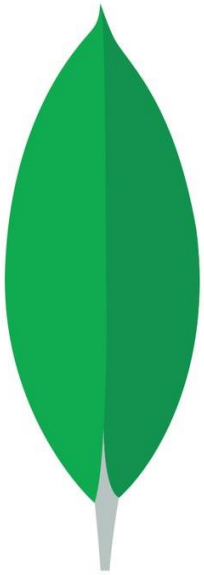


mongoDB®

INTRODUCTION

What is **MongoDB?**

MongoDB is a source-available, cross-platform, document-oriented database program.
Classified as a NoSQL database product, MongoDB utilizes JSON-like documents with optional schemas .

What is database?

- A database is an organized collection of data stored in a computer system and usually controlled by a database management system (DBMS).
- The data in common databases is modeled in tables, making querying and processing efficient.

Structured Data:

- Structured data refers to data that is organized and formatted in a specific way to make it easily readable and understandable by both humans and machines.

- This is typically achieved through the use of a well-defined schema or data model, which provides a structure for the data.

Database Management System:

- A database management system (DBMS) is system software for creating and managing databases.
- A DBMS makes it possible for end users to create, protect, read, update and delete data in a database.

SET UP:

https://www.geeksforgeeks.org/how-to-install-mongodb-on-windows/?ref=ml_lbp

FEW COMMANDS TO TEST AFTER CONNECTIONS

show dbs:

It will display a list of all the available databases.

use db:

To create a database.

show collections:

It will show all the collections in the currently selected database.

db.collection.insert():

Inserts a document or documents into a collection.

db.collection.find():

Selects documents in a collection or view and returns a cursor to the selected documents.

Document:

A **document** is a fundamental unit of data storage. It's a record that contains field-and-value pairs, similar to a JSON object.

The representation of a document varies by programming language, but most languages have a data structure that is a natural fit, such as a map, hash, or dictionary.

{"greeting" : "DATA SCIENCE"}

Collections:

A collection is a grouping of MongoDB documents. Each document within a collection can have different fields. They are analogous to tables in relational databases.

Database:

MongoDB groups collections into databases.

A single instance of MongoDB can host several databases, each grouping together zero or more collections.

A database has its own permissions, and each database is stored in separate files on disk.

A good rule of thumb is to store all data for a single application in the same database.

Datatype:

Basically each document will be in JSON format which will be as follows. Where each attributes inside can be of multiple data types

```
{
    "name: Nanditha Naveen”,
    “address”:{
       “street”:”Jai Maruthi Nagar”,
       “city”:”Chikmagalur”,
       “state”:”Karnataka”
     }
}
```

WHERE, AND, OR & CRUD

WHERE

Given a Collection you want to FILTER a subset based on a condition. That is the place WHERE is used.

```
b.students.find({ gpa: {$lt: 2.5}});
```

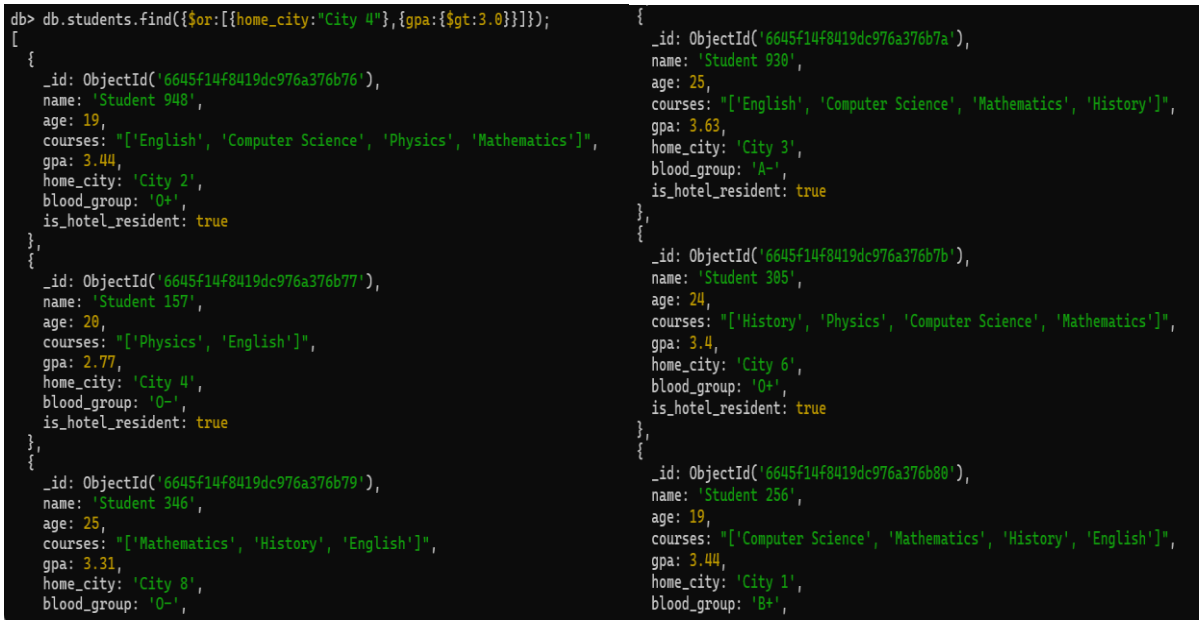
OUTPUT

OR

The $or operator is used to specify a compound query with multiple conditions, where at least one condition must be satisfied for a document to match.

```
db.students.find({$or:[{home_city:"City 4"},{gpa:{$gt:3.0}}]});
```

OUTPUT



```
db> db.students.find({$or:[{home_city:"City 4"},{gpa:{$gt:3.0}}]});
[
  {
    _id: ObjectId('6645f14f8419dc976a376b76'),
    name: 'Student 948',
    age: 19,
    courses: "['English', 'Computer Science', 'Physics', 'Mathematics']",
    gpa: 3.44,
    home_city: 'City 2',
    blood_group: 'O+',
    is_hotel_resident: true
  },
  {
    _id: ObjectId('6645f14f8419dc976a376b77'),
    name: 'Student 157',
    age: 20,
    courses: "['Physics', 'English']",
    gpa: 2.77,
    home_city: 'City 4',
    blood_group: 'O-',
    is_hotel_resident: true
  },
  {
    _id: ObjectId('6645f14f8419dc976a376b79'),
    name: 'Student 346',
    age: 25,
    courses: "['Mathematics', 'History', 'English']",
    gpa: 3.31,
    home_city: 'City 8',
    blood_group: 'O-',
  {
    _id: ObjectId('6645f14f8419dc976a376b7a'),
    name: 'Student 930',
    age: 25,
    courses: "['English', 'Computer Science', 'Mathematics', 'History']",
    gpa: 3.63,
    home_city: 'City 3',
    blood_group: 'A-',
    is_hotel_resident: true
  },
  {
    _id: ObjectId('6645f14f8419dc976a376b7b'),
    name: 'Student 305',
    age: 24,
    courses: "['History', 'Physics', 'Computer Science', 'Mathematics']",
    gpa: 3.4,
    home_city: 'City 6',
    blood_group: 'O+',
    is_hotel_resident: true
  },
  {
    _id: ObjectId('6645f14f8419dc976a376b80'),
    name: 'Student 256',
    age: 19,
    courses: "['Computer Science', 'Mathematics', 'History', 'English']",
    gpa: 3.44,
    home_city: 'City 1',
    blood_group: 'B+',
```

AND

The $and operator allows you to specify multiple conditions that documents must satisfy to match the query.

```
db.students.find({ $and: [{ is_hotel_resident:true} , { home_city:"City 5"}]});
```

OUTPUT

```
db> db.students.find({$and:[{is_hotel_resident:true},{home_city:"City 5"}]});
[
  {
    _id: ObjectId('6645f14f8419dc976a376bb4'),
    name: 'Student 219',
    age: 18,
    courses: "['Physics', 'Computer Science', 'Mathematics', 'History']",
    gpa: 3.4,
    home_city: 'City 5',
    blood_group: 'B-',
    is_hotel_resident: true
  },
  {
    _id: ObjectId('6645f14f8419dc976a376bb9'),
    name: 'Student 632',
    age: 23,
    courses: "['Physics', 'English', 'Computer Science']",
    gpa: 3.76,
    home_city: 'City 5',
    blood_group: 'AB-',
    is_hotel_resident: true
  },
  {
    _id: ObjectId('6645f14f8419dc976a376bcf'),
    name: 'Student 989',
    age: 24,
    courses: "['Computer Science', 'Mathematics']",
    gpa: 3.32,
```

```
  {
    _id: ObjectId('6645f14f8419dc976a376bda'),
    name: 'Student 880',
    age: 24,
    courses: "['History', 'Mathematics', 'English', 'Computer Science']",
    gpa: 3.12,
    home_city: 'City 5',
    blood_group: 'O-',
    is_hotel_resident: true
  },
  {
    _id: ObjectId('6645f14f8419dc976a376bf2'),
    name: 'Student 928',
    age: 21,
    courses: "['Computer Science', 'Physics', 'English', 'History']",
    gpa: 2.66,
    home_city: 'City 5',
    blood_group: 'AB-',
    is_hotel_resident: true
  },
  {
    _id: ObjectId('6645f14f8419dc976a376c4f'),
    name: 'Student 578',
    age: 20,
    courses: "['History', 'English', 'Physics', 'Mathematics']",
    gpa: 3.48,
    home_city: 'City 5',
    blood_group: 'AB+',
    is_hotel_resident: true
  },
```

CRUD

- C - Create / Insert
- R - Remove
- U - update
- D - Delete

This is applicable for a Collection (Table) or a Document (Row)

INSERT

- The **insert() method** in MongoDB inserts documents in the MongoDB collection. This method is also used to create a new **collection** by inserting documents.
- You can insert documents with or without the **_id field**. If you insert a document in the collection without the _id field, then MongoDB will automatically add an _id field and assign it with a unique ObjectId.

And if you insert a document with the _id field, then the value of the _id field must be unique to avoid the duplicate key error.

insertOne()

- **insertOne()** method inserts a document into the collection. This method inserts only one document at a time. This method can also be used inside multi-document transactions.

```
const studentData = {
    “name”: “John Doe”,
    “age”: 24,
    “courses”: ['Physics', 'Computer Science', 'Mathematics', 'History'],
    “gpa”:4.5,
    “home_city”:”New York”,
```

“blood_group”:”O+”,

“is_hotel_resident”:true

}:

UPDATE

- The **update()** method in MongoDB updates a document or multiple documents in the collection. When the document is updated the **_id field** remains unchanged.
- This method can be used for a single updating of documents as well as multiple documents. By default, the **db.collection.update() method** updates a single document.

UpdateOne()

- The **updateOne()** method in MongoDB updates the first matched document within the collection based on the given query.
- The value of the **_id field** remains unchanged after updating the value. This method updates one document at a time and can also add new fields to the given document.

```
db.students.updateOne({ name: “John Doe” },
{ $set: { gpa: 4.2 }});
```

UpdateMany()

- The **updateMany()** method updates all the documents in MongoDB collections that match the given query. When you update your document, the value of the _id field remains unchanged.
- You can also use this method inside multi-document transactions.

```
db.students.updateMany({ gpa: { $lt: 4.0}},{$inc:
{gpa: 0.5}});
```

DeleteMany()

- The deleteMany() method is a part of MongoDB’s CRUD (Create, Read, Update, and Delete) operations. As the name suggests, it is used to delete more than one document that satisfies the specified criteria.
- deleteMany() returns acknowledged as true if the function runs with the writeConcern parameter; otherwise, false.

```
db.students.deleteMany({ is_hotel_resident: true});
```

PROJECTION

- MongoDB Projection is a special feature allowing you to select only the necessary data rather than selecting the whole set of data from the document.
- For Example, If a Document contains 10 fields and only 5 fields are to be shown the same can be achieved using the Projections. This enable us to:
- Project concise yet transparent data
- Filter data without impacting the overall database performance.

How Does MongoDB Projection Works?

- MongoDB projections are constructed on top of the existing find() query and therefore making it easier to use without significant modifications to the existing functions/queries.
- Moreover, projection plays a key factor when looking for user-centric data from a given large data set.

EXAMPLE 1:

```
db.students.find({}, {_id: 1, gpa: 1});
```

OUTPUT

```
db> db.students.find({},{_id:1,gpa:1});
[
  { _id: ObjectId('6645f14f8419dc976a376b76'), gpa: 3.44 },
  { _id: ObjectId('6645f14f8419dc976a376b77'), gpa: 2.77 },
  { _id: ObjectId('6645f14f8419dc976a376b78'), gpa: 2.82 },
  { _id: ObjectId('6645f14f8419dc976a376b79'), gpa: 3.31 },
  { _id: ObjectId('6645f14f8419dc976a376b7a'), gpa: 3.63 },
  { _id: ObjectId('6645f14f8419dc976a376b7b'), gpa: 3.4 },
  { _id: ObjectId('6645f14f8419dc976a376b7e'), gpa: 2.56 },
  { _id: ObjectId('6645f14f8419dc976a376b80'), gpa: 3.44 },
  { _id: ObjectId('6645f14f8419dc976a376b81'), gpa: 3.02 },
  { _id: ObjectId('6645f14f8419dc976a376b83'), gpa: 2.6 },
  { _id: ObjectId('6645f14f8419dc976a376b84'), gpa: 2.89 },
  { _id: ObjectId('6645f14f8419dc976a376b85'), gpa: 2.75 },
  { _id: ObjectId('6645f14f8419dc976a376b88'), gpa: 3.43 },
  { _id: ObjectId('6645f14f8419dc976a376b89'), gpa: 3.04 },
  { _id: ObjectId('6645f14f8419dc976a376b8a'), gpa: 3.42 },
  { _id: ObjectId('6645f14f8419dc976a376b8d'), gpa: 3.97 },
  { _id: ObjectId('6645f14f8419dc976a376b8e'), gpa: 2.92 },
  { _id: ObjectId('6645f14f8419dc976a376b90'), gpa: 3.37 },
  { _id: ObjectId('6645f14f8419dc976a376b94'), gpa: 3.11 },
  { _id: ObjectId('6645f14f8419dc976a376b99'), gpa: 3.71 }
]
```

EXAMPLE 2 :

```
db.students.find({}, {name:1, home_city:1, _id:0});
```

OUTPUT

```
db> db.students.find({}, {name:1, home_city:1, _id:0});
[
  { name: 'Student 948', home_city: 'City 2' },
  { name: 'Student 157', home_city: 'City 4' },
  { name: 'Student 316' },
  { name: 'Student 346', home_city: 'City 8' },
  { name: 'Student 930', home_city: 'City 3' },
  { name: 'Student 305', home_city: 'City 6' },
  { name: 'Student 440', home_city: 'City 10' },
  { name: 'Student 256', home_city: 'City 1' },
  { name: 'Student 177', home_city: 'City 10' },
  { name: 'Student 487', home_city: 'City 3' },
  { name: 'Student 213' },
  { name: 'Student 690', home_city: 'City 7' },
  { name: 'Student 647', home_city: 'City 6' },
  { name: 'Student 232', home_city: 'City 1' },
  { name: 'Student 328', home_city: 'City 2' },
  { name: 'Student 468' },
  { name: 'Student 504', home_city: 'City 2' },
  { name: 'Student 915' },
  { name: 'Student 367', home_city: 'City 1' },
  { name: 'Student 969' }
]
```

MongoDB Projection Operators

MongoDB projection method positively impacts database performance as it reduces the workload of the find query when trying to retrieve specific data from a document, minimizing resource usage.

To enhance the querying and reduce the workload, multiple operators can be used within a projection query like the ones below:

- $slice
- $elemMatch
- $meta

1. $slice operator :

The $slice operator bounds the number of elements that should be returned as the output of a MongoDB projection query.

Limitations in $slice operator:

- In a nested array the **$slice** operator will only return the sliced element and will not return any other item, especially from MongoDB 4.4.
- The find() action is not supported by the $slice operator on MongoDB views.
- Due to a constraint imposed by MongoDB, the $slice operator cannot be combined with the $ projection operator. This is because top-level fields are not permitted to contain the $ symbol as part of the field name.

EXAMPLE:

```
db.students.find({}, {name:1, age: {$slice:4}});
```

OUTPUT:

```
db> db.students.find({}, {name:1, age: {$slice:4}});
[
  {
    _id: ObjectId('6645f14f8419dc976a376b76'),
    name: 'Student 948',
    age: 19
  },
  {
    _id: ObjectId('6645f14f8419dc976a376b77'),
    name: 'Student 157',
    age: 20
  },
  {
    _id: ObjectId('6645f14f8419dc976a376b78'),
    name: 'Student 316',
    age: 20
  },
  {
    _id: ObjectId('6645f14f8419dc976a376b79'),
    name: 'Student 346',
    age: 25
  },
  {
    _id: ObjectId('6645f14f8419dc976a376b7a'),
    name: 'Student 930',
    age: 25
  },
  {
    _id: ObjectId('6645f14f8419dc976a376b7b'),
    name: 'Student 305',
    _id: ObjectId('6645f14f8419dc976a376b7e'),
    name: 'Student 440',
    age: 21
  },
  {
    _id: ObjectId('6645f14f8419dc976a376b80'),
    name: 'Student 256',
    age: 19
  },
  {
    _id: ObjectId('6645f14f8419dc976a376b81'),
    name: 'Student 177',
    age: 23
  },
  {
    _id: ObjectId('6645f14f8419dc976a376b83'),
    name: 'Student 487',
    age: 21
  },
  {
    _id: ObjectId('6645f14f8419dc976a376b84'),
    name: 'Student 213',
    age: 18
  },
  {
    _id: ObjectId('6645f14f8419dc976a376b85'),
    name: 'Student 690',
    age: 22
  },
  {
```

2. $elemMatch :

The $elemMatch operator also limits the contents of an array to the first element that fits the given constraint. Though, there is a minor difference from the $ operator because the $elemMatch projection operator needs an explicit condition argument.

Limitations of $elemMatch operator are as follows:

- The field to which the $elemMatch projection is applied is returned as the last field of the document, regardless of the order in which the fields are ordered.
- $elemMatch projection operator is not supported by find() operations on MongoDB views.
- The $elemMatch operator does not handle $text query expressions.

EXAMPLE :

```
db.candidates.find({courses:
{$elemMatch:{$eq:"English"}}},{age:1,"courses.$":1})
;
```

OUTPUT:

```
db> db.candidates.find({courses: {$elemMatch:{$eq:"English"}}},{age:1,"courses.$":1});
[
  {
    _id: ObjectId('66685877770ac6da0c342116'),
    age: 20,
    courses: [ 'English' ]
  },
  {
    _id: ObjectId('66685877770ac6da0c342118'),
    age: 19,
    courses: [ 'English' ]
  },
  {
    _id: ObjectId('66685877770ac6da0c34211a'),
    age: 23,
    courses: [ 'English' ]
  },
  {
    _id: ObjectId('66685877770ac6da0c34211e'),
    age: 22,
    courses: [ 'English' ]
  }
]
```