



Databases

CHEAT SHEET

SQL VS NO SQL

SQL CRUD

SQL – Create

SQL – Update

SQL – Read

SQL – Delete

SQL Joins

Mongo DB CRUD

MongoDB – Create

MongoDB – Read

MongoDB – Update

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MongoDB - Relations

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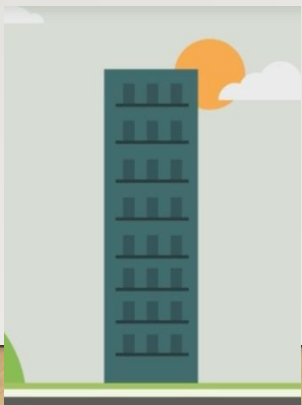
Data validation

Implementing Relations

SQL VS NO SQL

The difference between 2 main types of databases explained ...

SQL (Structured Query Language)	NO SQL (Not only Structured Query Language)
MySQL, PostgreSQL	MongoDB, Redis, Neo4j
<ul style="list-style-type: none">○ More mature & have been used for a long time since the late 1960's	<ul style="list-style-type: none">○ Shiny & new & have been introduced in the early 21st century
<ul style="list-style-type: none">○ Data stored in tables & follows table structure	<ul style="list-style-type: none">○ Data stored in json objects & follows document structure
<ul style="list-style-type: none">○ Inflexible to changing requirements as it follows a pre defined structure (Schema)	<ul style="list-style-type: none">○ Flexible to changing requirements
<ul style="list-style-type: none">○ Great with relationships between data (Relational)	<ul style="list-style-type: none">○ Not great with complex relationships between data (Non - relational)
<ul style="list-style-type: none">○ They scale vertically	<ul style="list-style-type: none">○ They scale horizontally & data can be distributed among computers



SQL VS NO SQL

The difference between 2 main types of databases explained ...

SQL

- Follows table Structure
- Inflexible to changing requirements

Customers			
First Name	Last Name	Address	Email
John	Doe	32 Cherry Blvd	Null
Angela	Yu	12 Sunset Drive	angela@gmail.com
Jack	Bauer	Null	Null

NO SQL

- Follows Document structure
- Flexible to changing requirements

```
{
  first_name: "John",
  last_name: "Doe",
  address: "32 Cherry Blvd"
}

{
  first_name: "Angela",
  last_name: "Yu",
  address: "12 Sunset Drive",
  email: "angela@gmail.com"
}

{
  first_name: "Jack",
  last_name: "Bauer"
}
```

SQL VS NO SQL

The difference between 2 main types of databases explained ...

SQL

- Great with relationships

Customers			
Customer ID	First Name	Last Name	Address
1	John	Doe	32 Cherry Blvd
2	Angela	Yu	12 Sunset Drive

Products		
Product ID	Name	Price
1	Pen	1.20
2	Pencil	0.80

Orders			
Order ID	Customer ID	Product ID	Quantity
1	2	2	12

NO SQL

- Not Great with complex relationship's

```
{  
  order_id: order_01,  
  customer: {  
    first_name: "Angela",  
    last_name: "Yu",  
    address: "12 Sunset Drive"  
  },  
  products: {  
    product_name: "Pencil",  
    product_price: 0.80  
  },  
  order_quantity: 12  
}
```

Store everything in one object

```
{  
  order_id: order_01,  
  customer: person_01,  
  products: product_01,  
  order_quantity: 12  
}
```

```
{  
  person_id: person_01,  
  first_name: "Angela",  
  last_name: "Yu",  
  address: "12 Sunset Drive"  
}
```

```
{  
  product_id: product_01,  
  product_name: "Pencil",  
  product_price: 0.80  
}
```

Store in multiple documents

SQL – Database operations

Create a Database :- create database db_name	Create database imdb;
Show all created Databases :-	show databases;
Use a particular database :- Use db_name	Use imdb;
Dump data from another SQL into DB :- source file_path_of_SQL_file	source D:\DBMS\imdb.sql;
Delete particular database :- Drop database db_name	Drop database imdb;

SQL CRUD - Create

Create table :- create table table_name (col_1 datatype, col_2 datatype, ... col_n datatype,);	Create table emp (eid int, name varchar(20), address char(25), salary decimal(18, 2));
Data is compulsory :- col_name datatype NOT NULL	Create table student (sid int NOT NULL);
Data should be Unique for every row :- col_name datatype UNIQUE	Create table student (username varchar(20) UNIQUE)
Data should satisfy user defined condition :- col_name datatype, check (col in ('val_1', 'val_2'))	Create table customer (gender char(1), check (gender in ('m','f')));

SQL CRUD - Create

Add default value, if data not specified :- col_name datatype default default_value	Create table customer (name char(25) Default 'unknown');
Primary key :- <ul style="list-style-type: none">It allows to uniquely identify a record	// Set particular column as primary key create table orders (id INT NOT NULL, PRIMARY KEY (id),);
Foreign key :- <ul style="list-style-type: none">It allows to establish a link between 2 or more tables by referencing a table's primary key into another table	// Set particular column as foreign key create table orders (customer_id INT, product_id INT, FOREIGN KEY (customer_id) references customers(id), FOREIGN KEY (product_id) references products(id));

SQL CRUD - Read

Display table info :- desc table_name;	desc products; or describe actors;
Select all columns/display full table :- select * from table_name;	select * from products;
Select specific columns :- Select col_name from table_name;	select name, price from products;
Select unique records :- Select DISTINCT col_name from table_name;	select DISTINCT name from products; Q.) Select rows whose combination of first_name, last_name is unique select distinct first_name, last_name from directors;
Select records based on specific condition :- select * from table_name where condition;	select * from products where id=1;

SQL CRUD - Read

Q.) Find all the orders issued against the salesman who may works for customer whose id is 3007	Select * from orders where customer_id = 3007;
Q.) Display the commission of all the salesmen servicing customers in Paris	Select commission from salesman where city = 'Paris';

SQL – Data Query Language

LIMIT :- Limits no. of rows to be displayed select * from table_name limit limit_no.	select * From departments limit 3;
OFFSET :- Specifies no. of rows to ignore from start select * from table_name offset offset_no.;	Q.) Display the 20 rows after the initial 20 rows select name, rankscore from movies limit 20 offset 20;

SQL – Data Query Language

ORDER BY :- Display records in sorted order

```
// Sort in ascending order  
select * from table_name  
order by col_name;
```

```
// Sort in descending order  
select * from table  
order by col_name desc;
```

Q.) Show movies in descending order by year (Get recent movies)
select name, year from movies
order by year desc;

Q.) Show movies in ascending order by year (Get old movies)
select name, year from movies
order by year;

Q.) Order alphabetically (A→Z)
select first_name from directors
order by first_name;

Q.) Order alphabetically (Z→A)
select first_name from directors
order by first_name desc;

Q.) List top 20 movies
select name, year, rankscore from movies
where rankscore>9
order by rankscore desc
limit 20;

SQL – Data Query Language

GROUP BY :- Groups related rows based on specified attribute/col. name

Select col_name from Table_name

Group by col_name;

Q.) Retrieve no. of students in various departments

Select dept, count(sid) from Student_Dept
Group by Dept;

Q.) Find no. of movies released per year

Select year, count(year) from movies
Group by year order by year;

Q.) Find no. of movies released per year and order them by year_count

Select year, count(year) year_count
from movies

Group by year

Order by year_count;

Note:- year count is an alias

SQL – Data Query Language

HAVING :- it is used after grouping to display grouped records based on specific condition

- Having without group by is same as where
- Where is applied on individual rows before grouping
- Having is applied on groups after grouping

Order of execution:-

1. GROUP By to create groups
2. Apply the aggregate function
3. Apply Having condition

Q.) Retrieve departments having more than 2 students in it.

```
Select dept, count(sid)
From Student_Dept
Group by Dept;
Having count(sid) >2;
```

Q.) Find years having more than 1000 movies

```
Select year, count(year) year_count
from movies
Group by year
HAVING year_count>1000;
```

Q.) Find years having more than 20 movies such that the rankscore of those movie's are greater is 9

```
Select year, count(year) year_count
From movies
Where rankscore>9
Group by year
Having year_count > 20;
```

SQL - DQL (Comparison Operators)

Operator - (equal to =)

Note :- equal operator does not work on NULL, for that we need to use the IS keyword

Q.) Find movies whose genre is comedy

```
select * from movies_genres  
where genre = 'Comedy';
```

Q.) Find movies whose rankscore is NULL

```
select name, year, rankscore from movies  
where rankscore IS NULL;
```

Q.) Find movies whose rankscore is Not NULL

```
select name, year, rankscore from movies  
where rankscore IS NOT NULL;
```

Operator - (not equal to <>)

Q.) Find all faculty not teaching 'DT'

```
Select * from Faculty  
Where Subject <> 'DT';
```

Operator - (Greater than >)

Q.) Find all faculty teaching more than 10 hours

```
Select * from Faculty  
Where Hours > 10;
```

SQL - DQL (Set Operators)

Set - (Union) Query_1 Union Query_2	Select * from stud Union Select * from stud_extern;
Set - (Intersect) Query_1 Intersect Query_2	Select * from stud Intersect Select * from stud_extern;
Set - (Except) Query_1 Except Query_2	Select * from stud Except Select * from stud_extern;

SQL – DQL (Logical Operators)

Logical – (AND)	<p>Q.) Find all faculty not teaching 'DT' and taught more than 10 hours Select * from Faculty Where Subject <> 'DT' AND Hours > 10;</p> <p>Q.) Find all movies whose rankscore is greater than 9 & released after year 2000 select name, year, rankscore from movies where rankscore>9 AND year>2000;</p>
Logical - (OR)	<p>Q.) Find all faculty not teaching 'DT' or taught more than 10 hours Select * from Faculty Where Subject <> 'DT' OR Hours > 10 ;</p>
Logical - (NOT)	<p>Q.) Find all faculty not teaching more than 10 hours Select * from Faculty Where NOT Hours > 10 ;</p>

SQL – DQL (Logical Operators)

Logical – (BETWEEN)

Note :- lowValue <= highvalue else empty result set will be returned

Eg. Hours BETWEEN 20 AND 10 will return a empty set;

Q.) Find all faculty teaching between 10 to 20 hours

**Select * from Faculty
Where Hours BETWEEN 10 AND 20;**

Q.) Find all faculty not teaching between 10 to 20 hours

**Select * from Faculty
Where Hours NOT BETWEEN 10 AND 20;**

Logical – (IN)

Q.) Find director_id of those who directed Comedy or Horror movies
select director_id, genre
from directors_genres
where genre IN ('Comedy','Horror');

SQL – DQL (Pattern matching using LIKE)

Logical - (Like) (Pattern matching) % → String of 0 or more characters _ → Single character	Select col_name From Table_name Where col_name Like {Pattern};
Q.) Find all faculties whose name starts with 'A'	Select * From Faculty Where Faculty_name Like 'A%';
Q.) Find all faculties whose name starts with 'Om'	Select * From Faculty Where Faculty_name Like 'Om%';
Q.) Find all faculties whose name ends with 'h'	Select * From Faculty Where Faculty_name Like '%h';
Q.) Find all faculties whose name contains letter 'a'	Select * From Faculty Where Faculty_name Like '%a%';
Q.) Find all faculties whose names second letter is 'a'	Select * From Faculty Where Faculty_name Like '_a%';
Q.) Find all faculties whose names second last letter is 's'	Select * From Faculty Where Faculty_name Like '%s_';
Q.) Find all faculties whose name do not contains 'a'	Select * From Faculty Where Faculty_name NOT Like '%a%';
Q.) Find all faculties whose names second letter is 'a', Contains letter 'e' and name ending with 'h'	Select * From Faculty Where Faculty_name Like '_a%e%h';
Q.) Find students who have 96% percentage Note:- We can use backslash (\) so that it's not interpreted as % for pattern matching	Select * From students Where percentage = "96\%"

SQL – DQL (Aggregate functions)

SUM()	Q.) Find the sum of total fare from ticket_header select sum(fare) from ticket_header;
AVG()	Q.) Give the average of total fare from ticket_header select avg(fare) from ticket_header;
MAX()	Q.) Find out the highest fare from ticket_details select max(fare) from ticket_details;
MIN()	Q.) Give the min distance from route_header select min(dist) from route_header;
COUNT()	Q.) Give the total collection of fare from ticket_details select count(fare) from ticket_details;
Q.) Find count of no. of movies whose year is greater than 2000	select count(*) from movies Where year>2000;
Q). Give the total no of people who have travelled more than 36hrs. Group by ticket no	select count(adult), count(child) From ticket_header Where time>36 Group by tikno;

SQL – Subqueries, nested & inner queries

First inner query is executed & then the outer query is executed using the output values in inner query

Nested queries :- First inner query is executed & then the outer query is executed using the output values in inner query

Possible Operators :- in, not in, exists, not exists, any, all, comparison operators

1. IN checks where the records belongs to the set & returns the result accordingly
2. EXISTS returns true if the subquery returns one or more records or NULL
2. ANY operator returns true if any of the subquery values meet the condition
3. ALL Operator returns true if all of the subquery values meet the condition

// Syntax :-

```
SELECT col_name From table_name  
WHERE col_name OPERATOR(  
    SELECT col_name From table_name  
    WHERE = (condition or subquery)  
)
```

Q.) List all actors present in the movie Schindler's List

actors(id, first_name, last_name, gender)
roles(actor_id, movie_id, role)
movies(id, name, year, rankscore)

```
select first_name, last_name from actors  
where id IN (  
    select actor_id from roles  
    where movie_id IN(  
        select id from movies  
        where name="Schindler's List"  
    )  
);
```

SQL – Subqueries, nested & inner queries

Q.) List all movies whose rankscore is same as the maximum rankscore	<pre>select * from movies where rankscore >= ALL(select max(rankscore) from movies);</pre>
Q.) List all employees whose salary is greater than average salary of the department it belongs to	<pre>Select emp_no, name from emp Where salary > (select avg(salary) from emp where department = emp.department);</pre>
Q.) Find all employees whose salary is less than smriti's salary	<pre>Select name, salary from emp Where salary < (select salary from emp where name = "Smriti");</pre>
Q.) Find departments who do not have any employees	<pre>Select * from department Where dept_name not in (select distinct department from emp)</pre>
Q.) Display all the orders from the orders table issued by the salesman 'Paul Adam'.	<pre>Select * from orders Where salesman_id = (select salesman_id from salesman where name = 'Paul Adam');</pre>

SQL – Subqueries, nested & inner queries

Q.) Display all the orders for the salesman who belongs to the city London.	Select * from orders Where salesman_id in (select salesman_id from salesman where city='London');
Q.) Display all the orders whose values are greater than the average order value for 10 th October 2012	Select * from orders Where purch_amt > (select avg(purch_amt) from orders where ord_date = 10-oct-12);
Q.) find all orders attributed to a salesman in New york.	Select * from orders Where salesman_id in (select salesman id from salesman where city='new york');

SQL CRUD - Update

Insert values/rows into table :- insert into table_name values(col_1_data, col_2_data, .. col_n_data);	Insert into products values (1, "PEN", 1.20); Insert into products values (1, "PEN", 1.30), (2, "GLUE", 2.00), (3, "CARD", 1.10) Insert into products (id, name) values (4, "PENCIL");
Copying rows from other table :-	Insert into products select * from products1 where name in ("eraser", "ruler")
Update data values :- update table_name set col_name= data where condition;	update products set price = 0.80 where id=2;

SQL CRUD - Update

Add/modify/drop columns into table :- Alter table table_name add/modify col_name datatype; Alter table table_name drop col_name;	Alter table products add stock int; Alter table products modify name varchar(50); Alter table products drop brand;
Rename table :- Rename table_name to new_name;	Rename products to goods;
Q.) Modify emp database so that 'Jack' now lives in 'Newyork'.	Update emp Set city = "Newyork" Where Name = "Jack";
Q.) Give all employees of company_name 'ABC corporation' a 10% salary raise in Works database.	Update Works Set salary = 0.1*salary Where company_name = "ABC corporation";
Q.) Update Damage_amt for car with license no "Mum2022" in accident with Report_no "AR2197" to Rs. 5000 in Participated database	Update Participated Set Damage_amt = 5000 Where Report_no LIKE "AR2197" and Car = "Mum2022" ;

SQL CRUD - Delete

Delete specific row :- Delete from table_name where condition;	Delete from products where name = "pencil";
Delete only all table records :- Truncate table table_name	Truncate table products;
Delete full table & it's records :- Drop table table_name;	Drop table emp;

SQL – Joins

<p>Join 2 tables :-</p> <p>Select *</p> <p>From T1 Join T2;</p> <p>Or</p> <p>Select *</p> <p>From T1 join T2</p> <p>using (c1);</p>	<p>Q.) Join order & products table based on primary key</p> <pre>SELECT orders.order_number, products.name, products.price FROM orders INNER JOIN products on orders.product_id = products.id;</pre> <p>Q.) For each movie present in movie table display name & genre present in movies_genres table</p> <pre>SELECT m.name, g.genre from movies m JOIN movies_genres g on m.id = g.movie_id;</pre> <p>* Note m, g are table aliases</p>
<p>Join 3 tables :-</p>	<p>Q.)Join customer, order & products table based on primary key</p> <pre>SELECT customers.id, customers.first_name, customers.last_name, orders.order_number, products.name, products.price FROM customers JOIN orders ON customers.id=orders.customer_id JOIN products ON products.id=orders.product_id</pre>

SQL – Joins

**Left Outer join &
Right Outer join :-**

Q.) Left outer join movie & movies_genres table

```
SELECT m.name, g.genre from movies m  
LEFT OUTER JOIN movies_genres g  
on m.id = g.movie_id;
```

Q.) Right outer join movie & movies_genres table

```
SELECT m.name, g.genre from movies m  
RIGHT OUTER JOIN movies_genres g  
on m.id = g.movie_id;
```


SQL – Data control

GRANT :- Granting privileges to user's by allowing specified users to perform specified tasks	Create user 'jeff'@'localhost' identified by 'password'; grant ALL on db1 to 'jeff'@'localhost'; grant SELECT on db1 to 'jeff'@'localhost';
Revoke:- Revoking privileges from user's by canceling previously granted permissions	revoke DROP on db1 from 'jeff'@'localhost';

Mongo DB CRUD - Create

Create collection :- db.createCollection();	// Create products collection db.createCollection("products");
Insert records into collection :- db.collection.insertOne() db.collection.insertMany()	 db.products.insertOne({ _id: 3, name: "Rubber", price: 1.50, reviews: [{ authorName: "Sally" rating: 5, review: "Awesome rubber!" }] }) db.products.insertMany([{ _id: 1, name: "pen", price: 1.20 }, { _id: 2, name: "pencil", price: 0.80 }])

Mongo DB CRUD - Read

Display collection/specific records :-

db.collection.find(query, projection)

- **Projection** - To specify which fields we want to see

```
// Display all records in pretty print  
db.products.find().pretty()
```

```
// Display 1st record from collection  
db.products.findOne()
```

```
// Display pencil products  
db.products.find({name: "Pencil"})
```

```
// Display products with id 1 and show only name field  
db.products.find({_id: 1}, {name:1})
```

```
// Display products having price > 1  
db.products.find({price: {$gt: 1}})
```

```
// Display products having 0 < price < 1  
db.products.find({price: {$gt: 0, $lt: 1}})
```

```
// Display products having price atleast 1  
db.products.find({price: {"$not: {$lt: 1}}})
```

```
// Sort products by increasing price  
db.products.find().sort({price:1})
```

```
// Sort products by decreasing price  
db.products.find().sort({price:-1})
```

Mongo DB CRUD - Update

Update records in collection :-
db.collection.updateOne()

```
// Add stock field for id 1
db.products.updateOne(
  {_id:1},
  {$set: {stock: 32}}
)
```

Mongo DB CRUD – Delete

Delete records in collection :-
`db.collection.deleteOne()`

// Delete id 1 element
`db.products.deleteOne({_id: 2})`

Mongo DB – Relations

Implementing relationships in MongoDB :-

// Products collection

```
{  
  _id: 1,  
  name: "pen",  
  price: 1.20  
}
```

```
{  
  _id: 2,  
  name: "pencil",  
  price: 0.80  
}
```

// Orders collection

```
{  
  orderNumber: 3243,  
  productsOrdered: [1,2]  
}
```


Mongoose – Connecting node app to MongoDB

Connecting node app to mongo database via mongoose & adding a record in collection :-

Mongoose Schema :-

```
const schemaName = new mongoose.Schema({  
  fieldName : FieldDataType,  
  ...  
});
```

Mongoose Model :-

```
const = mongoose.model(  
  SingularCollectionName,  
  schemaName  
);
```

Mongoose Document/Record :-

```
const constantName = new ModelName ({  
  fieldName : fieldData,  
  ...  
});
```

// Load mongoose package

```
const mongoose = require('mongoose');
```

// Specify port of mongodb & database name

```
mongoose.connect("mongodb://localhost:27017/fruitsDB");
```

// Create schema for fruits collection

```
const fruitSchema = new mongoose.Schema({  
  name: String,  
  rating: Number  
});
```

// Create mongoose model

// Specify collection name & schema to be followed by it

```
const Fruit = mongoose.model("Fruit", fruitSchema);
```

// Create New fruits record

```
const fruit = new Fruit ({name: "Apple", rating: 7});
```

// save fruit data in fruits collection & in fruitsdb

```
fruit.save();
```

// Close connection

```
mongoose.connection.close()
```

Mongoose – Performing CRUD

insertMany() :-

- For Adding multiple records in collection

- **Syntax :-**

```
ModelName.insertMany(RecordArray, function (err){  
    //Deal with error or log success.  
})
```

// Creating Fruits records

```
const kiwi = new Fruit({name: "kiwi", score: 10});  
const orange = new Fruit({name: "Orange", score: 4});
```

// The insert func. Consists of array of records to be inserted

// error function to log if any errors occurred while inserting the records

```
Fruit.insertMany([kiwi, orange], function(err){  
    if (err) {  
        console.log(err)  
    } else {  
        console.log("Successfully saved all fruits to fruitsDB")  
    }  
});
```

Mongoose – Performing CRUD

Reading from database :-

- find() is used

- **Syntax :-**

```
ModelName.find( {conditions}, function (err, results){  
  //Use the found results docs.  
});
```

// Read all records present in Fruits collection

```
Fruit.find(function(err, fruits) {
```

// Log if any errors occurred during finding records

```
if (err) {  
  console.log(err)  
} else {
```

// close connection

```
mongoose.connection.close()
```

// log the fruit name from fruits array

```
fruits.forEach(fruit => {  
  console.log(fruit.name)  
});
```

```
}  
})
```

Mongoose – Performing CRUD

updateOne() :-

- Update single record in collection

```
// Error function to log if any errors occurred while updating the record  
Fruit.updateOne({_id:"637d110dc9606c619709e5a0"}, {name: "peach"},  
function(err){  
  if(err){  
    console.log(err);  
  }else{  
    console.log("Successfully updated the document");  
  }  
})
```

Mongoose – Performing CRUD

deleteOne() :-

- Delete single record from collection

// Error function to log if any errors occurred while deleting the record

```
Fruit.deleteOne({name: 'peach'}, function(err) {  
  if(err){  
    console.log(err);  
  }else{  
    console.log("Successfully deleted the record");  
  }  
})
```

deleteMany() :-

- Delete multiple records from collection

// Error function to log if any errors occurred while deleting the record

// Delete all people entries having John name

```
People.deleteMany({name:"John"}, function(err) {  
  if(err){  
    console.log(err);  
  }else{  
    console.log("Successfully deleted the records");  
  }  
})
```

Mongoose – Performing CRUD

findByIdAndRemove() :-

- Remove record from collection by id

```
// Error function to log if any errors occurred while deleting the record  
Fruit.findByIdAndRemove( _id, function(err) {  
    if (err) {  
        console.log(err)  
    } else {  
        console.log("Successfully deleted the record");  
    }  
})
```


Mongoose – Data validation

Data validation with Mongoose :-

- Data can be easily validated using mongoose data validation syntax
- <https://mongoosejs.com/docs/validation.html>

// Validate fruitSchema to have a required name

// & a rating between 1 to 10

```
const fruitSchema = new mongoose.Schema({
```

```
  name: {  
    type: String,  
    required: true  
  },
```

```
  rating: {  
    type: Number,  
    min: 1,  
    max: 10  
  }  
}
```

```
});
```

Mongoose – Implementing Relations

Implementing relations with mongoose :-

```
const kiwi = new Fruit({  
  name: "kiwi",  
  score: 10,  
});
```

```
const person = new People({  
  name: "Amy",  
  age: 12,  
  favouriteFruit: kiwi  
});
```

Mongoose findOneAndUpdate()

```
<ModelName>.findOneAndUpdate(  
  {conditions},  
  {updates},  
  function(err, results){}  
);
```

```
<ModelName>.findOneAndUpdate(  
  {conditions},  
  {$pull: {field: {query}}},  
  function(err, results){}  
);
```

```
<ModelName>.findOneAndUpdate(  
  {conditions},  
  {$pull: {field: {_id: value}}},  
  function(err, results){}  
);
```