cars.find({},{model:1})
[
  { _id: ObjectId('690a31c2d72ea166af63b112'), model: 'Nexon' },
  { _id: ObjectId('690a31e6d72ea166af63b113'), model: 'Creta' },
  { _id: ObjectId('690a31e6d72ea166af63b114'), model: 'Baleno' },
  { _id: ObjectId('690a31e6d72ea166af63b115'), model: 'XUV500' },
  { _id: ObjectId('690a31e6d72ea166af63b116'), model: 'City' }
]
test> db.cars.find({},{model:1,_id:0})
[
  { model: 'Nexon' },
  { model: 'Creta' },
  { model: 'Baleno' },
  { model: 'XUV500' },
  { model: 'City' }
]
test> db.cars.find({},{model:1,maker:1,_id:0})
[
  { maker: 'Tata', model: 'Nexon' },
  { maker: 'Hyundai', model: 'Creta' },
  { maker: 'Maruti Suzuki', model: 'Baleno' },
  { maker: 'Mahindra', model: 'XUV500' },
  { maker: 'Honda', model: 'City' }
]
```

```
test> db.cars.find({"fuel_type":"Petrol"})
[
  {
    _id: ObjectId('690a31c2d72ea166af63b112'),
    maker: 'Tata',
    model: 'Nexon',
    fuel_type: 'Petrol',
    transmission: 'Automatic',
    engine: { type: 'Turbocharged', cc: 1199, torque: '170 Nm' },
    features: [ 'Touchscreen', 'Reverse Camera', 'Bluetooth Connectivity' ],
    sunroof: false,
    airbags: 2
  },
  {
    _id: ObjectId('690a31e6d72ea166af63b114'),
    maker: 'Maruti Suzuki',
    model: 'Baleno',
    fuel_type: 'Petrol',
    transmission: 'Automatic',
    engine: { type: 'Naturally Aspirated', cc: 1197, torque: '113 Nm' },
    features: [ 'Projector Headlamps', 'Apple CarPlay', 'ABS' ],
    sunroof: false,
    airbags: 2
  },
  {
    _id: ObjectId('690a31e6d72ea166af63b116'),
    maker: 'Honda',
    model: 'City',
    fuel_type: 'Petrol',
    transmission: 'Automatic',
    engine: { type: 'Naturally Aspirated', cc: 1498, torque: '145 Nm' },
    features: [ 'Keyless Entry', 'Auto AC', 'Multi-angle Rearview Camera' ],
    sunroof: false,
    airbags: 4
  }
]
```

```
test> db.cars.aggregate([
...   {
...     $group: {
...       _id: "$maker",
...       TotalCars: { $sum: 1 }
...     }
...   }
... ])
...
[
  { _id: 'Maruti Suzuki', TotalCars: 1 },
  { _id: 'Tata', TotalCars: 1 },
  { _id: 'Hyundai', TotalCars: 1 },
  { _id: 'Honda', TotalCars: 1 },
  { _id: 'Mahindra', TotalCars: 1 }
]
test> db.cars.aggregate([
...   {
...     $group: {
...       _id: "$fuel_type",
...       TotalCars: { $sum: 1 }
...     }
...   }
... ])
```

7. Learning Outcomes:

- Understand the concept of **NoSQL databases** and their differences from SQL databases.
- Gain knowledge of **MongoDB architecture**, including databases, collections, and documents.
- Learn to perform **CRUD operations** (Create, Read, Update, Delete) using MongoDB commands.
- Use operators such as `$set`, `$push`, `$pull`, `$unset`, and `$upsert` for data manipulation.
- Apply **aggregation and grouping operations** using operators like `$sum`, `$avg`, `$min`, and `$max`.
- Develop the ability to query and analyze data efficiently in MongoDB.
- Compare the advantages and use cases of **SQL vs NoSQL** database models.
- Gain practical experience handling real-world data (e.g., car dealership dataset) using MongoDB.