MongoDB

Introduction

- **MongoDB** is a **No SQL** database. It is an **open-source, cross-platform, document-oriented** database written in C++.
- **MongoDB** uses the concept of the **document** to store data, which is more flexible than the **row concept** in the relational database management system.
- **MongoDB** doesn't **require predefined schemas** that allow you to add to or remove fields from documents more quickly.
- Like any database system, **MongoDB** allows you **to insert, update, and delete, and select data.** In addition, it supports other **features** like **Indexing, Aggregation, Specify collection and index types, File Storage**
- The philosophy of **MongoDB** is to create a full-featured database that is **scalable, flexible, and fast.**

History

- **MongoDB** was developed and is supported by a company named **10gen** which is a **New York based organization.**
- The initial development of **MongoDB** began in **2007** when the company was building a platform as a service like window azure.
- **MongoDB** was initially developed as a **PAAS** (Platform as a Service). Later in 2009, it is introduced in the market as an **open-source database** server that was maintained and supported by **MongoDB Inc.**
- The first version of **MongoDB** was released in **August 2009** as **1.0**
- The first ready production of **MongoDB** has been considered from **version 1.6** which was released in **August 2010.**
- **MongoDB 6.0** was the latest and stable version which was released in **July 2022.**
- **MongoDB 8.0 preview** is the latest version as of **2024.**
- Complete **MongoDB Version History** with features: Link

MongoDB Installation Guide

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MongoDB Server connection using terminal (command prompt)

- Open the bin path of the MongoDB server folder and copy the path.
- Open the terminal and navigate to the bin directory: **cd C:\Program Files\MongoDB\Server\6.0\bin** ***-> press enter.***
- Use the command **mongosh** to connect to the MongoDB server: C:\Program Files\MongoDB\Server\6.0\bin>***mongosh -> press enter.***
- You are connected to the MongoDB server and can start writing commands: ***test> show databases***

Data Types in MongoDB

Data Types are used to define the type of data stored in each field of a document. Some of the common MongoDB data types are:

- **String:** Used to store textual data. Strings are the most used data type.

➔ Example: {"name": "RVK"}

- **Integer:** Used to store numerical data (whole numbers).

➔ Example: {"age": 21}

- **Double:** Used to store floating-point numbers.

➔ Example: {"cgpa": 9.49}

- **Boolean:** Used to store a Boolean (true/false) value.

➔ Example: {"isPlaced": false}

- **Date:** Used to store dates in ISODate format.

➔ Example: {"joinedAt": ISODate("2023-07-24T00:00:00Z")}

- **Array:** Used to store arrays or lists of values.

➔ Example: {"tags": ["full stack dev", "cloud aspirant", "team player"]}

- **Object:** Used to store embedded documents (sub-documents).

➔ Example: {"address": {"Village": "NKP", "City": "Bargarh", "State": "OD"}}

- **ObjectId:** Used to store unique identifiers for documents.

➔ Example: {"_id": ObjectId("507f191e810c19729de860ea")}

➔ We cannot provide **ObjectId** while inserting a document into collection as it will be provided by default to out document.

- **Null:** Used to store a null value.

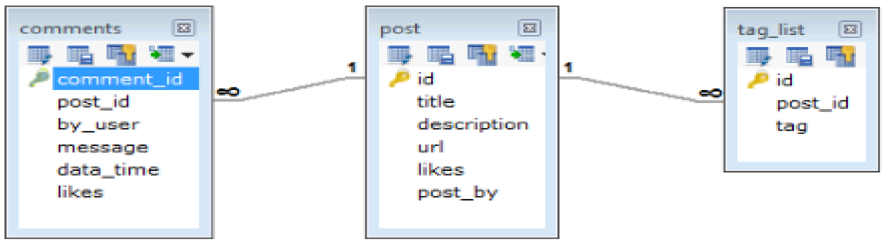
➔ Example: {"relationship": null}

Data Modelling in MongoDB

In MongoDB, data has a flexible schema. It is totally different from SQL database where you had to determine and declare a table's schema before inserting data. MongoDB collections do not enforce document structure.

For example:

- Let us take an example of a client who needs a database design for his website. His website has the following requirements:
- Every post is distinct (contains unique title, description and url).
- Every post can have one or more tags.
- Every post has the name of its publisher and total number of likes.
- Each post can have zero or more comments and the comments must contain username, message, data-time and likes.
- For the above requirement, a minimum of three tables are required in RDBMS.



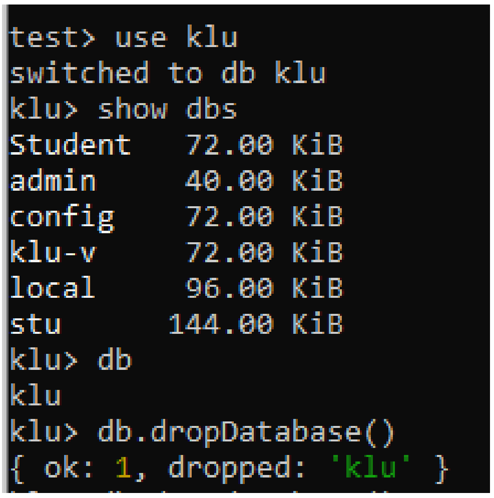
But in **MongoDB,** schema design will have one collection post and has the following **structure:**

{ _id: POST_ID, title: TITLE_OF_POST, description: POST_DESCRIPTION, by: POST_BY, url: URL_OF_POST, tags: [TAG1, TAG2, TAG3], likes: TOTAL_LIKES, comments: [{ user: 'COMMENT_BY', message: TEXT, dateCreated: DATE_TIME, like: LIKES }, { user: 'COMMENT_BY', message: TEXT, dateCreated: DATE_TIME, like: LIKES }] }

MongoDB Database commands

- There is no create database command in MongoDB. MongoDB do not provide any command to create databases.
- If we want a new database, we require **use** command, the use command in MongoDB creates a database if the database with the specified name doesn't exist. If a database with the same name already exists then it switches to that database.
- **Syntax: use Database_Name**
- **Example: use klu**
    - ➢ After executing above command if a database named as klu already exists then it switches to klu or else creates a database named as klu
- To check the **currently selected database** we can use **db** command.
- To get the **list of all available databases,** we can use below commands:
    - ➢ **Show dbs**
    - ➢ **Show databases**
- To **drop or to delete** an existing database, we can use the below command:
    - ➢ **db.dropDatabase()**
    - ➢ The above command will delete the current database that you are using; to delete other databases, you need to switch to them through **use db** command.

Example:

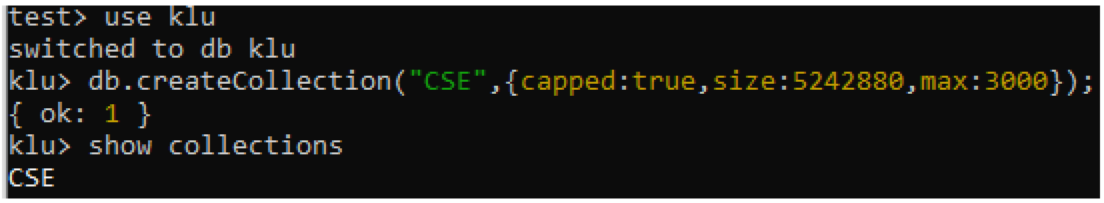


```
test> use klu
switched to db klu
klu> show dbs
Student    72.00 KiB
admin      40.00 KiB
config     72.00 KiB
klu-v      72.00 KiB
local      96.00 KiB
stu       144.00 KiB
klu> db
klu
klu> db.dropDatabase()
{ ok: 1, dropped: 'klu' }
```

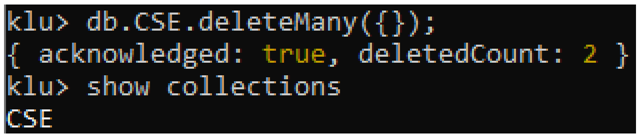
- In the example a database named as klu is created and switched with **use klu**
- **show dbs** command is used to display the list of all available databases
- **db** command is used to check the currently selected database
- **db.dropDatabase()** command is used to delete the database klu.

MongoDB Collection Commands

- A **collection** is a **group of MongoDB documents.** Documents within a collection can have different fields. A **collection** is the equivalent of a **table** in a relational database system.
- **Collections** can be created by **db.createCollection("collectionName", Options)** command, **Options** is a document type, specifies the memory size and indexing of the collection. It is an optional parameter.
- There are **four types of options** which can be used while creating collections and they are **Capped, AutoIndexID, Size, Max.**
  - **Capped:** Enables a capped collection. Capped collections are fixed-size collections that automatically overwrite their oldest entries when they reach their maximum size.
  - **AutoIndexID:** Automatically creates an index on the **_id** field. Its default value is **false.**
  - **Size**: Specifies a maximum size in bytes for a capped collection. If **capped** is **true**, then this field must be specified.
  - **Max**: Specifies the maximum number of documents allowed in the capped collection.
- To **list out** all the collections we can use **show collections** or **db.getCollectionNames()** commands.
- To **drop** an existing collection we can use **db.collectionName.drop()** command, this command will delete the entire collection.
- If we want to **delete only the documents** inside the collection but not the entire collection then we can use **db.collectionName.deleteMany({}).**
- To **find all documents** available inside a collection we can use the following command: **db.collectionName.find().**



```
test> use klu
switched to db klu
klu> db.createCollection("CSE",{capped:true,size:5242880,max:3000});
{ ok: 1 }
klu> show collections
CSE
```



```
klu> db.CSE.deleteMany({});
{ acknowledged: true, deletedCount: 2 }
klu> show collections
CSE
```

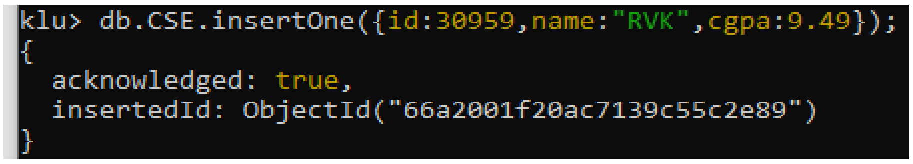
MongoDB Document Commands

- **Documents** in MongoDB are JSON-like objects (BSON) that store data as field-value pairs.

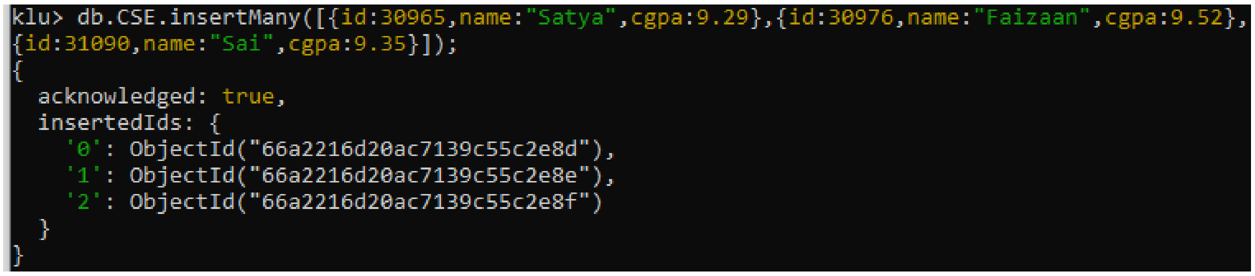
MongoDB Insert

- **Documents** can be **inserted** into MongoDB using the **insertOne()** and **insertMany()** commands.
- The **db.collectionName.insertOne()** is used to insert a single document.
- The **db.collectionName.insertMany()** is for inserting multiple documents.

Examples



```
klu> db.CSE.insertOne({id:30959,name:"RVK",cgpa:9.49});
{
  acknowledged: true,
  insertedId: ObjectId("66a2001f20ac7139c55c2e89")
}
```

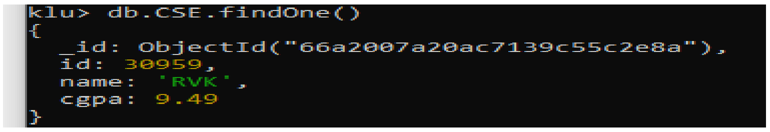


```
klu> db.CSE.insertMany([{id:30965,name:"Satya",cgpa:9.29},{id:30976,name:"Faizaan",cgpa:9.52},
{id:31090,name:"Sai",cgpa:9.35}]);
{
  acknowledged: true,
  insertedIds: {
    '0': ObjectId("66a2216d20ac7139c55c2e8d"),
    '1': ObjectId("66a2216d20ac7139c55c2e8e"),
    '2': ObjectId("66a2216d20ac7139c55c2e8f")
  }
}
```

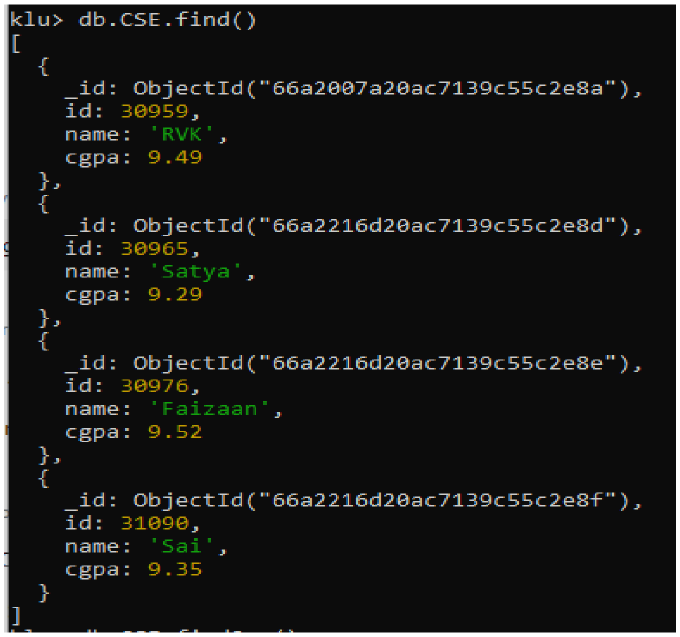
MongoDB Find

- **Documents** can be **selected** using **find()** and **findOne()** commands.
- The **find()** method accepts a query object. If left empty, all documents will be returned.
- The **findOne()** method is used to select only one document. This method accepts a query object. If left empty, it will return the first document it finds.

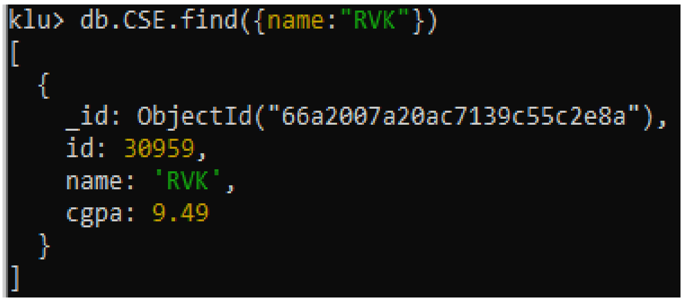
Examples



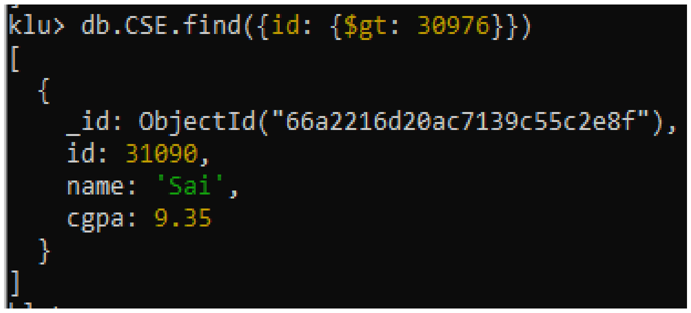
```
klu> db.CSE.findOne()
{
  _id: ObjectId("66a2007a20ac7139c55c2e8a"),
  id: 30959,
  name: 'RVK',
  cgpa: 9.49
}
```



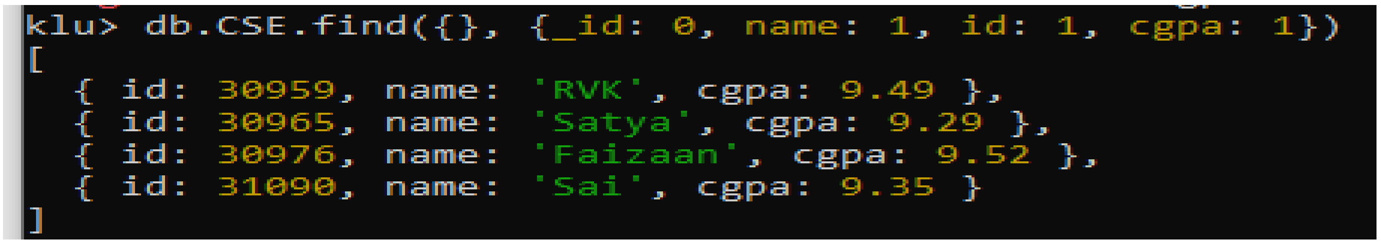
```
klu> db.CSE.find()
[
  {
    _id: ObjectId("66a2007a20ac7139c55c2e8a"),
    id: 30959,
    name: 'RVK',
    cgpa: 9.49
  },
  {
    _id: ObjectId("66a2216d20ac7139c55c2e8d"),
    id: 30965,
    name: 'Satya',
    cgpa: 9.29
  },
  {
    _id: ObjectId("66a2216d20ac7139c55c2e8e"),
    id: 30976,
    name: 'Faizaan',
    cgpa: 9.52
  },
  {
    _id: ObjectId("66a2216d20ac7139c55c2e8f"),
    id: 31090,
    name: 'Sai',
    cgpa: 9.35
  }
]
```



```
klu> db.CSE.find({name:"RVK"})
[
  {
    _id: ObjectId("66a2007a20ac7139c55c2e8a"),
    id: 30959,
    name: 'RVK',
    cgpa: 9.49
  }
]
```



```
klu> db.CSE.find({id: {$gt: 30976}})
[
  {
    _id: ObjectId("66a2216d20ac7139c55c2e8f"),
    id: 31090,
    name: 'Sai',
    cgpa: 9.35
  }
]
```



```
klu> db.CSE.find({}, {_id: 0, name: 1, id: 1, cgpa: 1})
[
  { id: 30959, name: 'RVK', cgpa: 9.49 },
  { id: 30965, name: 'Satya', cgpa: 9.29 },
  { id: 30976, name: 'Faizaan', cgpa: 9.52 },
  { id: 31090, name: 'Sai', cgpa: 9.35 }
]
```

The above shown 5 examples explanations:

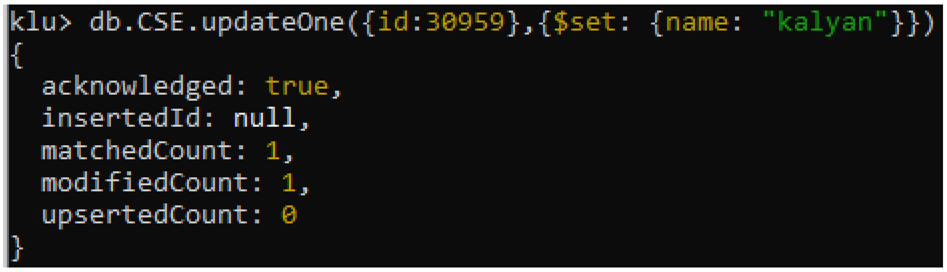
- The **first example** returned the first document because we used **findOne().**
- The **second example** returned all the documents because we used **find().**
- The **third example** returned a single document with name as **rvk** because we used a **query in find().**
- The **fourth example** returned the documents with id greater than 30976 because we used the **$gt query** in **find().**
- The **fifth example** returned all the documents but excluded the **_id** field because we specified **_id: 0** in **find()** and set other **fields to 1**.

MongoDB Update

- To **update** an existing document in MongoDB we can use **updateOne()** and **updateMany()** methods.

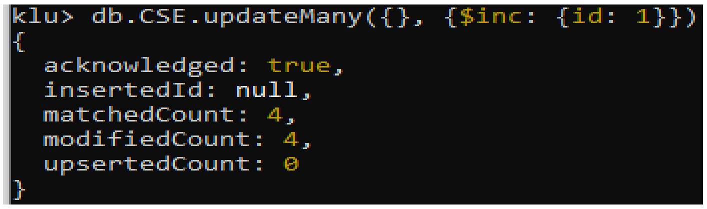
- These methods accept **two parameters** out of which the first parameter is a query object to define which document, or documents should be updated, and the second parameter is an object defining the updated data.
- The **updateOne()** method will update the first document that is found matching the provided query.
- The **updateMany()** method will update all documents that match the provided query.

Examples



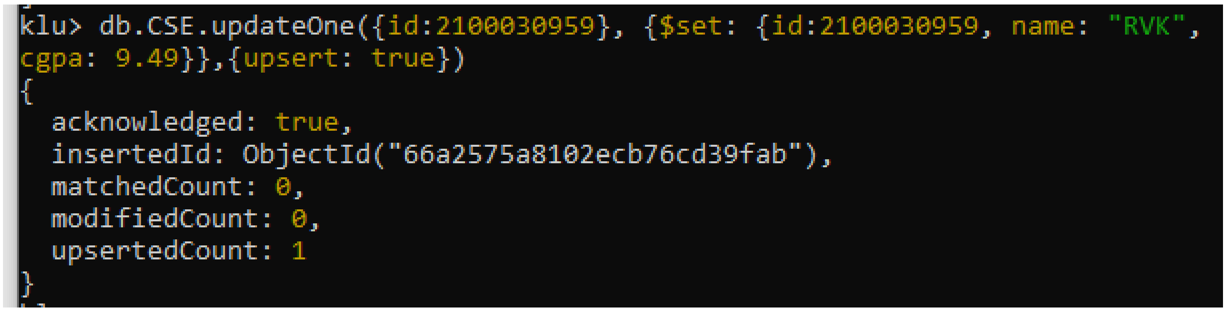
```
klu> db.CSE.updateOne({id:30959},{$set: {name: "kalyan"}})
{
  acknowledged: true,
  insertedId: null,
  matchedCount: 1,
  modifiedCount: 1,
  upsertedCount: 0
}
```

Here we update name to “kalyan" for student with id 30959 using updateOne()



```
klu> db.CSE.updateMany({}, {$inc: {id: 1}})
{
  acknowledged: true,
  insertedId: null,
  matchedCount: 4,
  modifiedCount: 4,
  upsertedCount: 0
}
```

➢ Here we have updated the ids of all students by incrementing them with 1.



```
klu> db.CSE.updateOne({id:2100030959}, {$set: {id:2100030959, name: "RVK",
cgpa: 9.49}},{upsert: true})
{
  acknowledged: true,
  insertedId: ObjectId("66a2575a8102ecb76cd39fab"),
  matchedCount: 0,
  modifiedCount: 0,
  upsertedCount: 1
}
```

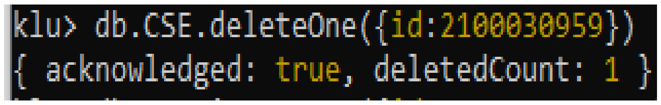
➢ In the above example, we tried to update a student with id 2100030959, and since they were not available in our records, a new document was created because we used **upsert.**

➢ **Upsert** is an option in MongoDB update operations. When set to true, it ensures that if the document specified in the filter criteria does not exist, a new document will be created with the specified update values.

MongoDB Delete

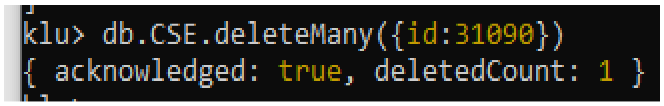
- In MongoDB, We can delete documents by using the methods **deleteOne()** or **deleteMany().**
- These methods accept a query object. The matching documents will be deleted.
- The **deleteOne()** method will delete the first document that matches the query provided.
- The **deleteMany()** method will delete all documents that match the query provided.
- If no query is provided in **deleteOne(),** then it deletes the first document it encounters in the collection.
- If no query is provided in **deleteMany(),** then it deletes all documents in the collection.

Examples



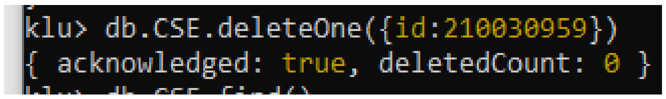
```
klu> db.CSE.deleteOne({id:2100030959})
{ acknowledged: true, deletedCount: 1 }
```

This will delete the record having id as 2100030959.



```
klu> db.CSE.deleteMany({id:31090})
{ acknowledged: true, deletedCount: 1 }
```

This will delete all the records having id as 31090.



```
klu> db.CSE.deleteOne({id:210030959})
{ acknowledged: true, deletedCount: 0 }
```

This will not delete any records as no records found with that id.

MongoDB Query Operators

Equality ($eq)

- It matches documents where the field value equals the specified value.
- **Example**:
  Find students with cgpa equal to 9.5

```
db.CSE.find({ cgpa: { $eq: 9.5 } });
```

Greater Than ($gt)

- It matches documents where the field value is greater than the specified value.
- **Example:** Find students with cgpa greater than 9.0

```
db.CSE.find({ cgpa: { $gt: 9.0 } });
```

Less Than ($lt)

- It matches documents where the field value is less than the specified value.
- **Example**: Find students with cgpa less than 8.0

```
db.CSE.find({ cgpa: { $lt: 8.0 } });
```

Greater Than or Equal ($gte)

- It matches documents where the field value is greater than or equal to the specified value.
- **Example**: Find students with cgpa greater than or equal to 8.5

```
db.CSE.find({ cgpa: { $gte: 8.5 } });
```

Less Than or Equal ($lte)

- It matches documents where the field value is less than or equal to the specified value.
- **Example**: Find students with cgpa less than or equal to 7.5

```
db.CSE.find({ cgpa: { $lte: 7.5 } });
```

Not Equal ($ne)

- It matches documents where the field value is not equal to the specified value.
- **Example**:
  Find students with cgpa not equal to 8.0

```
db.CSE.find({ cgpa: { $ne: 8.0 } });
```

In ($in)

- It matches documents where the field value is in an array of specified values.
- **Example**: Find students with cgpa of 8.5, 9.0, or 9.5

```
db.CSE.find({ cgpa: { $in: [8.5, 9.0, 9.5] } });
```

Not In ($nin)

- It matches documents where the field value is not in an array of specified values.
- **Example**: Find students with cgpa not equal to 8.5, 9.0, or 9.5

```
db.CSE.find({ cgpa: { $nin: [8.5, 9.0, 9.5] } });
```

And ($and)

- It matches documents that satisfy all the specified conditions.
- **Example**: Find students with id 2100030959 and cgpa 9.5

```
db.CSE.find({ $and: [{ id: 2100030959 }, { cgpa: 9.5 }] });
```

Or ($or)

- It matches documents that satisfy at least one of the specified conditions.
- **Example**: Find students with cgpa 9.5 or cgpa 8.5

```
db.CSE.find({ $or: [{ cgpa: 9.5 }, { cgpa: 8.5 }] });
```

Not ($not)

- It Inverts the effect of a query expression.
- **Example**: Find students with cgpa not greater than 9.0

```
db.CSE.find({ cgpa: { $not: { $gt: 9.0 } } });
```