ATME College of Engineering

13thKM Stone, Bannur Road, Mysore - 560 028

Department of CSE–Artificial Intelligence & Machine Learning

(Academic Year 2023-24)

LABORATORY MANUAL

SUBJECT: DATABASE MANAGEMENT SYSTEM

SUB CODE: BCS403

SEMESTER: IV

SCHEME: 2022

Prepared By	Verified By	Approved by
Ms. GEETHA.B Instructor	Mrs.KHATEEJA AMBAREEN Assistant Professor Dept. of CSE-AI &ML	Dr. M S SUNITHA PATEL Assoc. Professor & Head Dept. of CS-AI &ML

Institute Vision

- Development of academically excellent, culturally vibrant, socially responsible and globally competent human resources.

Institute Mission

- To keep pace with advancements in knowledge and make the students competitive and capable at the global level.
- To create an environment for the students to acquire the right physical, intellectual, emotional and moral foundations and shine as torch bearers of tomorrow’s society.
- To strive to attain ever-higher benchmarks of educational excellence.

Department Vision

To impart technical education in the field of Artificial intelligence and machine learning of topnotch quality with a high level of professional competence, social obligation, and global cognizance among the students.

Department Mission

- To impart technical education that is up to date, relevant and makes students to compete at global level
- Fostering an ambiance where students can adopt the suitable moral, intellectual, emotional, and physical attributes to shine as the leaders of tomorrow’s society.
- To strive to meet ever higher educational standard.

Program Outcomes (PO's)

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and

design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

Program Educational Objectives (PEO's):

PEO1: Graduates will be able to hone their problem-solving abilities and capacity to offer solutions to challenges that arise in the actual world.

PEO2: Able to design and develop AI based solutions to real-world problems in a business, research, or social environment.

PEO3: Graduates shall acquire and inculcate corporate culture, core attributes, and leadership qualities as well as professional etiquette's and lifelong learning.

Program Specific Outcomes (PSO's)

PSO1: Ability to design and develop artificial intelligent based solutions by applying optimal algorithms to solve real world issues.

PSO2: Ability to apply suitable AI tools and techniques to offer solutions in the various domains of engineering.

TABLE OF CONTENTS

Course outcomes (Course Skill Set):
At the end of the course, the student will be able to:

- Describe the basic elements of a relational database management system
- Design entity relationship for the given scenario.
- Apply various Structured Query Language (SQL) statements for database manipulation.
- Analyze various normalization forms for the given application.
- Develop database applications for the given real-world problem.
- Understand the concepts related to NoSQL databases.

Assessment Details (both CIE and SEE)
The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum

passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CIE for the theory component of the IPCC (maximum marks 50)

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal AssessmentTests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIEmarks for the theory component of IPCC (that is for **25 marks)**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the theorycomponent of IPCC.

CIE for the practical component of the IPCC

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluatedfor 10 marks. Marks of all experiments' write-ups are added and scaled down to **15 marks**.
- The laboratory test **(duration 02/03 hours)** after completion of all the experiments shall be conducted for50 marks and scaled down to **10 marks.**
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

DBMS LABORATORY

Aim: Study of Open-Source Relational Databases: MySQL

Objective: To learn and understand open-source relational databases.

Hardware requirements: Any CPU with Pentium Processor or similar,256 MB RAM or more, 1 GB Hard Disk or more.

Software requirements: Ubuntu 14 Operating System, MySQL WorkBench

THEORY

A database-management system (DBMS) is a collection of interrelated data and a set of programs to access those data. The collection of data, usually referred to as the database, contains information relevant to an enterprise. The primary goal of a DBMS is to provide a way to store and retrieve database information that is both convenient and efficient.
A relational database management system (RDBMS) is a program that lets you create, update, and administer a relational database. Most commercial RDBMS's use the Structured Query Language (SQL) to access the database, although SQL was invented after the development of the relational model and is not necessary for its use.

MySQL open-source RDBMS overview:

MySQL is a popular open-source relational database management system (RDBMS) choice for web-based applications. Developers, database administrators use MySQL to build and manage next-generation web- and cloud-based applications. With most open-source RDBMS options, MySQL is available in several different editions and runs on Windows, OS X, Solaris, FreeBSD and other variants of Linux and Unix

MySQL Workbench

MySQL Workbench is a unified visual tool for database architects, developers, and DBAs. MySQL Workbench provides data modeling, SQL development, and comprehensive administration tools for server configuration, user administration, backup, and much more. MySQL Workbench is available on Windows, Linux and Mac OS X.

Design

MySQL Workbench enables a DBA, developer, or data architect to visually design, model, generate, and manage databases. It includes everything a data modeler needs for creating complex ER models, forward and reverse engineering, and also delivers key features for performing difficult change management and documentation tasks that normally require much time and effort.

Develop

MySQL Workbench delivers visual tools for creating, executing, and optimizing SQL queries. The SQL Editor provides color syntax highlighting, auto-complete, reuse of SQL snippets, and execution history of SQL. The Database Connections Panel enables developers to easily manage standard database connections, including MySQL Fabric. The Object Browser provides instant access to database schema and objects.

Database Migration

MySQL Workbench now provides a complete, easy to use solution for migrating Microsoft SQL Server, Microsoft Access, Sybase ASE, PostgreSQL, and other RDBMS tables, objects and data to MySQL. Developers and DBAs can quickly and easily convert existing applications to run on MySQL both on Windows and other platforms. Migration also supports migrating from earlier versions of MySQL to the latest releases

Administer

MySQL Workbench provides a visual console to easily administer MySQL environments and gain better visibility into databases. Developers and DBAs can use the visual tools for configuring servers, administering users, performing backup and recovery, inspecting audit data, and viewing database health.

Design and Develop SQL DDL statements which demonstrate the use of SQL objects such as

Table View Index

Introduction to SQL:
SQL stands for Structured Query Language SQLlets you access and manipulate databases
SQL is an ANSI (American National Standards Institute) standard
Commands of SQL are grouped into four languages.
1>DDL

DDL is abbreviation of Data Definition Language. It is used to create and modify the structure of database objects in database.

Examples: CREATE, ALTER, DROP, RENAME, TRUNCATE statements

2>DML

DML is abbreviation of Data Manipulation Language. It is used to retrieve, store, modify, delete, insert and update data in database.

Examples: SELECT, UPDATE, INSERT, DELETE statements

3>DCL

DCL is abbreviation of Data Control Language. It is used to create roles, permissions, and referential integrity as well it is used to control access to database by securing it.
Examples: GRANT, REVOKE statements

4>TCL

TCL is abbreviation of Transactional Control Language. It is used to manage different transactions occurring within a database.

Examples: COMMIT, ROLLBACK statements

Data Definition Language (DDL)

1.Data definition Language (DDL) is used to create, rename, alter, modify, drop, replace, and delete tables, Indexes, Views, and comment on database objects; and establish a default database.
2.The DDL part of SQL permits database tables to be created or deleted. It also defines indexes (keys), specify links between tables, and impose constraints between tables. The most important DDL statements in SQL are:

CREATE TABLE- Creates a new table
ALTER TABLE- Modifies a table
DROP TABLE- Deletes a table
TRUNCATE -Use to truncate (delete all rows) a table.
CREATE INDEX- Creates an index (search key)
DROP INDEX- Deletes an index

1.The CREATE TABLE Statement
The CREATE TABLE statement is used to create a table in a database.

Syntax
CREATE TABLE table name
(attr1_name attr1_datatype(size) attr1_constraint, attr2_name attr2_datatype(size) attr2_constraint,….);

SQL Constraints

Constraints are used to limit the type of data that can go into a table.
Constraints can be specified when a table is created (with the CREATE TABLE statement) or after the table is created (with the ALTER TABLE statement).
We will focus on the following constraints:

NOT NULL
UNIQUE PRIMARY KEY
FOREIGN KEY
CHECK
DEFAULT

Add constraint after table creation using alter table option

Syntax - Alter table add constraint constraint_name constraint_type(Attr_name)
Example -Alter table stud add constraint prk
1 primary key(rollno); Drop constraint:
Syntax- Drop Constraint Constraint_name;
Example - Drop constraint prk1;
2.The Drop TABLE Statement
Removes the table from the database

Syntax
DROP TABLE table_name;

3. The ALTER TABLE Statement
The ALTER TABLE statement is used to add, delete, or modify columns in an existing table.

Syntax
To add a column in a table, use the following syntax:

ALTER TABLE table_name

ADD column_name datatype;

To delete a column in a table, use the following syntax (notice that some database systems don't allow deleting a column):

ALTER TABLE table_name DROP COLUMN column_name;
To change the data type of a column in a table, use the following syntax:

ALTER TABLE table_name
MODIFY COLUMN column_name datatype;

4. The RENAME TABLE Statement
Rename the old table to new table;
Syntax
Rename old_tabname to new_tabname;

5. The TRUNCATE TABLE Statement
The ALTER TABLE Statement is used to truncate (delete all rows) a table.
Syntax
To truncate a table, use following syntax: TRUNCATE TABLE table_name;

6. CREATE VIEW Statement
In SQL, a view is a virtual table based on the result-set of an SQL statement.
A view contains rows and columns, just like a real table.
The fields in a view are fields from one or more real tables in the database.

Syntax
```
 CREATE VIEW view_name AS
 SELECT column_name(s)
 FROM table_name
 WHERE condition;
```

7. SQL Dropping a View
You can delete a view with the DROP VIEW command.
Syntax
```
 DROP VIEW view_name;
```

8 . Create Index Statement

1. Index in SQL is created on existing tables to retrieve the rows quickly. When there are thousands of records in a
table, retrieving information will take a long time.

2. Therefore, indexes are created on columns which are accessed frequently, so that theinformation can be
retrieved quickly.

3. Indexes can be created on a single column or a group of columns. When a index is created, it first sorts the
data and then it assigns a ROWID for each row.

Syntax
```
 CREATE INDEX index_name
 ON table_name (column_name1, column_name2...);
```
index_name is the name of the INDEX.
table_name is the name of the table to which the indexed column belongs.
column_name1, column_name2. is the list of columns which make up the INDEX.

9. Drop Index Statement
Syntax: DROP INDEX
index_name;
10. Create Synonym statement

1. Use the CREATE SYNONYM statement to create a synonym, which is an alternative name

for a table, view, sequence, procedure, stored function, package, materialized view.

2. Synonyms provide both data independence and location transparency. Synonyms permit applications to function without modification regardless of which user owns the table or view and regardless of which database holds the table or view.

3. You can refer to synonyms in the following DML statements: SELECT, INSERT, UPDATE, DELETE
Syntax - Create synonym synonym-name for object-name;
Example-Create synonym synonym_name for table_**name**
DML command
Data Manipulation Language (DML) statements are used for managing data in database. DMLcommands are not auto-committed. It means changes made by DML command are not permanent to database, it can be rolled back.

1) INSERT command
Insert command is used to insert data into a table. Following is its general syntax,
INSERT into table-name values(data1,data2,..)
Lets see an example,
Consider a table Student with following fields.S_id S_Name age
INSERT into Student values(101,'Adam',15);
The above command will insert a record into Student table.
S_id S_Name age 101 Adam 15

2) UPDATE command
Update command is used to update a row of a table. Following is its general syntax,
UPDATE table-name set column-name = value where condition;
Lets see an example,
update Student set age=18 where s_id=102;
Example to Update multiple columns
UPDATE Student set s_name='Abhi',age=17 where s_id=103;

3) Delete command
Delete command is used to delete data from a table. Delete command can also be used with condition to delete a particular row.
Following is its general syntax,
DELETE from table-name;
Example to Delete all Records from a Table
DELETE from Student;
The above command will delete all the records from Student table.
Example to Delete a particular Record from a Table
Consider Student table
DELETE from Student where s_id=103;

SQL Functions
SQL provides many built-in functions to perform operations on data. These functions are useful while performing mathematical calculations, string concatenations, sub-strings etc. SQL functions are divided into two categories,

- **Aggregate Functions**
- **Scalar Functions**

Aggregate Functions
These functions return a single value after calculating from a group of values. Following are some frequently used Aggregate functions.
1) AVG ()
Average returns average value after calculating from values in a numeric column.
Its general Syntax is,
SELECT AVG (column_name) from table_name
e.g. SELECT avg(salary) from Emp;

2) COUNT ()
Count returns the number of rows present in the table either based on some condition or without condition. Its general Syntax is,
SELECT COUNT (column_name) from table-name;
Example using COUNT ()
Consider following Emp table

eid	name	age	salary
401	Anu	22	9000
402	Shane	29	8000

SQL query to count employees, satisfying specified condition is,
SELECT COUNT (name) from Emp where salary = 8000;

3) FIRST ()
First function returns first value of a selected column
Syntax for FIRST function is,
SELECT FIRST (column_name) from table-name
SQL query
SELECT FIRST (salary) from Emp;

4) LAST ()
LAST return the return last value from selected column
Syntax of LAST function is,
SELECT LAST(column_name) from table-name
SQL query will be,
SELECT LAST(salary) from emp;

5) MAX()
MAX function returns maximum value from selected column of the table.
Syntax of MAX function is,
SELECT MAX(column_name) from table-name
SQL query to find Maximum salary is,
SELECT MAX(salary) from emp;

6) MIN()
MIN function returns minimum value from a selected column of the table.
Syntax for MIN function is,

SELECT MIN(column_name) from table-name
SQL query to find minimum salaryis,
SELECT MIN(salary) from emp;

7) SUM()
SUM function returns total sum of a selected columns numeric values.
Syntax for SUM is,
SELECT SUM(column_name) from table-name
SQL query to find sum of salaries will be,
SELECT SUM(salary) from emp;

Scalar Functions

Scalar functions return a single value from an input value. Following are soe frequently used Scalar Functions.
1) UCASE()
UCASE function is used to convert value of string column to Uppercase character.
Syntax of UCASE,
SELECT UCASE(column_name) from table-name
Example of UCASE()
SQL query for using UCASE is,
SELECT UCASE(name) from emp;

2) LCASE()
LCASE function is used to convert value of string column to Lowercase character.
Syntax for LCASE is:
SELECT LCASE(column_name) from table-name

3) MID()
MID function is used to extract substrings from column values of string type in a table.
Syntax for MID function is:
SELECT MID(column_name, start, length) from table-name

4) ROUND()
ROUND function is used to round a numeric field to number of nearest integer. It is used on Decimal point values.
Syntax of Round function is,
SELECT ROUND(column_name, decimals) from table-name

Operators:
AND and OR operators are used with Where clause to make more precise conditions for fetching data from database by combining more than one condition together.

1) AND operator
AND operator is used to set multiple conditions with Where clause.
Example of AND
SELECT * from Emp WHERE salary < 10000 AND age > 25

2) OR operator
OR operator is also used to combine multiple conditions with Where clause. The only difference between AND and OR is their behavior. When we use AND to combine two or morethan two conditions, records satisfying all the condition will be in the result. But in case of OR,at least one condition from the conditions specified must be satisfied by any record to be in the result.

Example of OR
SELECT * from Emp WHERE salary > 10000 OR age
> 25 Set Operation in SQL
SQL supports few Set operations to be performed on table data. These are used to get meaningful results from data, under different special conditions.

3) Union
UNION is used to combine the results of two or more Select statements. However, it will eliminate duplicate rows from its result set. In case of union, number of columns and datatype must be same in both the tables.
Example of UNION
select * from First
UNION
select * from second
4) Union All
This operation is similar to Union. But it also shows the duplicate rows.Union All query will be like,
select * from
First UNION
ALL
select * from second
5) Intersect
Intersect operation is used to combine two SELECT statements, but it only returns the records which are common from both SELECT statements. In case of Intersect the number of columns and datatype must be same. MySQL does not support INTERSECT operator.
Intersect query will be,
select * from First
INTERSECT
select * from second
6) Minus
Minus operation combines result of two Select statements and return only those result which belongs to first set of result. MySQL does not support INTERSECT operator.
Minus query will be,
select * from First
MINUS
select * from second

INTRODUCTION TO MYSQL TRIGGER

- A trigger is a set of SQL Statements that are run automatically when a specified change operation (SQL INSERT, UPDATE, or DELETE statement) is performed on a specified table.
- A SQL trigger is a special type of stored procedure. It is special because it is not called directly like a stored procedure. The main difference between a trigger and a stored procedureis that a trigger is called automatically when a data modification event is made against a tablewhereas a stored procedure must be called explicitly.
- A trigger can be defined to be invoked either before or after the data is changedby INSERT, UPDATE or DELETE statement
- Triggers are useful for tasks such as enforcing business rules, validating input data, and keeping an audit trail. A trigger can be set to activate either before or after the trigger event. For example, you can have a trigger activate before each row that is inserted into a table or after eachrow that is updated
- It is important to understand the SQL trigger's advantages and disadvantages so that you can use it appropriately. In the following sections, we will discuss the advantages and disadvantages of using SQL triggers.

Advantages of using SQL triggers

- SQL triggers provide an alternative way to check the integrity of data.
- SQL triggers can catch errors in business logic in the database layer.
- SQL triggers provide an alternative way to run scheduled tasks. By using SQL triggers, you don't have to wait to run the scheduled tasks because the triggers are invoked automatically before or after a change is made to the data in the tables.
- SQL triggers are very useful to audit the changes of data in tables.

Disadvantages of using SQL triggers

- SQL triggers only can provide an extended validation and they cannot replace all the validations. Some simple validations have to be done in the application layer. For example, you can validate user's inputs in the client side by using JavaScript or on the server side using server-side scripting languages such as JSP, PHP, ASP.NET, Perl.
- SQL triggers are invoked and executed invisible from the client applications, therefore, it is difficult to figure out what happens in the database layer.
- SQL triggers may increase the overhead of the database server.

In MySQL, trigger can also be created. There are 6 type of triggers that can be made they are: -

1.After/Before insert
2.After/Before update
3.After/Before delete

CREATE TRIGGER
trigger_nametrigger_event
ON table_name
FOR EACH ROW
BEGIN **...** END;
Here,

- Trigger_name is the name of the trigger which must be put after CREATE TRIGGER statement.
- The naming convention for trigger_name can be like [trigger time] _ [table name] _ [trigger event]. For example, before_student_update or after_student_insert can be a name of the trigger.
- Trigger time is the time of trigger activation and it can be BEFORE or AFTER. We must have to specify the activation time while defining a trigger. We must to use BEFORE if we want to process action prior to the change made on the table and AFTER if we want to process action post to the change made on the table.
- Trigger event can be INSERT, UPDATE or DELETE. This event causes the trigger to be invoked. A trigger only can be invoked by one event. To define a trigger that is invoked by multiple events, we have to define multiple triggers, one for each event.
- Table_name is the name of the table. Actually, a trigger is always associated with a specific table. Without a table, a trigger would not exist hence we have to specify the tablename after the 'ON' keyword.
- BEGIN…END is the block in which we will define the logic for the trigger.

AFTER/BEFORE INSERT TRIGGER

CREATE TRIGGER trigger_name
AFTER/BEFORE INSERT ON table_name
FOR EACH ROW
BEGIN
--variable declarations
--trigger code
END;
Parameter:

- trigger_name: name of the trigger to be created.
- AFTER/BEFORE INSERT: It points the trigger after or before insert query is executed.
- table_name: name of the table in which a trigger is created.

AFTER/ BEFORE UPDATE Trigger

- In MySQL, AFTER/BEFORE UPDATE trigger can also be created.
- AFTER/BEFORE UPDATE trigger means trigger will invoke after/before the record is updated.

Syntax:

CREATE TRIGGER trigger_name
AFTER/BEFORE UPDATE ON table_name
FOR EACH ROW
BEGIN
--variable declarations
--trigger code
END;

Parameter:

- trigger_name: name of the trigger to be created.
- AFTER UPDATE: It points the trigger update query is executed.
- table_name: name of the table in which a trigger is created.

AFTER/BEFORE DELETE Trigger

- In MySQL, AFTER/BEFORE DELETE trigger can also be created.
- AFTER/BEFORE DELETE trigger means trigger will invoke after/before the record is deleted.

Syntax:

CREATE TRIGGER trigger_name
AFTER/BEFORE DELETE ON table_name
FOR EACH ROW
BEGIN
--variable declarations
--trigger code
END;

Parameter:

- trigger_name: name of the trigger to be created.
- AFTER/BEFORE DELETE: It points the trigger after/before delete query is executed.
- table_name: name of the table in which a trigger is created.

AUDIT TRACKING

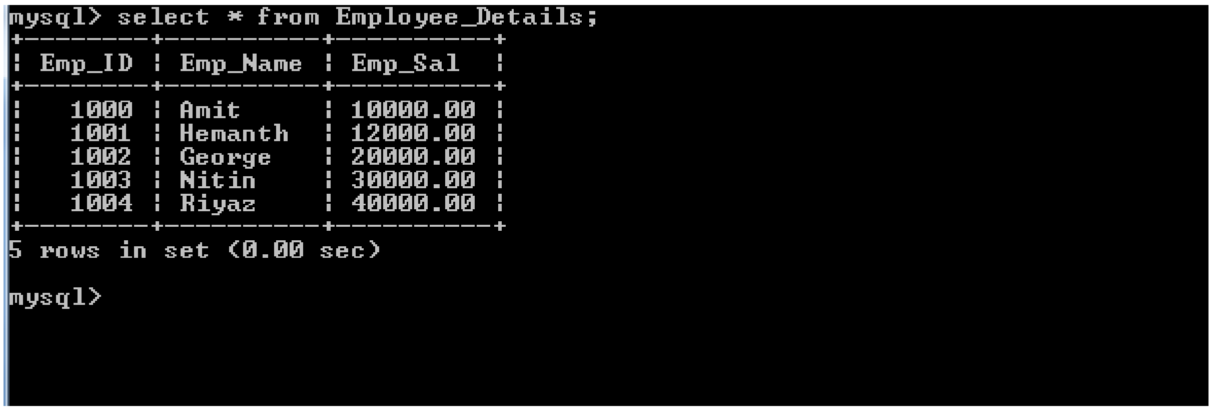
EXAMPLES OF TRIGGERS FOR AUDIT PURPOSE

```
CREATE TABLE
Employee_Details(Emp_ID int primary key , Emp_Name
varchar(55), Emp_Sal decimal (10,2));

CREATE TABLE
Employee_Details_Audit(Emp_ID  int, Emp_Name varchar (55), Emp_Sal decimal(10,2),
Action varchar(55)) ;
```

Above we have two scripts for creating two table Employee_Details and Employee_Details_Audit.Both tables have same no of column names,same column name and same date type. In second table, Employee_Details_Audit keeps track of what kind of operations are performed on table Employee_Details and any insert, update and delete operation value are stored in Employee_Details_Audit

For the First table Employee_Details we insert five records .

Insert into Employee_Details values
(1000,'Amit',10000);
Insert into Employee_Details values
(1001,'Hemanth',12000);
Insert into Employee_Details values
(1002,'George',20000);
Insert into Employee_Details values
(1003,'Nitin',30000);
Insert into Employee_Details values
(1004,'Riyaz',40000);



```
mysql> select * from Employee_Details;
+--------+----------+----------+
| Emp_ID | Emp_Name | Emp_Sal  |
+--------+----------+----------+
|   1000 | Amit     | 10000.00 |
|   1001 | Hemanth  | 12000.00 |
|   1002 | George   | 20000.00 |
|   1003 | Nitin    | 30000.00 |
|   1004 | Riyaz    | 40000.00 |
+--------+----------+----------+
5 rows in set (0.00 sec)

mysql>
```

Below we have written three types of trigger meant for auditing purpose. What ever operations performed on table Employee_Details gets automatically reflected in Employee_Details_Audit. For example, we perform any insert, update or delete operations on Employee_Details, its get automatically get reflected in Employee_Details_Audit table becausewe have written triggers on Employee_Details table.

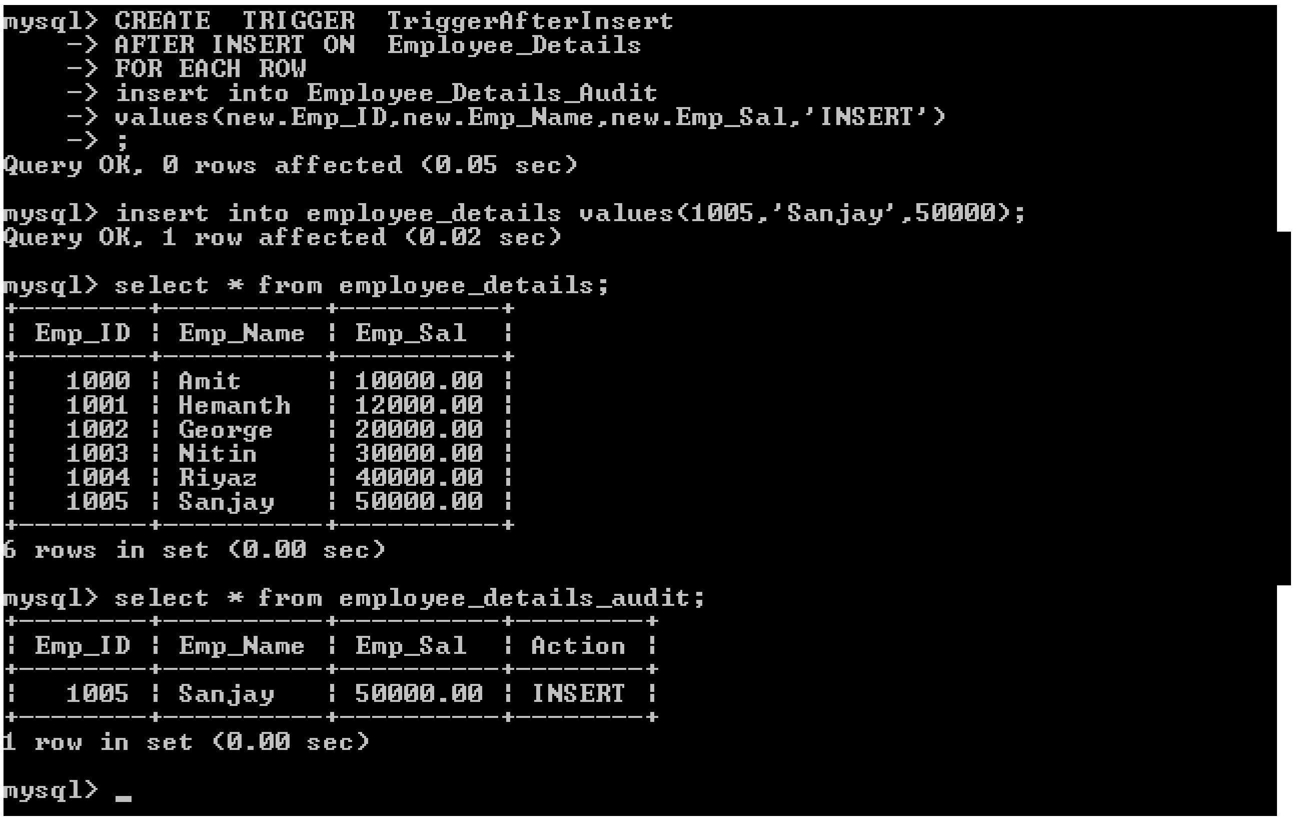
TRIGGER EXAMPLE 1

EXAMPLE OF CREATING AFTER INSERT TRIGGER FOR AUDIT PURPOSE

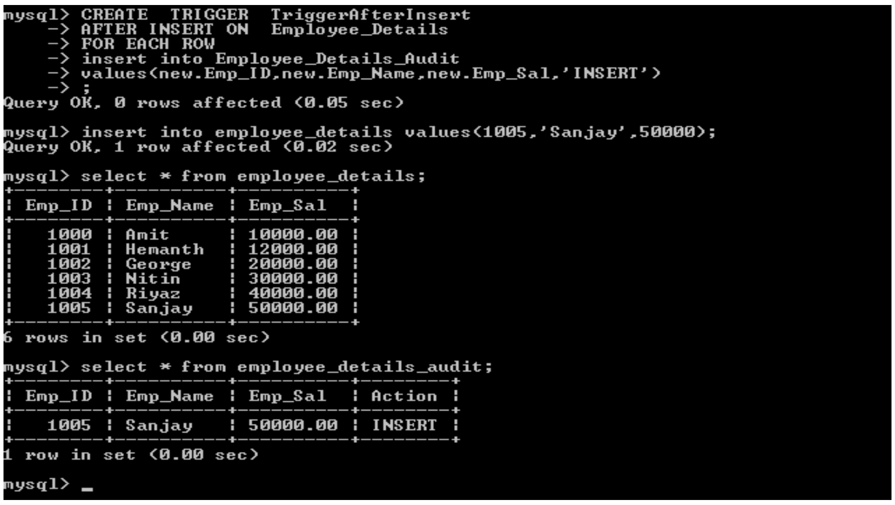
```
CREATE TRIGGER
TriggerAfterInsert AFTER
INSERT  ON  Employee_Details
FOR EACH ROW
insert into Employee_Details_Audit
values(new.Emp_ID,new.Emp_Name,new.Emp_Sal,'INSERT')
```

In above example,TriggerAfterInsert,an Insert Trigger written on table Employee_Details. whenever weperform insert operation on Employee_Details table, automatically TriggerAfterInsert is fired and whatever records we have inserted in Employee_Detailsthe same recods gets inserted in Employee_Details_Audit along with what action we performed for example Insert action we have performed that too get inserted in Employee_Details_Audit.

Below is screen shot of output of TriggerAfterInser fired on table Employee_Detail



```
mysql> CREATE  TRIGGER  TriggerAfterInsert
    -> AFTER INSERT ON  Employee_Details
    -> FOR EACH ROW
    -> insert into Employee_Details_Audit
    -> values(new.Emp_ID,new.Emp_Name,new.Emp_Sal,'INSERT')
    -> ;
Query OK, 0 rows affected (0.05 sec)

mysql> insert into employee_details values(1005,'Sanjay',50000);
Query OK, 1 row affected (0.02 sec)

mysql> select * from employee_details;
+--------+----------+----------+
| Emp_ID | Emp_Name | Emp_Sal  |
+--------+----------+----------+
|   1000 | Amit     | 10000.00 |
|   1001 | Hemanth  | 12000.00 |
|   1002 | George   | 20000.00 |
|   1003 | Nitin    | 30000.00 |
|   1004 | Riyaz    | 40000.00 |
|   1005 | Sanjay   | 50000.00 |
+--------+----------+----------+
6 rows in set (0.00 sec)

mysql> select * from employee_details_audit;
+--------+----------+----------+--------+
| Emp_ID | Emp_Name | Emp_Sal  | Action |
+--------+----------+----------+--------+
|   1005 | Sanjay   | 50000.00 | INSERT |
+--------+----------+----------+--------+
1 row in set (0.00 sec)

mysql> _
```



```
mysql> CREATE  TRIGGER  TriggerAfterInsert
    -> AFTER INSERT ON  Employee_Details
    -> FOR EACH ROW
    -> insert into Employee_Details_Audit
    -> values(new.Emp_ID,new.Emp_Name,new.Emp_Sal,'INSERT')
    -> ;
Query OK, 0 rows affected (0.05 sec)

mysql> insert into employee_details values(1005,'Sanjay',50000);
Query OK, 1 row affected (0.02 sec)

mysql> select * from employee_details;
+--------+----------+----------+
| Emp_ID | Emp_Name | Emp_Sal  |
+--------+----------+----------+
|   1000 | Amit     | 10000.00 |
|   1001 | Hemanth  | 12000.00 |
|   1002 | George   | 20000.00 |
|   1003 | Nitin    | 30000.00 |
|   1004 | Riyaz    | 40000.00 |
|   1005 | Sanjay   | 50000.00 |
+--------+----------+----------+
6 rows in set (0.00 sec)

mysql> select * from employee_details_audit;
+--------+----------+----------+--------+
| Emp_ID | Emp_Name | Emp_Sal  | Action |
+--------+----------+----------+--------+
|   1005 | Sanjay   | 50000.00 | INSERT |
+--------+----------+----------+--------+
1 row in set (0.00 sec)

mysql> _
```

TRIGGER EXAMPLE 2

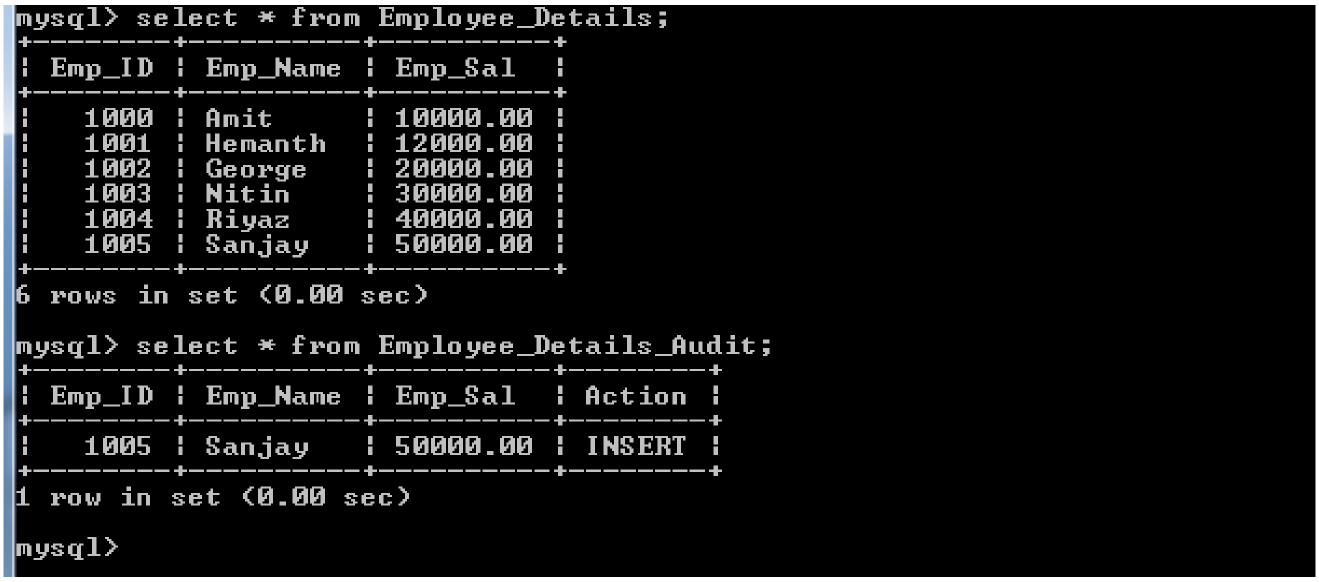
EXAMPLE OF CREATINGAFTER UPDATE TRIGGER FOR AUDIT PURPOSE

create trigger TriggerAfterUpdate

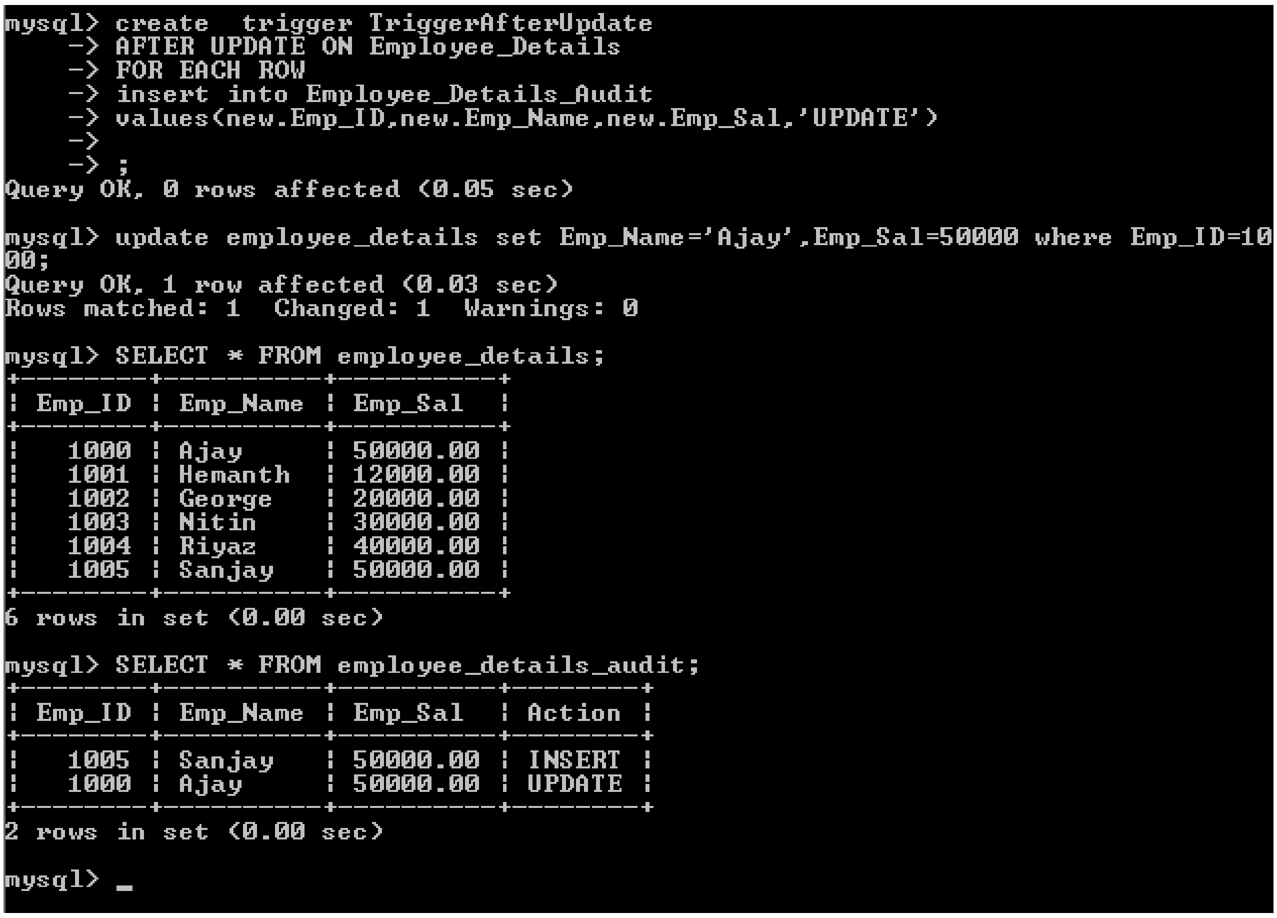
insert into Employee_Details_Audit
values(new.Emp_ID,new.Emp_Name,new.Emp_Sal,'UPDATE')

In above example,TriggerAfterUpdate,an Update Trigger written on table Employee_Details.whenever we perform Update operation on Employee_Details table, automatically TriggerAfterUpdateis fired and whatever records we have updated in Employee_Details same recods gets updated in Employee_Details_Audit along with what action we performed for example Update action we have performed that too get inserted in Employee_Details_Audit

Below is a screen shot of output of TriggerAfterUpdate fired on table Employee_Details



```
mysql> select * from Employee_Details;
+--------+----------+----------+
| Emp_ID | Emp_Name | Emp_Sal  |
+--------+----------+----------+
|   1000 | Amit     | 10000.00 |
|   1001 | Hemanth  | 12000.00 |
|   1002 | George   | 20000.00 |
|   1003 | Nitin    | 30000.00 |
|   1004 | Riyaz    | 40000.00 |
|   1005 | Sanjay   | 50000.00 |
+--------+----------+----------+
6 rows in set (0.00 sec)

mysql> select * from Employee_Details_Audit;
+--------+----------+----------+--------+
| Emp_ID | Emp_Name | Emp_Sal  | Action |
+--------+----------+----------+--------+
|   1005 | Sanjay   | 50000.00 | INSERT |
+--------+----------+----------+--------+
1 row in set (0.00 sec)

mysql>
```



```
mysql> create  trigger TriggerAfterUpdate
    -> AFTER UPDATE ON Employee_Details
    -> FOR EACH ROW
    -> insert into Employee_Details_Audit
    -> values(new.Emp_ID,new.Emp_Name,new.Emp_Sal,'UPDATE')
    ->
    -> ;
Query OK, 0 rows affected (0.05 sec)

mysql> update employee_details set Emp_Name='Ajay',Emp_Sal=50000 where Emp_ID=10
00;
Query OK, 1 row affected (0.03 sec)
Rows matched: 1  Changed: 1  Warnings: 0

mysql> SELECT * FROM employee_details;
+--------+----------+----------+
| Emp_ID | Emp_Name | Emp_Sal  |
+--------+----------+----------+
|   1000 | Ajay     | 50000.00 |
|   1001 | Hemanth  | 12000.00 |
|   1002 | George   | 20000.00 |
|   1003 | Nitin    | 30000.00 |
|   1004 | Riyaz    | 40000.00 |
|   1005 | Sanjay   | 50000.00 |
+--------+----------+----------+
6 rows in set (0.00 sec)

mysql> SELECT * FROM employee_details_audit;
+--------+----------+----------+--------+
| Emp_ID | Emp_Name | Emp_Sal  | Action |
+--------+----------+----------+--------+
|   1005 | Sanjay   | 50000.00 | INSERT |
|   1000 | Ajay     | 50000.00 | UPDATE |
+--------+----------+----------+--------+
2 rows in set (0.00 sec)

mysql> _
```

INTRODUCTION TO STORED PROCEDURES

- A stored procedure is a prepared SQL code that you can save, so the code can be reused over and over again. So if you have an SQL query that you write over and over again, save it as a stored procedure, and then just call it to execute it.

- You can also pass parameters to a stored procedure, so that the stored procedure can act based on the parameter value(s) that is passed.

- A procedure can return one or more than one value through parameters or may not return at all. The procedure can be used in SQL queries.

Creating aprocedureSyntax

CREATE PROCEDURE

procedure_name(parameter datatype,

Parameter datatype)

BEGIN

Declaration_section Executable_section

END;

Parameter

procedure_name: name of the stored procedure.

Parameter: number of parameters. It can be one or more

than one.**declaration_section:** all variables are declared.

executable_section: code is written here.

A variable is a named data object whose value can change during the stored procedure execution. We typically use the variables in stored procedures to hold the immediate results. These variables are local to the stored procedure. You must declare a variable before using it.

```
DELIMITER //
CREATE PROCEDURE
sp_name(p_1 INT)
BEGIN
...code goes
here...END
// DELIMITER;
```

- Replace procedure_name with sp_procedure_name whatever name you'd like to use for the stored procedure. The parentheses are required — they enclose any parameters. If no parameters are required, the parentheses can be empty.

- The main body of the stored procedure goes in between the BEGIN and END keywords. These keywords are used for writing compound statements. A compound statement can contain multiple statements, and these can be nested if required. Therefore, you can nest BEGIN and END blocks.

- In most cases, you will also need to surround the CREATE PROCEDURE statement with DELIMITER commands and change END; to END //. Like this:

About the DELIMITER Command

- The first command is DELIMITER // , which is not related to the stored procedure syntax.
The DELIMITER statement changes the standard delimiter which is a semicolon (;) to another.

- In this case, the delimiter is changed from the semicolon (;) to double-slashes (//) We need to change delimiter from; to //. Because we want to pass the stored procedure to the server as a whole rather than letting MySQL tool interpret each statement at a time

- Following the END keyword, we use the delimiter // to indicate the end of the stored procedure.
The last command (DELIMITER;) changes the delimiter back to the semicolon(;).

How to Execute a Stored Procedure

Call sp_procedure_name ();

Writing the first MySQL stored procedure

Here we are creating sample table named employee

```
create table employee (employee_id int primary key, Name varchar (50),
Designation varchar (50), Salary decimal (10,2))

insert into employee values(100,'vishwanath','clerk',20000.00);
insert into employee values(101,'shashikiran','instructor',20000.00);
insert into employee values (102,'nitin','assitiant professor',25000.00);
insert into employee values (103,'deepak','associate professor',40000.00);
insert intoemployee  values(104,'sanjay','professor',80000.00);
insert into employee  values (105,'yogesh','systemadmin',30000.00);
insert into employee values(106,'anand','clerk',20000.00);
insert into employee values(107,'Hemanth','professor',80000.00);
insert into employee values(108,'Robert','cashier',15000.00);
insertinto employee  values(109,'amit','clerk',20000.00);
insert into employee  values (110,'george','HR Manager',30000.00);
```

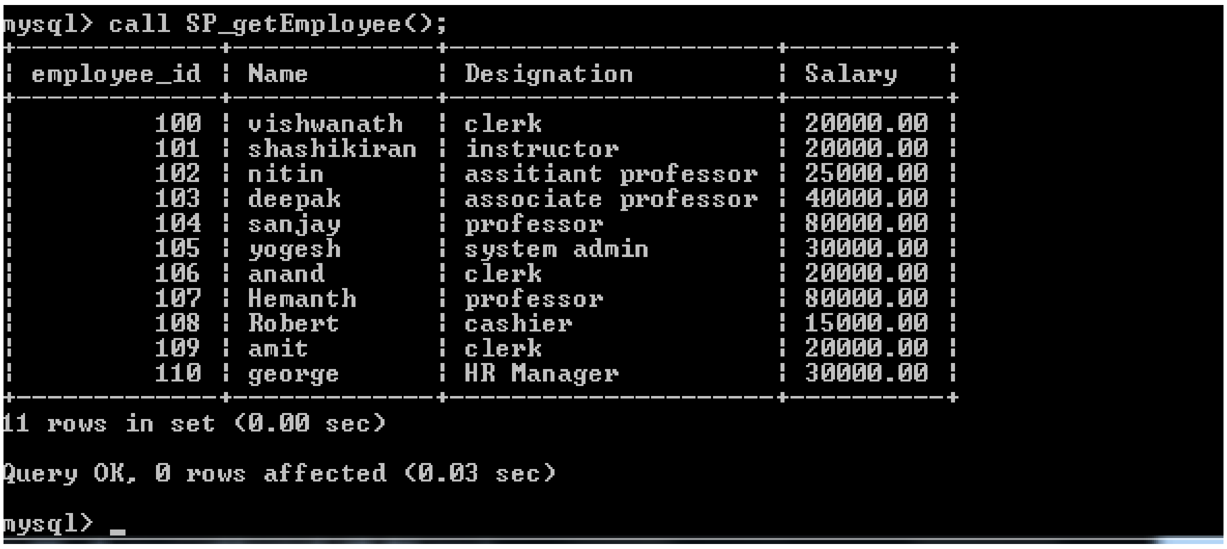
Example

We are going to develop a simple stored procedure named SP_getEmployee to help you get familiar with the syntax. The SP_getEmployee() stored procedure selects all employee information from the employee table.:

```
DELIMITER $$
DROP PROCEDURE IF EXISTS
SP_getEmployee $$CREATE PROCEDURE
SP_getEmployee()
BEGIN
SELECT * FROM
employee;END$$
```

Execute the stored procedure above as follows:

```
call SP_getEmployee();
```



```
mysql> call SP_getEmployee();
+-------------+-------------+----------------------+----------+
| employee_id | Name        | Designation          | Salary   |
+-------------+-------------+----------------------+----------+
|         100 | vishwanath  | clerk                | 20000.00 |
|         101 | shashikiran | instructor           | 20000.00 |
|         102 | nitin       | assitiant professor  | 25000.00 |
|         103 | deepak      | associate professor  | 40000.00 |
|         104 | sanjay      | professor            | 80000.00 |
|         105 | yogesh      | system admin         | 30000.00 |
|         106 | anand       | clerk                | 20000.00 |
|         107 | Hemanth     | professor            | 80000.00 |
|         108 | Robert      | cashier              | 15000.00 |
|         109 | amit        | clerk                | 20000.00 |
|         110 | george      | HR Manager           | 30000.00 |
+-------------+-------------+----------------------+----------+
11 rows in set (0.00 sec)

Query OK, 0 rows affected (0.03 sec)

mysql> _
```

Concept of Normalization

A large database defined as a single relation may result in data duplication. This repetition of data may result in:

- Making relations very large.
- It isn't easy to maintain and update data as it would involve searching many records in relation.
- Wastage and poor utilization of disk space and resources.
- The likelihood of errors and inconsistencies increases.

So to handle these problems, we should analyze and decompose the relations with redundant data into smaller, simpler, and well-structured relations that are satisfy desirable properties. Normalization is a process of decomposing the relations into relations with fewer attributes.

What is Normalization?

- Normalization is the process of organizing the data in the database.
- Normalization is used to minimize the redundancy from a relation or set of relations. It is also used to eliminate undesirable characteristics like Insertion, Update, and Deletion Anomalies.
- Normalization divides the larger table into smaller and links them using relationships.
- The normal form is used to reduce redundancy from the database table.

Why do we need Normalization?

The main reason for normalizing the relations is removing these anomalies. Failure to eliminate anomalies leads to data redundancy and can cause data integrity and other problems as the database grows. Normalization consists of a series of guidelines that helps to guide you in creating a good database structure.

Data modification anomalies can be categorized into three types:

- Insertion Anomaly: Insertion Anomaly refers to when one cannot insert a new tuple into a relationship due to lack of data.
- Deletion Anomaly: The delete anomaly refers to the situation where the deletion of data results in the unintended loss of some other important data.
- Updatation Anomaly: The update anomaly is when an update of a single data value requires multiple rows of data to be updated.

Advantages of Normalization

- Normalization helps to minimize data redundancy.
- Greater overall database organization.
- Data consistency within the database.
- Much more flexible database design.
- Enforces the concept of relational integrity.

Disadvantages of Normalization

- You cannot start building the database before knowing what the user needs.
- It is very time-consuming and difficult to normalize relations of a higher degree.
- Careless decomposition may lead to a bad database design, leading to serious problems

Concepts of MongoDB

MongoDB, the most popular NoSQL database, is an open-source document-oriented database. The term 'NoSQL' means 'non-relational'. It means that MongoDB isn't based on the table-like relational database structure but provides an altogether different mechanism for storage and retrieval of data. This format of storage is called BSON (similar to JSON format).

SQL databases store data in tabular format. This data is stored in a predefined data model which is not very much flexible for today's real-world highly growing applications. **Modern applications are more networked, social and interactive than ever**. Applications are storing more and more data and are accessing it at higher rates.

Relational Database Management System(RDBMS) **is not the correct choice when it comes to handling big data by the virtue of their design since they are not horizontally scalable**. If the database runs on a single server, then it will reach a scaling limit. NoSQL databases are more scalable and provide superior performance. MongoDB is such a NoSQL database that scales by adding more and more servers and increases productivity with its flexible document model.

RDBMS vs MongoDB:

- RDBMS has a typical schema design that shows number of tables and the relationship between these tables whereas MongoDB is document-oriented. There is no concept of schema or relationship.
- Complex transactions are not supported in MongoDB because complex join operations are not available.
- MongoDB allows a highly flexible and scalable document structure. For example, one data document of a collection in MongoDB can have two fields whereas the other document in the same collection can have four.
- MongoDB is faster as compared to RDBMS due to efficient indexing and storage techniques.
- There are a few terms that are related in both databases. What's called Table in RDBMS is called a Collection in MongoDB. Similarly, a Row is called a Document and a Column is called a Field. MongoDB provides a default '_id' (if not provided explicitly) which is a 12-byte hexadecimal number that assures the uniqueness of every document. It is similar to the Primary key in RDBMS.

Features of MongoDB:

- **Document Oriented**: MongoDB stores the main subject in the minimal number of documents and not by breaking it up into multiple relational structures like RDBMS. For example, it stores all the information of a computer in a single document called Computer and not in distinct relational structures like CPU, RAM, Hard disk, etc.

- **Indexing**: Without indexing, a database would have to scan every document of a collection to select those that match the query which would be inefficient. So, for efficient searching Indexing is a must and MongoDB uses it to process huge volumes of data in very less time.

- **Scalability**: MongoDB scales horizontally using sharding (partitioning data across various servers). Data is partitioned into data chunks using the shard key, and these data chunks are evenly distributed across shards that reside across many physical servers. Also, new machines can be added to a running database.

- **Replication and High Availability**: MongoDB increases the data availability with multiple copies of data on different servers. By providing redundancy, it protects the database from hardware failures. If one server goes down, the data can be retrieved easily from other active servers which also had the data stored on them.

- **Aggregation**: Aggregation operations process data records and return the computed results. It is similar to the GROUPBY clause in SQL. A few aggregation expressions are sum, avg, min, max, etc

Where do we use MongoDB?

MongoDB is preferred over RDBMS in the following scenarios:

- **Big Data**: If you have huge amount of data to be stored in tables, think of MongoDB before RDBMS databases. MongoDB has built-in solution for partitioning and sharing your database.

- **Unstable Schema**: Adding a new column in RDBMS is hard whereas MongoDB is schema-less. Adding a new field does not affect old documents and will be very easy.

- **Distributed data** Since multiple copies of data are stored across different servers, recovery of data is instant and safe even if there is a hardware failure.

Lab Experiments:

Program 1: Create a table called Employee & execute the following.
Employee (EMPNO, ENAME, JOB, MANAGER_NO, SAL, COMMISSION)

1. **Create a user and grant all permissions to the user**

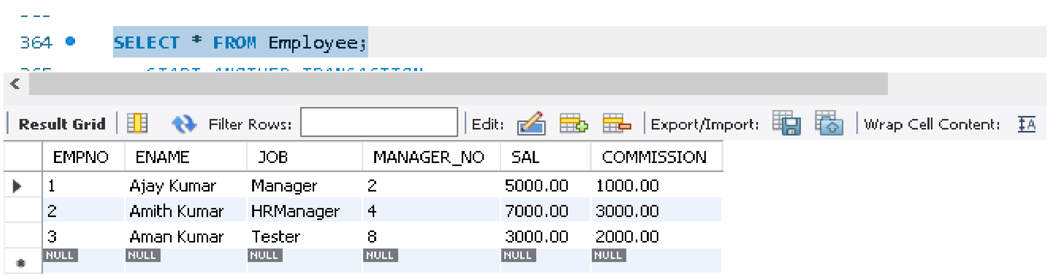
This step can differ significantly based on the database system being used. Below is an example for My:drop user abc@localhost;flush privileges;

```
create user abc@localhost identified by 'abc'
GRANT ALL PRIVILEGES ON *.* TO 'abc'@'localhost' WITH GRANT OPTION;
FLUSH PRIVILEGES;
```

2. **Insert any three records in the employee table contains attributes EMPNO, ENAME JOB, MANAGER_NO, SAL, COMMISSION and use rollback. Check the result.**

```
CREATE  DATABASE  Employee
USE Employee
 CREATE TABLE Employee (EMPNO I NT ,
             ENAME VARCHAR(255) NOT NULL,
             JOB VARCHAR(255) NOT NULL,
             MANAGER_NO INT NOT NULL,
             SAL DECIMAL(10, 2) NOT NULL,
             COMMISSION DECIMAL(10, 2) NOT NULL);
INSERT INTO Employee (EMPNO, ENAME, JOB, MANAGER_NO, SAL, COMMISSION)
VALUES (1, 'Ajay Kumar', 'Manager', 2, 5000.00, 1000.00);

 INSERT  INTO  Employee (EMPNO, ENAME, JOB, MANAGER_NO, SAL, COMMISSION)
 VALUES (2, 'Amith Kumar', 'HRManager', 4, 7000.00, 3000.00);

INSERT INTO Employee (EMPNO, ENAME, JOB, MANAGER_NO, SAL, COMMISSION)
VALUES (3, 'Aman Kumar', 'Tester', 8, 3000.00, 2000.00);
```

SELECT * FROM Employee;



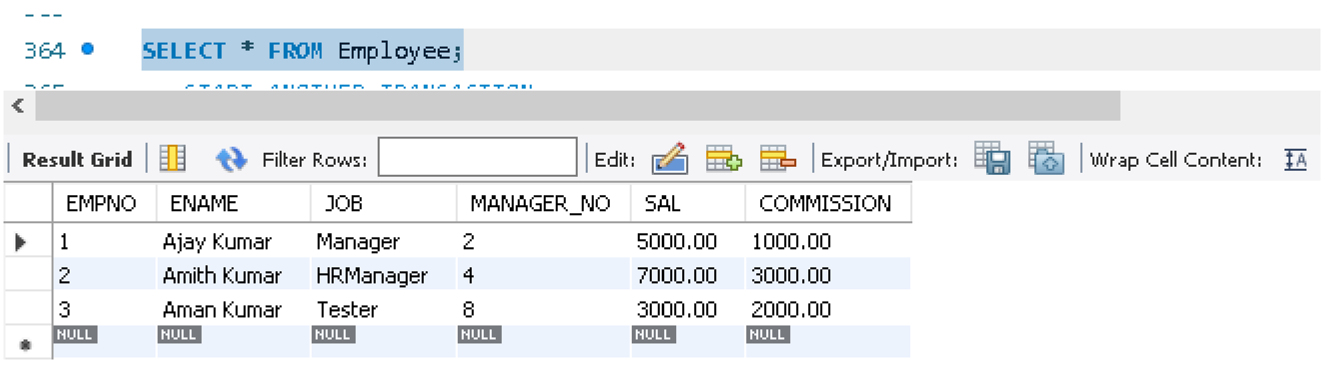
```
SELECT * FROM Employee;
```

EMPNO	ENAME	JOB	MANAGER_NO	SAL	COMMISSION
1	Ajay Kumar	Manager	2	5000.00	1000.00
2	Amith Kumar	HRManager	4	7000.00	3000.00
3	Aman Kumar	Tester	8	3000.00	2000.00
NULL	NULL	NULL	NULL	NULL	NULL

alter table Employee engine=innodb;

```
-- START A
TRANSACTIONSTART
TRANSACTION;
INSERT INTO Employee (EMPNO, ENAME, JOB, MANAGER_NO, SAL, COMMISSION)
VALUES (1, 'Ajay Kumar', 'Manager', 2, 5000.00, 1000.00);
INSERT INTO Employee (EMPNO, ENAME, JOB, MANAGER_NO, SAL, COMMISSION)
VALUES (2, 'Amith Kumar', 'HRManager', 4, 7000.00, 3000.00);
INSERT INTO Employee (EMPNO, ENAME, JOB, MANAGER_NO, SAL,
COMMISSION)VALUES (3, 'Aman Kumar', 'Tester', 8, 3000.00, 2000.00);

 COMMIT;
```

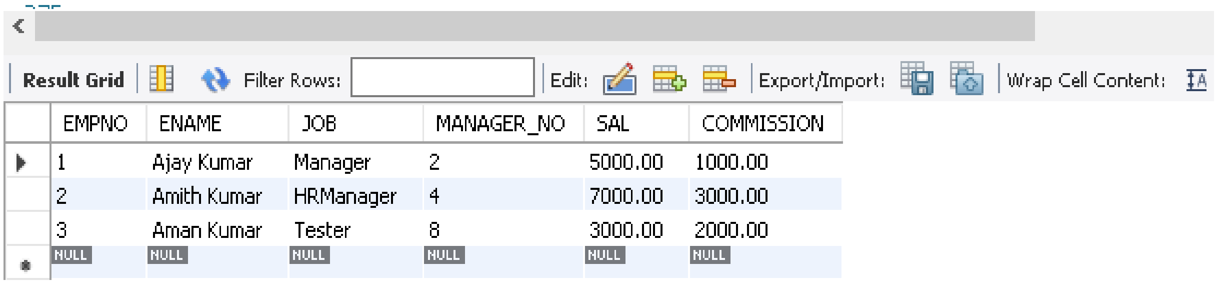
SELECT * FROM Employee;



```
SELECT * FROM Employee;
```

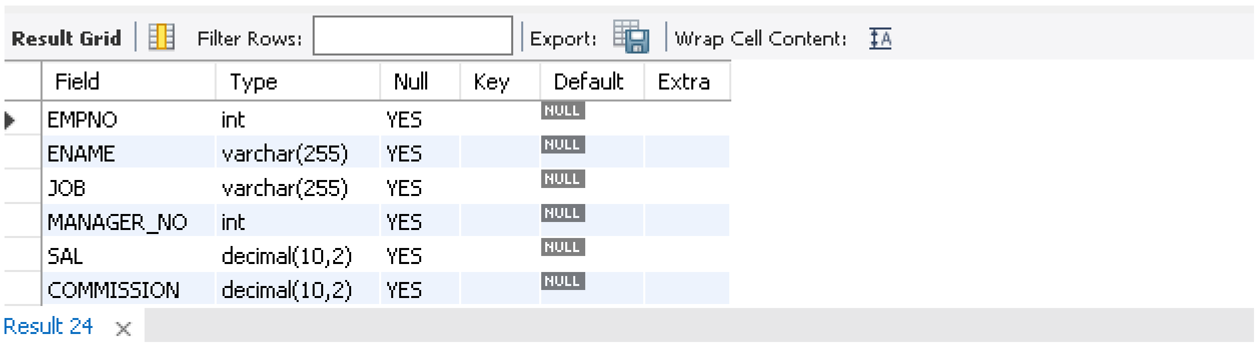
EMPNO	ENAME	JOB	MANAGER_NO	SAL	COMMISSION
1	Ajay Kumar	Manager	2	5000.00	1000.00
2	Amith Kumar	HRManager	4	7000.00	3000.00
3	Aman Kumar	Tester	8	3000.00	2000.00
NULL	NULL	NULL	NULL	NULL	NULL

```
-- START ANOTHER
TRANSACTIONSTART
TRANSACTION;
INSERT INTO Employee (EMPNO, ENAME, JOB, MANAGER_NO, SAL, COMMISSION)
VALUES (4, 'Pradeep Kumar', 'FinanceManager', 5, 8000.00,4000.00);
UPDATE Employee SET ENAME='Sanjay Kumar' where EMPNO=2;
DELETE FROM Employee where ENAME = 'Ajay umar';
-- ROLLBACK 2 INSERTS AND 1 DELETE
OPERATIONS ROLLBACK;

SELECT * FROM Employee;
```


Result Grid | Filter Rows: | Edit: | Export/Import: | Wrap Cell Content:

EMPNO	ENAME	JOB	MANAGER_NO	SAL	COMMISSION
1	Ajay Kumar	Manager	2	5000.00	1000.00
2	Amith Kumar	HRManager	4	7000.00	3000.00
3	Aman Kumar	Tester	8	3000.00	2000.00
NULL	NULL	NULL	NULL	NULL	NULL

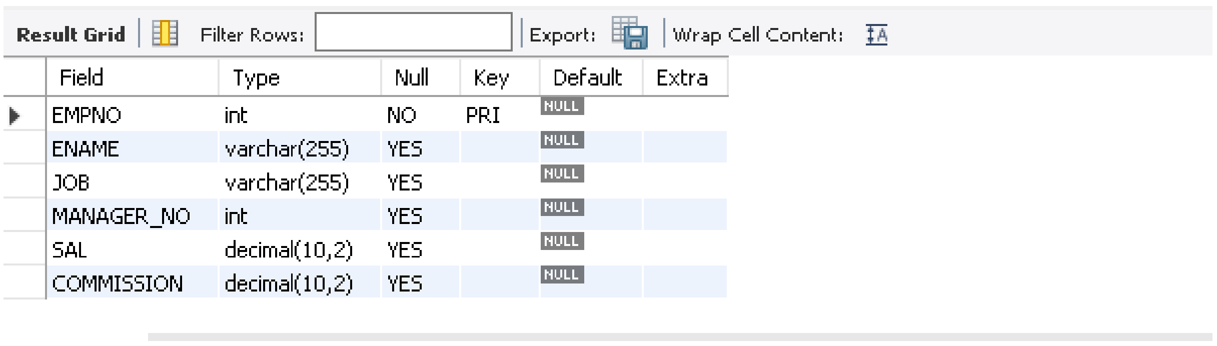
3. Add primary key constraint and not null constraint to the employee table.


Result Grid | Filter Rows: | Export: | Wrap Cell Content:

Field	Type	Null	Key	Default	Extra
EMPNO	int	YES		NULL	
ENAME	varchar(255)	YES		NULL	
JOB	varchar(255)	YES		NULL	
MANAGER_NO	int	YES		NULL	
SAL	decimal(10,2)	YES		NULL	
COMMISSION	decimal(10,2)	YES		NULL	

Result 24

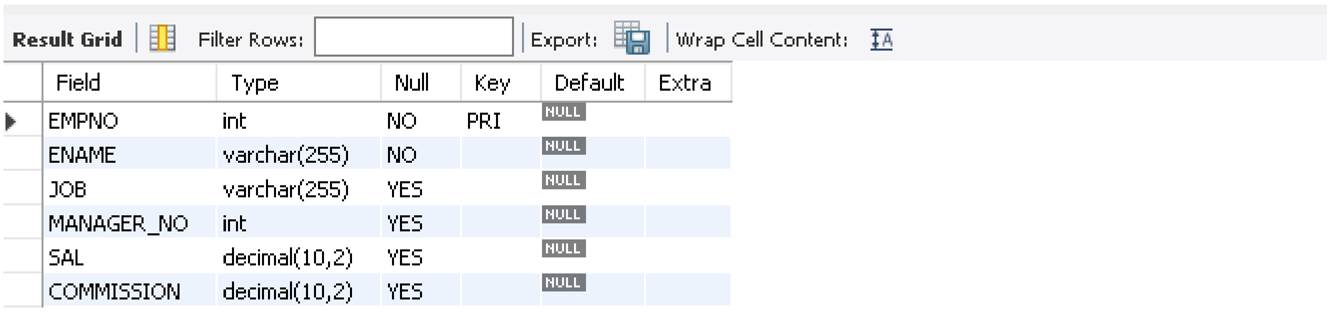
```
ALTER  TABLE  Employee ADD PRIMARY KEY( EMPNO)
```


Result Grid | Filter Rows: | Export: | Wrap Cell Content:

Field	Type	Null	Key	Default	Extra
EMPNO	int	NO	PRI	NULL	
ENAME	varchar(255)	YES		NULL	
JOB	varchar(255)	YES		NULL	
MANAGER_NO	int	YES		NULL	
SAL	decimal(10,2)	YES		NULL	
COMMISSION	decimal(10,2)	YES		NULL	

NOT NULL CONSTRAINT

ALTER TABLE Employee MODIFY ENAME VARCHAR(255) NOT NULL



Field	Type	Null	Key	Default	Extra
EMPNO	int	NO	PRI	NULL	
ENAME	varchar(255)	NO		NULL	
JOB	varchar(255)	YES		NULL	
MANAGER_NO	int	YES		NULL	
SAL	decimal(10,2)	YES		NULL	
COMMISSION	decimal(10,2)	YES		NULL	

INSERT INTO Employee (EMPNO, ENAME, JOB, MANAGER_NO, SAL,COMMISSION)

VALUES (4, NULL, 'clerk,3, 50000, 20)

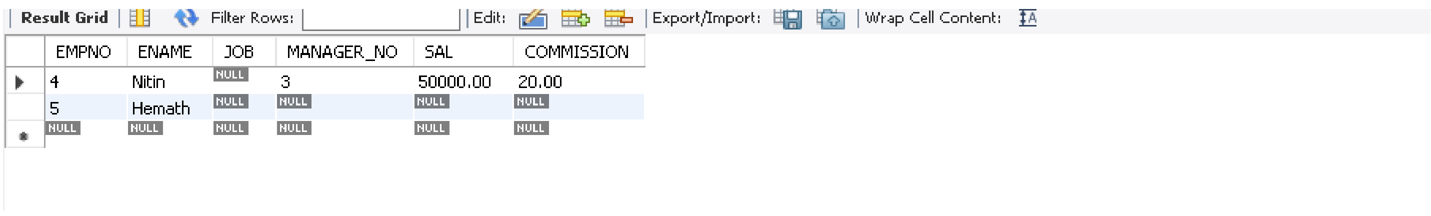
Error Code: 1048. Column 'ENAME' cannot be null 0.000 sec

4. **Insert null values to the employee table and verify the result.**

INSERT INTO Employee (EMPNO, ENAME, JOB, MANAGER_NO, SAL, COMMISSION)

VALUES (5, 'Hemath', NULL,NULL, NULL, null);

SELECT * FROM Employee



EMPNO	ENAME	JOB	MANAGER_NO	SAL	COMMISSION
4	Nitin	NULL	3	50000.00	20.00
5	Hemath	NULL	NULL	NULL	NULL
NULL	NULL	NULL	NULL	NULL	NULL

Program 2

Create a table called Employee that contain attributes EMPNO, ENAME,JOB, MGR,SAL & execute the following.

Create the Employee table:

```
CREATE TABLE Employee (EMPNO INT,
   ENAME VARCHAR(100),
   JOB VARCHAR(50),
   MGR INT,
   SAL DECIMAL(10, 2));
```

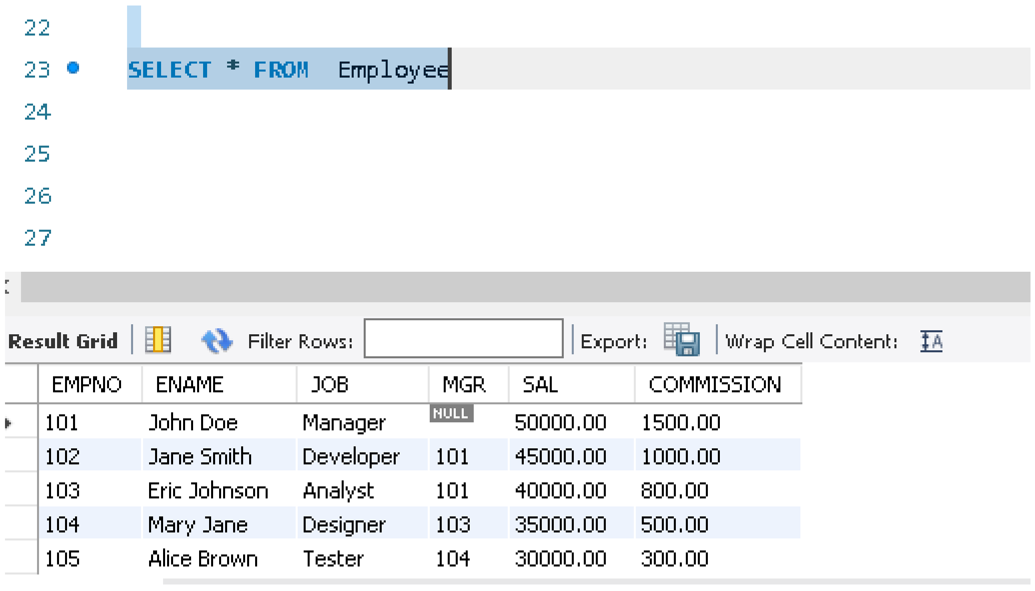
1. Add a column commission with domain to the Employeetable.

Assuming that you want to set a domain for the COMMISSION which typically means defining a specific range or type, standard doesn't directly support the "DOMAIN" keyword outside of Postgre. However, you can ensure only positive values are entered by using a CHECK constraint:

```
ALTER TABLE Employee
ADD COMMISSION DECIMAL(10, 2) CHECK (COMMISSION >= 0);
```

2. Insert any five records into the table.

```
INSERT INTO Employee (EMPNO, ENAME, JOB, MGR, SAL, COMMISSION) VALUES
(101, 'John Doe', 'Manager', NULL, 50000.00, 1500.00),
(102, 'Jane Smith', 'Developer', 101, 45000.00, 1000.00),
(103, 'Eric Johnson', 'Analyst', 101, 40000.00, 800.00),
(104, 'Mary Jane', 'Designer', 103, 35000.00, 500.00),
(105, 'Alice Brown', 'Tester', 104, 30000.00, 300.00);
```



```
SELECT * FROM Employee
```

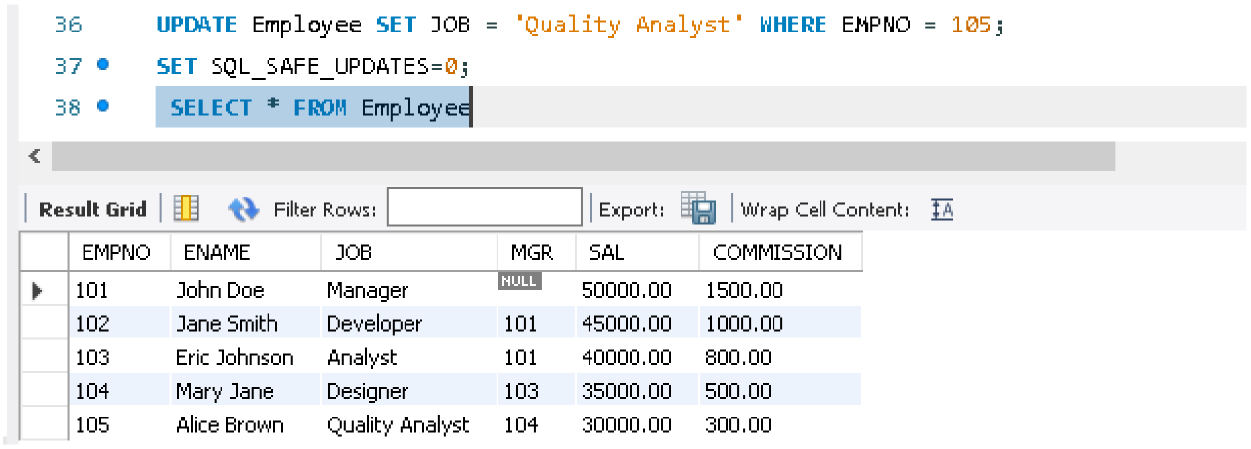
Result Grid | Filter Rows: | Export: | Wrap Cell Content:

EMPNO	ENAME	JOB	MGR	SAL	COMMISSION
101	John Doe	Manager	NULL	50000.00	1500.00
102	Jane Smith	Developer	101	45000.00	1000.00
103	Eric Johnson	Analyst	101	40000.00	800.00
104	Mary Jane	Designer	103	35000.00	500.00
105	Alice Brown	Tester	104	30000.00	300.00

3. Update the column details of the job

To update the job title for an employee, you would use an UPDATE statement. For instance, if you wanted to change the job title of all testers to 'Quality Analyst':

UPDATE Employee
SET JOB = 'Quality Analyst'
WHERE EMPNO = ‘105’;



```
UPDATE Employee SET JOB = 'Quality Analyst' WHERE EMPNO = 105;
SET SQL_SAFE_UPDATES=0;
SELECT * FROM Employee
```

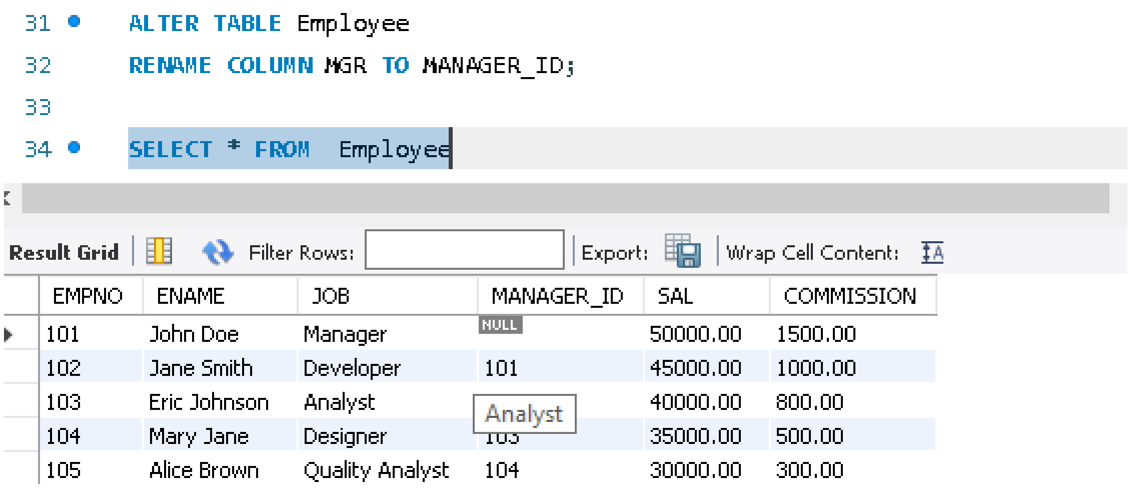
Result Grid | Filter Rows: | Export: | Wrap Cell Content:

EMPNO	ENAME	JOB	MGR	SAL	COMMISSION
101	John Doe	Manager	NULL	50000.00	1500.00
102	Jane Smith	Developer	101	45000.00	1000.00
103	Eric Johnson	Analyst	101	40000.00	800.00
104	Mary Jane	Designer	103	35000.00	500.00
105	Alice Brown	Quality Analyst	104	30000.00	300.00

4. Rename a column of the Employee table using the ALTER command

Suppose we want to rename the column MGR to MANAGER_ID:

```
ALTER TABLE Employee
RENAME COLUMN MGR TO MANAGER_ID;
```



```
ALTER TABLE Employee
RENAME COLUMN MGR TO MANAGER_ID;

SELECT * FROM  Employee
```

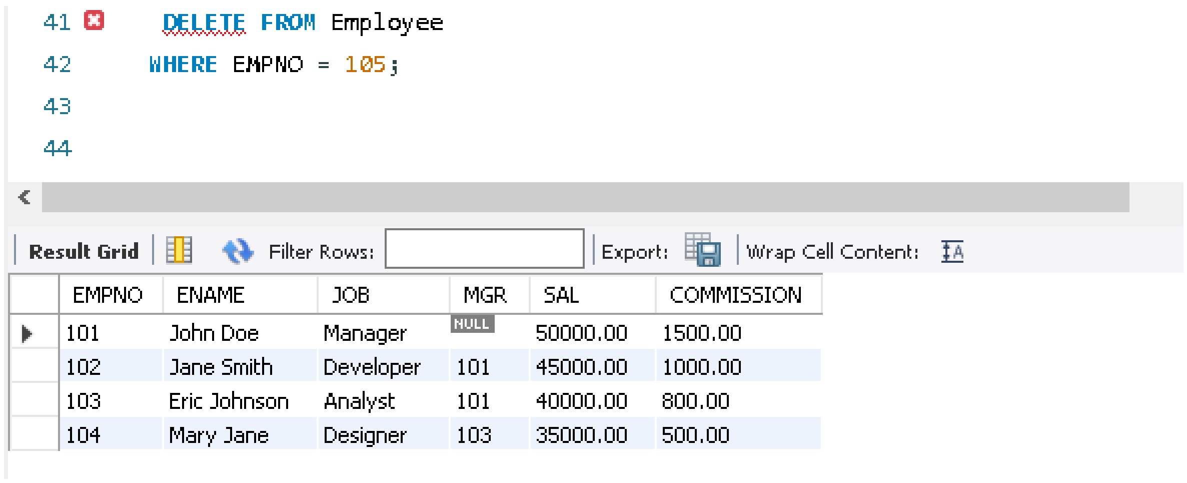
Result Grid | Filter Rows: | Export: | Wrap Cell Content:

EMPNO	ENAME	JOB	MANAGER_ID	SAL	COMMISSION
101	John Doe	Manager	NULL	50000.00	1500.00
102	Jane Smith	Developer	101	45000.00	1000.00
103	Eric Johnson	Analyst	Analyst	40000.00	800.00
104	Mary Jane	Designer	103	35000.00	500.00
105	Alice Brown	Quality Analyst	104	30000.00	300.00

5. Delete the employee whose EMPNO is 105

```
DELETE FROM Employee
WHERE EMPNO = 105;
```

This will remove the record for the employee with EMPNO 105 from the Employee table.



```
DELETE FROM Employee
WHERE EMPNO = 105;
```

Result Grid | Filter Rows: | Export: | Wrap Cell Content:

EMPNO	ENAME	JOB	MGR	SAL	COMMISSION
101	John Doe	Manager	NULL	50000.00	1500.00
102	Jane Smith	Developer	101	45000.00	1000.00
103	Eric Johnson	Analyst	101	40000.00	800.00
104	Mary Jane	Designer	103	35000.00	500.00

Lab Program 3

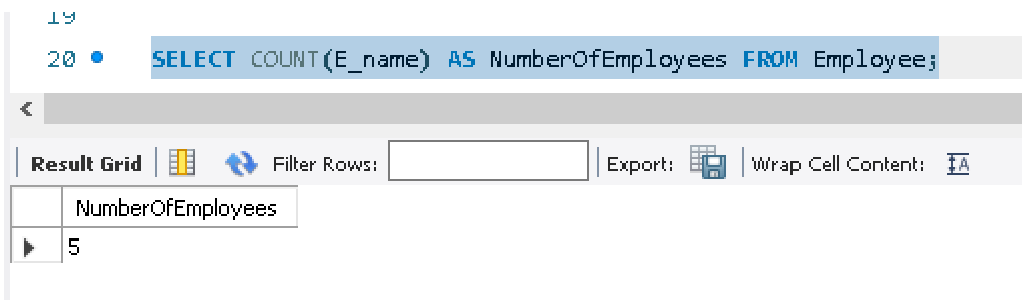
Queries using aggregate functions(COUNT,AVG,MIN,MAX,SUM),Group by,Orderby.
Employee(E_id, E_name, Age, Salary)

1. **Create Employee table containing all Records E_id, E_name, Age, Salary.**

```
CREATE TABLE Employee (E_id INT,
    E_name VARCHAR(100),Age INT,
    Salary DECIMAL(10, 2));
```

2. Count number of employee names from employeetable

```
SELECT COUNT(E_name) AS NumberOfEmployees FROM Employee;
```

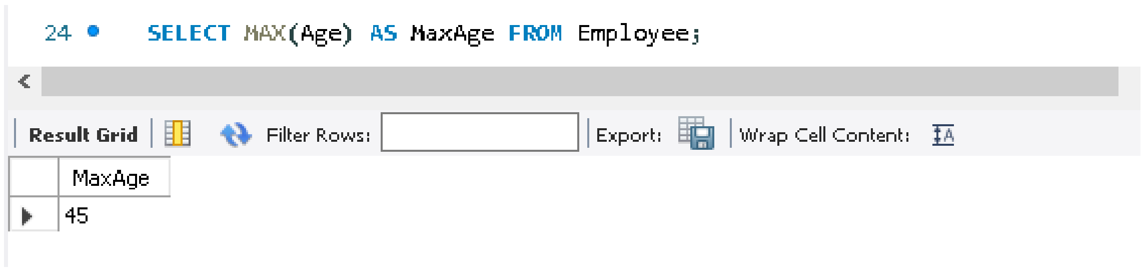


```
SELECT COUNT(E_name) AS NumberOfEmployees FROM Employee;
```

	NumberOfEmployees
▶	5

3. Find the Maximum age from employee table.

```
SELECT MAX(Age) AS MaxAge FROM Employee;
```

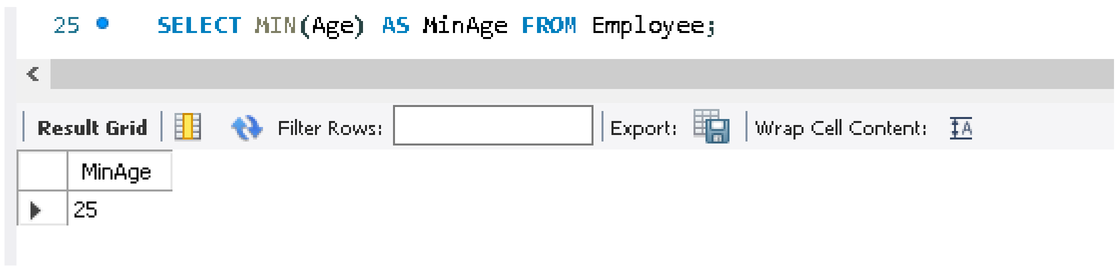


```
SELECT MAX(Age) AS MaxAge FROM Employee;
```

	MaxAge
▶	45

4. Find the Minimum age from employeetable.

SELECT MIN(Age) AS MinAge FROM Employee;



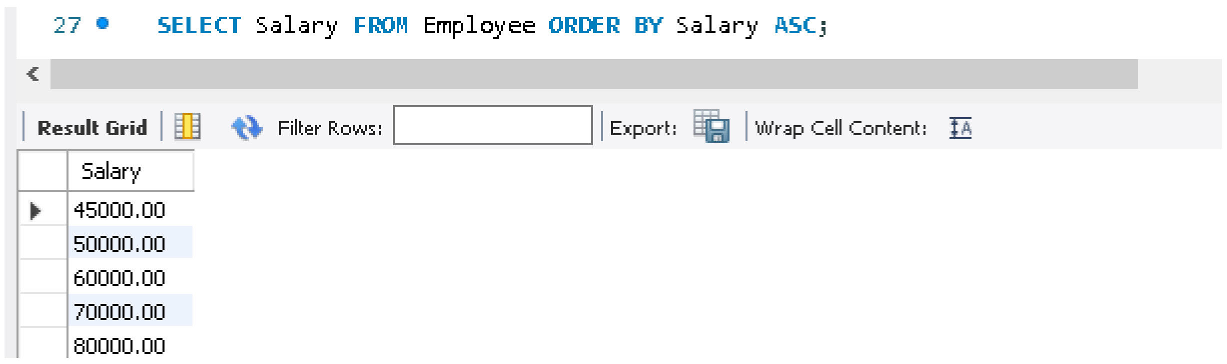
```
SELECT MIN(Age) AS MinAge FROM Employee;
```

Result Grid | Filter Rows: | Export: | Wrap Cell Content:

```
MinAge
25
```

5. Find salaries of employee in Ascending Order.

SELECT Salary FROM Employee ORDER BY Salary ASC;



```
SELECT Salary FROM Employee ORDER BY Salary ASC;
```

Result Grid | Filter Rows: | Export: | Wrap Cell Content:

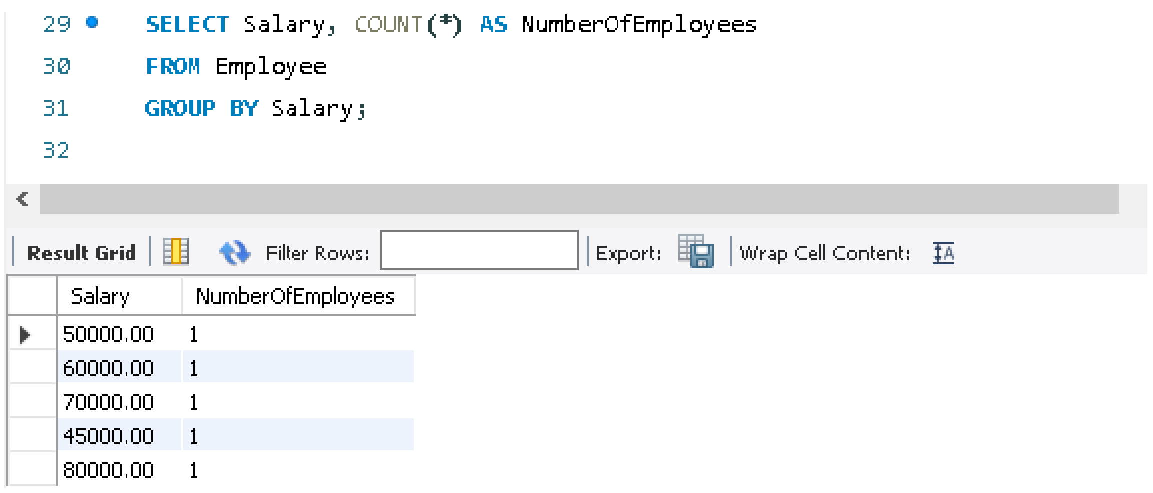
```
Salary
45000.00
50000.00
60000.00
70000.00
80000.00
```

6. Find Grouped Salaries of Employees

SELECT Salary, COUNT(*) AS NumberOfEmployees

FROM Employee

GROUP BY Salary;



```
SELECT Salary, COUNT(*) AS NumberOfEmployees
FROM Employee
GROUP BY Salary;

```

Result Grid | Filter Rows: | Export: | Wrap Cell Content:

```
Salary     NumberOfEmployees
50000.00   1
60000.00   1
70000.00   1
45000.00   1
80000.00   1
```

Insertion Commands

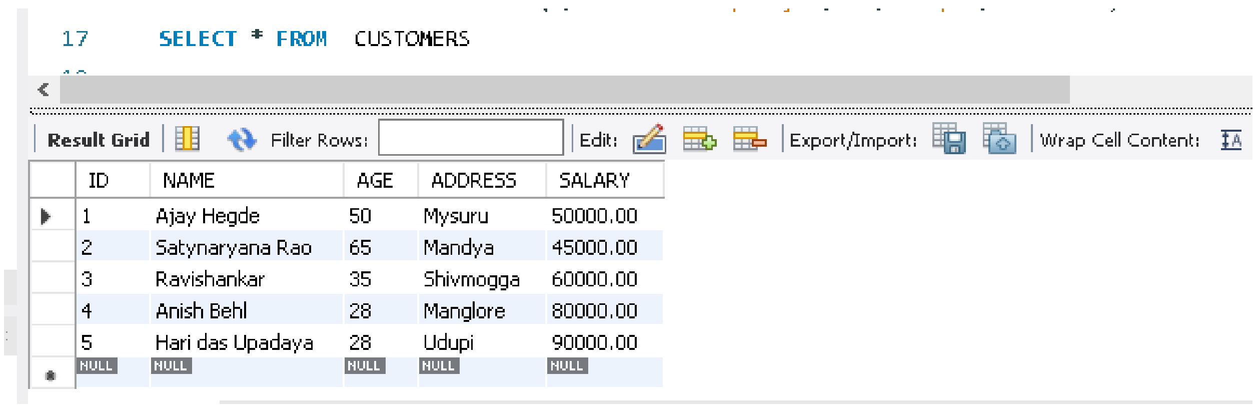
```
INSERT INTO Employee (E_id, E_name, Age, Salary) VALUES
(1, 'John', 30, 50000.00),
(2, 'Jane', 35, 60000.00),
(3, 'David', 40, 70000.00),
(4, 'Emily', 25, 45000.00),
(5, 'Michael', 45, 80000.00);
```

Lab Program 4

Create a row level trigger for the customers table that would fire for INSERT or UPDATE or DELETE operations performed on the CUSTOMERS table. This trigger will display the salary difference between the old & new Salary.
CUSTOMERS(ID,NAME,AGE,ADDRESS,SALARY)

```
create database CUSTOMERS
USE CUSTOMERS;

CREATE TABLE CUSTOMERS (
     ID INT PRIMARY KEY,
     NAME VARCHAR(255),
     AGE INT,
    ADDRESS VARCHAR(255),
    SALARY DECIMAL(10, 2));


INSERT INTO CUSTOMERS VALUES (1, 'Ajay Hegde', 50, 'Mysuru',50000.00);
INSERT INTO CUSTOMERS VALUES (2, 'Satynaryana Rao ', 65,'Mandya', 45000.00)
INSERT INTO CUSTOMERS VALUES (3, 'Ravishankar', 35,'Shivmogga', 60000.00)
INSERT INTO CUSTOMERS VALUES (4, 'Anish Behl', 28,'Manglore', 80000.00)
INSERT INTO CUSTOMERS VALUES (5, 'Hari das Upadaya', 28,'Udupi', 90000.00)
```

SELECT * FROM CUSTOMERS



```
SELECT * FROM  CUSTOMERS
```

ID	NAME	AGE	ADDRESS	SALARY
1	Ajay Hegde	50	Mysuru	50000.00
2	Satynaryana Rao	65	Mandya	45000.00
3	Ravishankar	35	Shivmogga	60000.00
4	Anish Behl	28	Manglore	80000.00
5	Hari das Upadaya	28	Udupi	90000.00
NULL	NULL	NULL	NULL	NULL

DELIMITER //

CREATE TRIGGER after_insert_salary_difference

AFTER INSERT ON CUSTOMERS

FOR EACH ROW

BEGIN

    SET @my_sal_diff = CONCAT('salary inserted is ', NEW.SALARY);

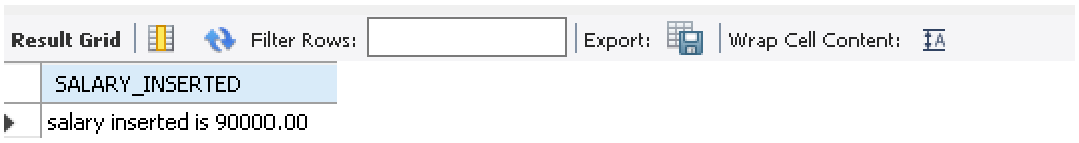
END;//

DELIMITER ;

INSERT INTO CUSTOMERS VALUES (6, 'amit kumar', 38,'bijapur', 90000.00)

select @my_sal_diff as SALARY_INSERTED

OUTPUT

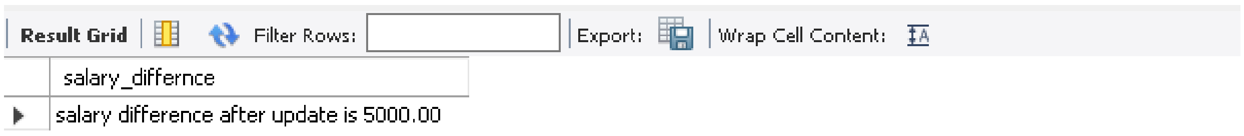


SALARY_INSERTED
salary inserted is 90000.00

```
DELIMITER //
CREATE TRIGGER after_update_salary_difference
AFTER UPDATE ON CUSTOMERS
FOR EACH ROW
BEGIN
    DECLARE old_salary DECIMAL(10, 2);
    DECLARE new_salary DECIMAL(10, 2);
    SET old_salary = OLD.SALARY;
    SET new_salary = NEW.SALARY;
     SET @my_sal_diff = CONCAT('salary difference after update is ', NEW.SALARY - OLD.SALARY);
END;//
DELIMITER ;
```

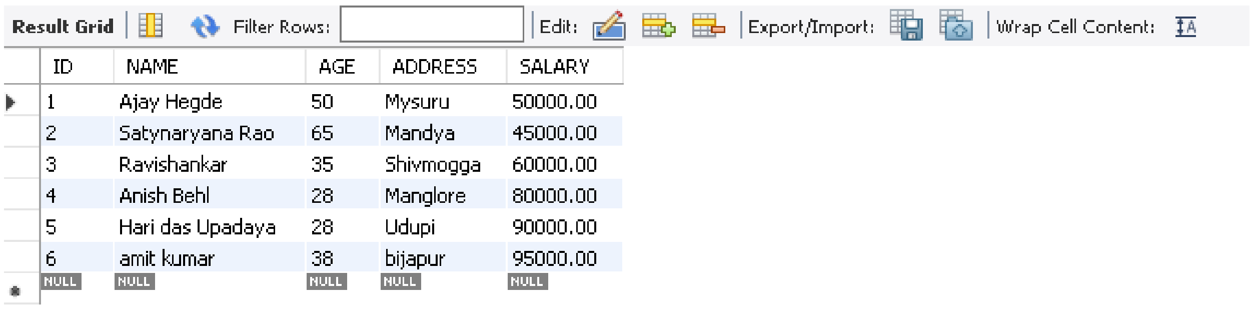
OUTPUT:

```
INSERT  INTO CUSTOMERS VALUES (6, 'amit kumar', 38,'bijapur', 90000.00)
UPDATE CUSTOMERS SET SALARY=95000 WHERE ID=6
SELECT @my_sal_diff AS salary_differnce
```



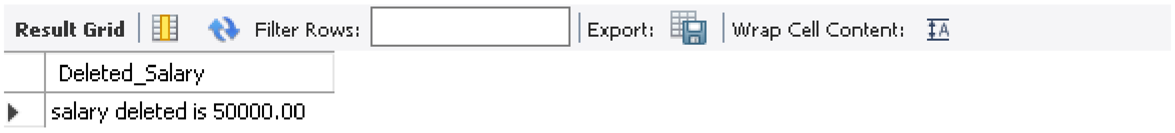
```
salary_differnce
salary difference after update is 5000.00
```

```
-- DELETE TRIGGER
DELIMITER //
CREATE TRIGGER after_delete_salary_difference
AFTER DELETE ON CUSTOMERS
FOR EACH ROW
BEGIN
    SET @my_sal_diff = CONCAT('salary deleted is ', OLD.SALARY);
END;//
DELIMITER ;

select * from CUSTOMERS
```



ID	NAME	AGE	ADDRESS	SALARY
1	Ajay Hegde	50	Mysuru	50000.00
2	Satynaryana Rao	65	Mandya	45000.00
3	Ravishankar	35	Shivmogga	60000.00
4	Anish Behl	28	Manglore	80000.00
5	Hari das Upadaya	28	Udupi	90000.00
6	amit kumar	38	bijapur	95000.00
NULL	NULL	NULL	NULL	NULL

```
delete from CUSTOMERS where ID=1

SELECT @my_sal_diff  AS  Deleted_Salary
```

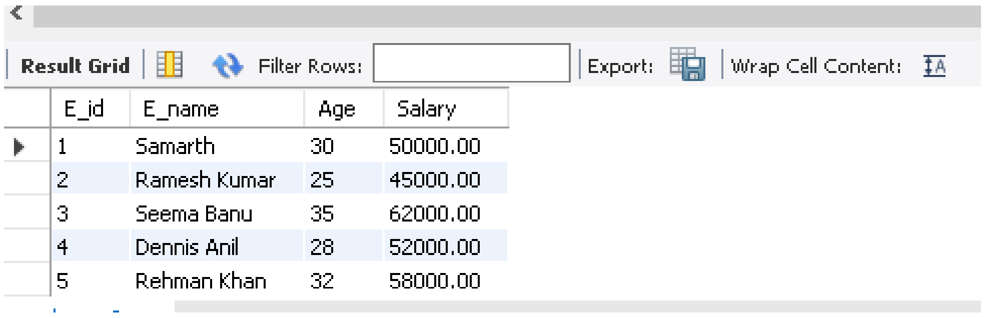


Deleted_Salary
salary deleted is 50000.00

Lab Program 5

Create cursor for Employee table & extract the values from the table. Declare the variables ,Open the cursor & extrct the values from the cursor. Close the cursor.
Employee(E_id, E_name, Age, Salary)

```
CREATE TABLE Employee (E_id INT,
  E_name VARCHAR(255),
  Age INT,
  Salary DECIMAL(10, 2));

INSERT INTO Employee (E_id, E_name, Age, Salary)
VALUES
    (1, 'Samarth', 30, 50000.00),
    (2, 'Ramesh Kumar', 25, 45000.00),
    (3, 'Seema Banu', 35, 62000.00),
    (4, 'Dennis Anil', 28, 52000.00),
    (5, 'Rehman Khan', 32, 58000.00);

SELECT * FROM Employee
```



E_id	E_name	Age	Salary
1	Samarth	30	50000.00
2	Ramesh Kumar	25	45000.00
3	Seema Banu	35	62000.00
4	Dennis Anil	28	52000.00
5	Rehman Khan	32	58000.00

```
DELIMITER $$
CREATE PROCEDURE gettable ( INOUT
Tableontents varchar(4000))

BEGIN
  DECLARE finished INTEGER DEFAULT 0;
  DECLARE content varchar(100) DEFAULT "";
   #Cursor declaration
      DEClARE curName
        CURSOR FOR
     SELECT concat(E_id ,' , ' , E_name,Age ,' , ' , Salary) FROM Employee order by E_id desc;
              #declare NOT FOUND handler
              DECLARE CONTINUE HANDLER FOR NOT FOUND SET finished = 1;
    #Open cursor
              OPEN curName;
    #fetch records
              getName: LOOP
                            FETCH curName INTO content;
                            IF finished = 1 THEN LEAVE getName;
                            END IF;
                            SET Tableontents = CONCAT(content,";",Tableontents);
              END LOOP getName;
              CLOSE curName;
END$$
DELIMITER;
SET @Tableontents = "";
CALL gettable(@Tableontents);
SELECT @Tableontents;
```

Output

```
1, Samarth30, 50000.00;
2, Ramesh Kumar25, 45000.00;
3, Seema Banu35, 62000.00;
4, Dennis Anil28, 52000.00;
5, Rehman Khan32, 58000.00;'
```

Lab Program 6

Write a PL/SQL block of code using parameterized Cursor, that will merge the data available in the newly created table N_RollCall with the data available in the table O_RollCall. If the data in the first table already exist in the second table, then that data should be skipped.

Below is an example of a PL/SQL block of code that uses a parameterized cursor to merge data from the N_RollCall table into the O_RollCall table, skipping records that already exist in the second table.

Let's start with the table schema and insertion commands:

Table Schema

```
CREATE DATABASE ROLLCALL;
USE ROLLCALL;

-- Create N_RollCall table
CREATE TABLE N_RollCall (
    student_id INT PRIMARY KEY,
    student_name VARCHAR (255),
    birth_date DATE);


-- Create O_RollCall table with common data
CREATE TABLE O_RollCall (
    student_id INT PRIMARY KEY,
    student_name VARCHAR (255),
    birth_date DATE);
```

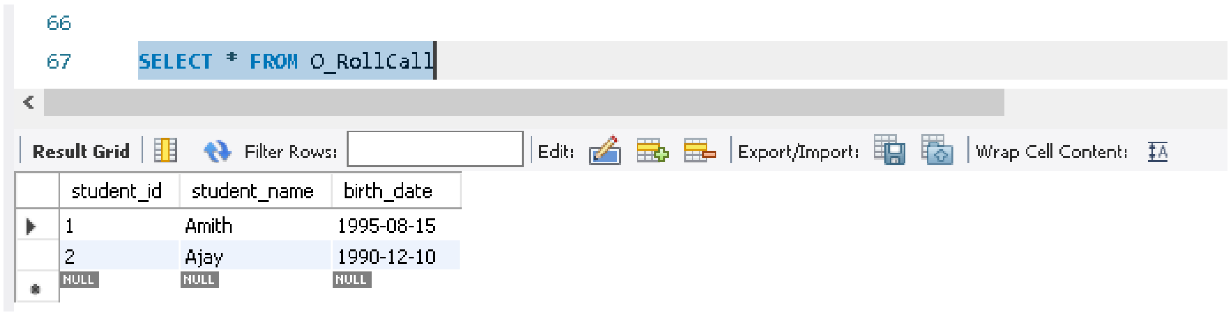
-- Insert common data into O_RollCall

INSERT INTO O_RollCall (student_id, student_name, birth_date)VALUES

(1, Amith, '1995-08-15'),

(2, Ajay, '1990-12-10');

SELECT * FROM O_RollCall



```
SELECT * FROM O_RollCall
```

Result Grid | Filter Rows: | Edit: | Export/Import: | Wrap Cell Content:

student_id	student_name	birth_date
1	Amith	1995-08-15
2	Ajay	1990-12-10
NULL	NULL	NULL

INSERT INTO N_RollCall (student_id, student_name, birth_date)

VALUES

(1, 'Amith', '1995-08-15'), -- Common record with O_RollCall

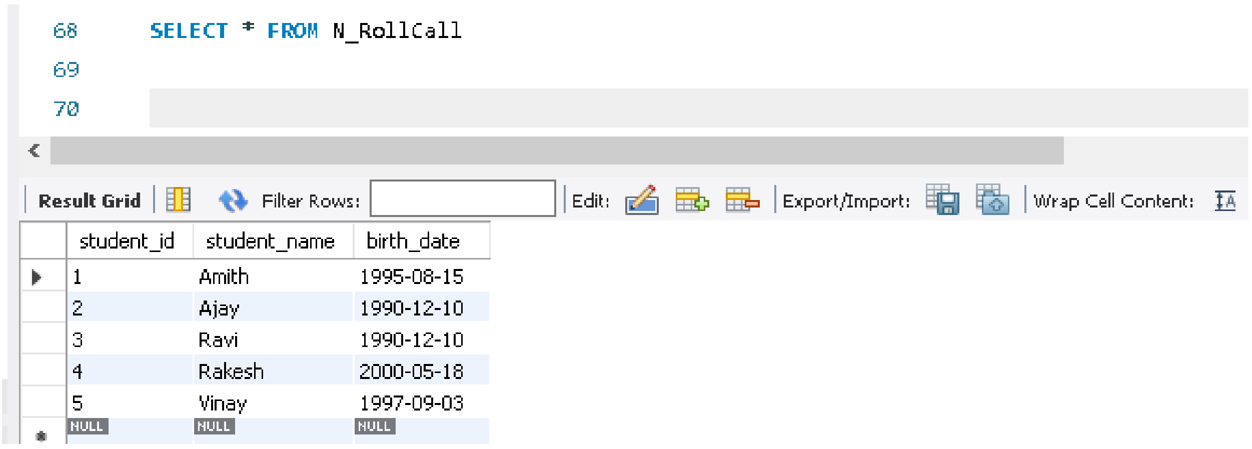
(2, 'Ajay', '1990-12-10'),

(3, 'Ravi', '1990-12-10'), -- Common record with O_RollCall

(4, 'Rakesh', '2000-05-18'),

(5, 'Vinay', '1997-09-03');

SELECT * FROM N_RollCall



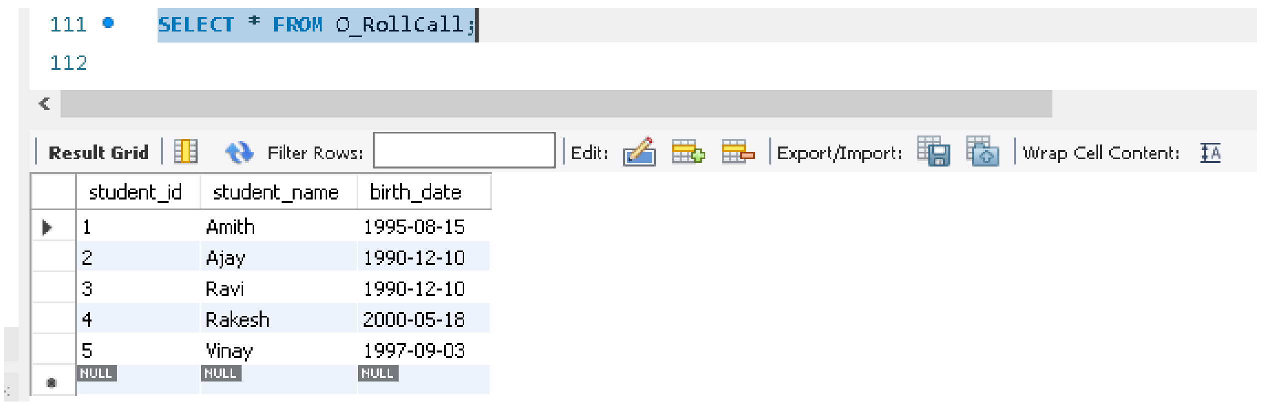
```
SELECT * FROM N_RollCall
```

Result Grid | Filter Rows: | Edit: | Export/Import: | Wrap Cell Content:

student_id	student_name	birth_date
1	Amith	1995-08-15
2	Ajay	1990-12-10
3	Ravi	1990-12-10
4	Rakesh	2000-05-18
5	Vinay	1997-09-03
NULL	NULL	NULL

```
DELIMITER //
CREATE PROCEDURE merge_rollcall_data()
BEGIN
   DECLARE done INT DEFAULT FALSE;
   DECLARE n_id INT;
   DECLARE n_name VARCHAR (255);
   DECLARE n_birth_date DATE;
   -- Declare cursor for N_RollCall table
   DECLARE n_cursor CURSOR FOR
      SELECT student_id, student_name, birth_date FROM N_RollCall;
   -- Declare handler for cursor
   DECLARE CONTINUE HANDLER FOR NOT FOUND
      SET done = TRUE;
   -- Open the cursor
   OPEN n_cursor;
   -- Start looping through cursor results
   cursor_loop: LOOP
      -- Fetch data from cursor into variables
      FETCH n_cursor INTO n_id, n_name, n_birth_date;
      -- Check if no more rows to fetch
      IF done THEN
         LEAVE cursor_loop;
      END IF;
      -- Check if the data already exists in O_RollCallIF NOT EXISTS

      (SELECT 1 FROM O_RollCall WHERE student_id = n_id)
      THEN
         -- Insert the record into O_RollCall
         INSERT INTO O_RollCall (student_id, student_name, birth_date)
         VALUES (n_id, n_name, n_birth_date);
      END IF;
   END LOOP;
```

```
    -- Close the cursor
    CLOSE n_cursor;
END//
DELIMITER ;


CALL merge_rollcall_data();
SELECT * FROM O_RollCall;
```



```
SELECT * FROM O_RollCall;
```

student_id	student_name	birth_date
1	Amith	1995-08-15
2	Ajay	1990-12-10
3	Ravi	1990-12-10
4	Rakesh	2000-05-18
5	Vinay	1997-09-03
NULL	NULL	NULL

This PL/SQL block iterates through each record in the N_RollCall table, checks if the record exists in the O_RollCall table based on the ID, and inserts it into O_RollCall if it doesn't already exist.

Lab Program 7

Install an Open Source NoSQL Data base MangoDB & perform basic CRUD(Create, Read, Update & Delete) operations. Execute MangoDB basic Queries using CRUD operations.

let's go through the steps to install MongoDB and perform basic CRUD operations.

1. Install MongoDB

Ubuntu

bash

```
sudo apt update
sudo apt install -y mongodb
```

CentOS/RHEL

bash

```
sudo yum install -y mongodb-org
```

macOS

You can use Homebrew:

bash

```
brew tap mongodb/brew
brew install mongodb-community
```

2. Start MongoDB Service

Ubuntu

bash

```
sudo systemctl start mongodb
```

CentOS/RHEL

bash

```
sudo systemctl start mongod
```

macOS

bash

```
brew services start mongodb-community
```

3. Connect to MongoDB

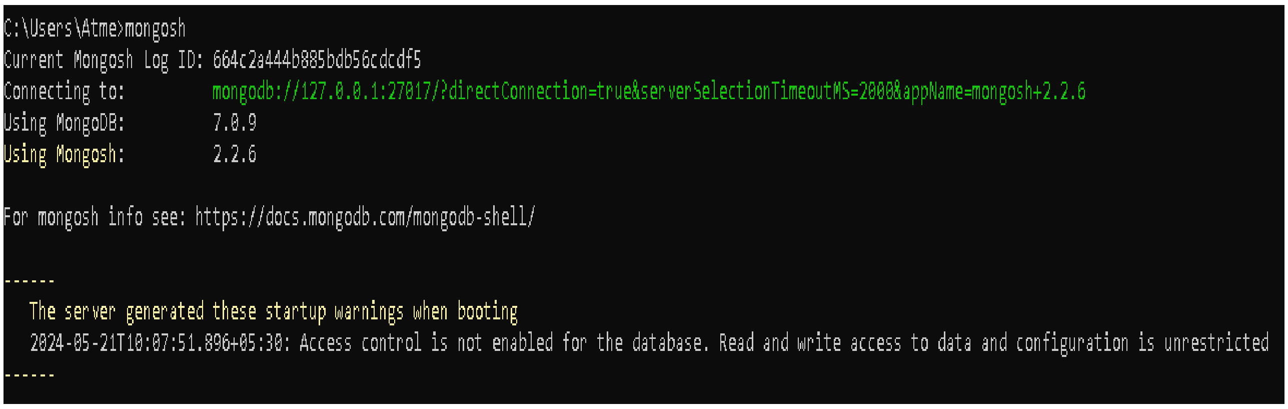
bash

```
mongo
```

4. <u>Basic CRUD Operations</u>

Launch the MongoDB shell to perform basic CRUD operations.

mongosh



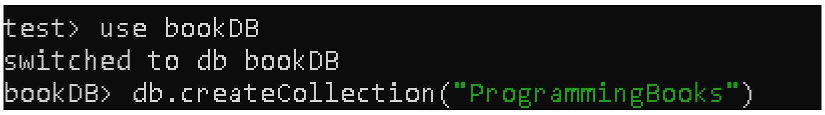
```
C:\Users\Atme>mongosh
Current Mongosh Log ID: 664c2a444b885bdb56cdcdf5
Connecting to:          mongodb://127.0.0.1:27017/?directConnection=true&serverSelectionTimeoutMS=2000&appName=mongosh+2.2.6
Using MongoDB:          7.0.9
Using Mongosh:          2.2.6

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

------
   The server generated these startup warnings when booting
   2024-05-21T10:07:51.896+05:30: Access control is not enabled for the database. Read and write access to data and configuration is unrestricted
------
```

Switch to a Database (Optional):

If you want to use a specific database, switch to that database using the **use** command. If the database doesn't exist, MongoDB will create it implicitly when you insert data into it:

use bookDB

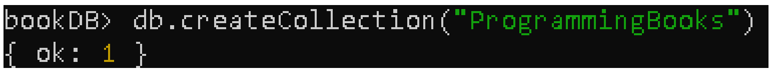
switched to db bookDB



```
test> use bookDB
switched to db bookDB
bookDB> db.createCollection("ProgrammingBooks")
```

Create the ProgrammingBooks Collection:

To create the **ProgrammingBooks** collection, use the **createCollection()** method. This step is optional because MongoDB will automatically create the collection when you insert data into it, but you can explicitly create it if needed:

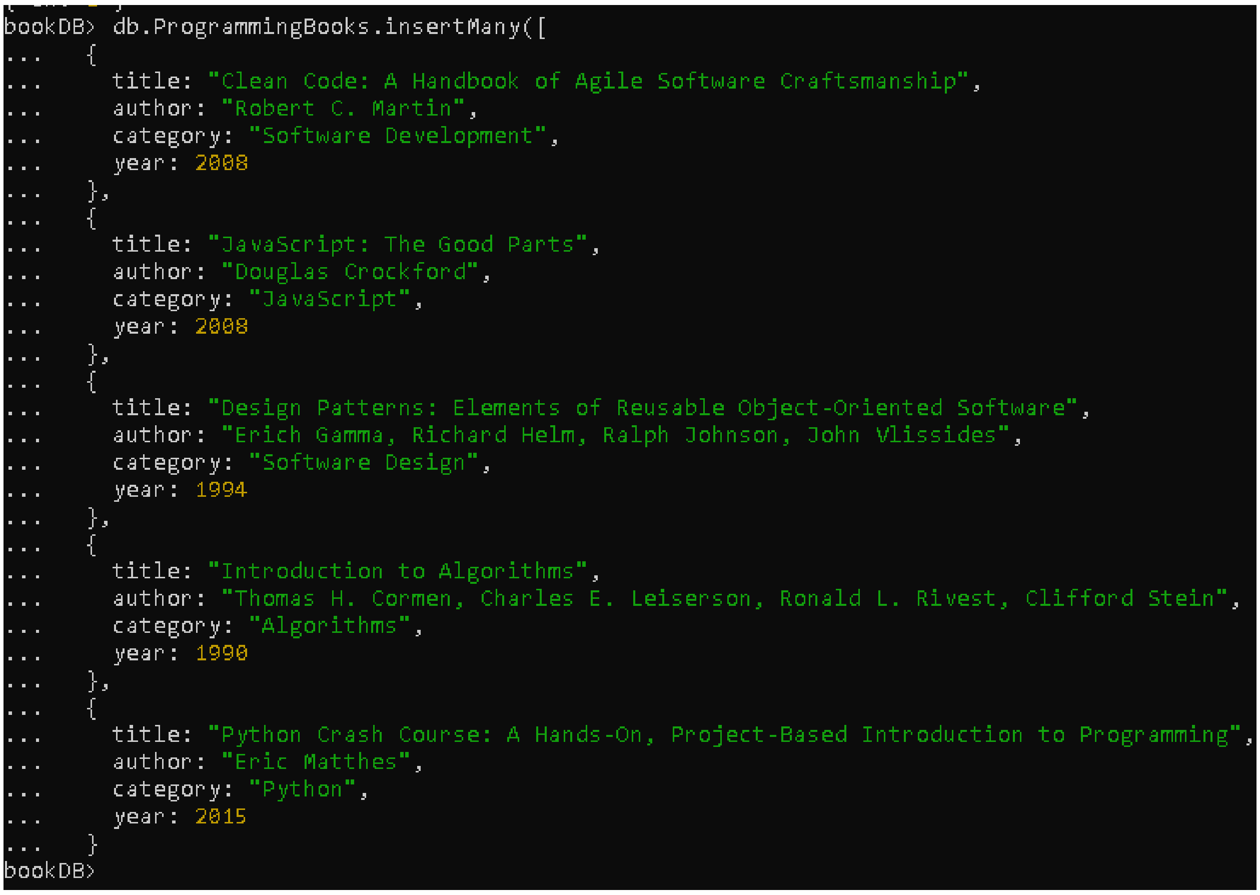


```
bookDB> db.createCollection("ProgrammingBooks")
{ ok: 1 }
```

INSERT operations

a. Insert 5 Documents into the ProgrammingBooks Collection :

Now, insert 5 documents representing programming books into the **ProgrammingBooks** collection using the **insertMany ()** method:

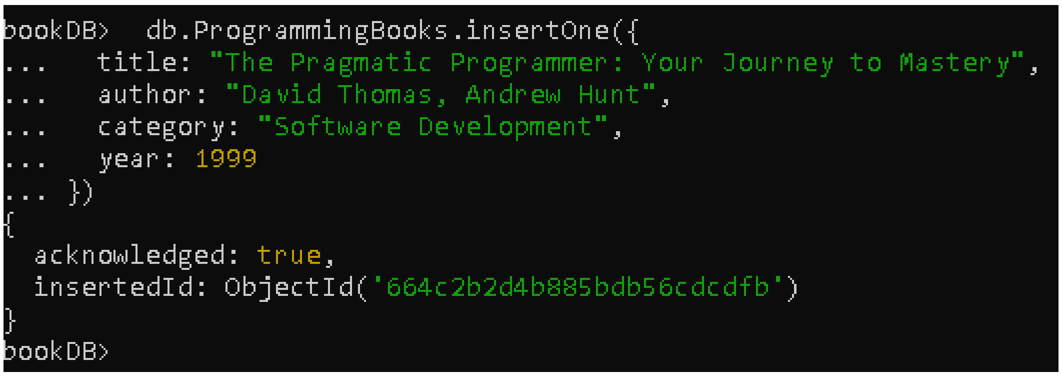


```
bookDB> db.ProgrammingBooks.insertMany([
...   {
...     title: "Clean Code: A Handbook of Agile Software Craftsmanship",
...     author: "Robert C. Martin",
...     category: "Software Development",
...     year: 2008
...   },
...   {
...     title: "JavaScript: The Good Parts",
...     author: "Douglas Crockford",
...     category: "JavaScript",
...     year: 2008
...   },
...   {
...     title: "Design Patterns: Elements of Reusable Object-Oriented Software",
...     author: "Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides",
...     category: "Software Design",
...     year: 1994
...   },
...   {
...     title: "Introduction to Algorithms",
...     author: "Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein",
...     category: "Algorithms",
...     year: 1990
...   },
...   {
...     title: "Python Crash Course: A Hands-On, Project-Based Introduction to Programming",
...     author: "Eric Matthes",
...     category: "Python",
...     year: 2015
...   }
bookDB>
```

Insert a Single Document into ProgrammingBooks:

Use the **insertOne()** method to insert a new document into the **ProgrammingBooks** collection:

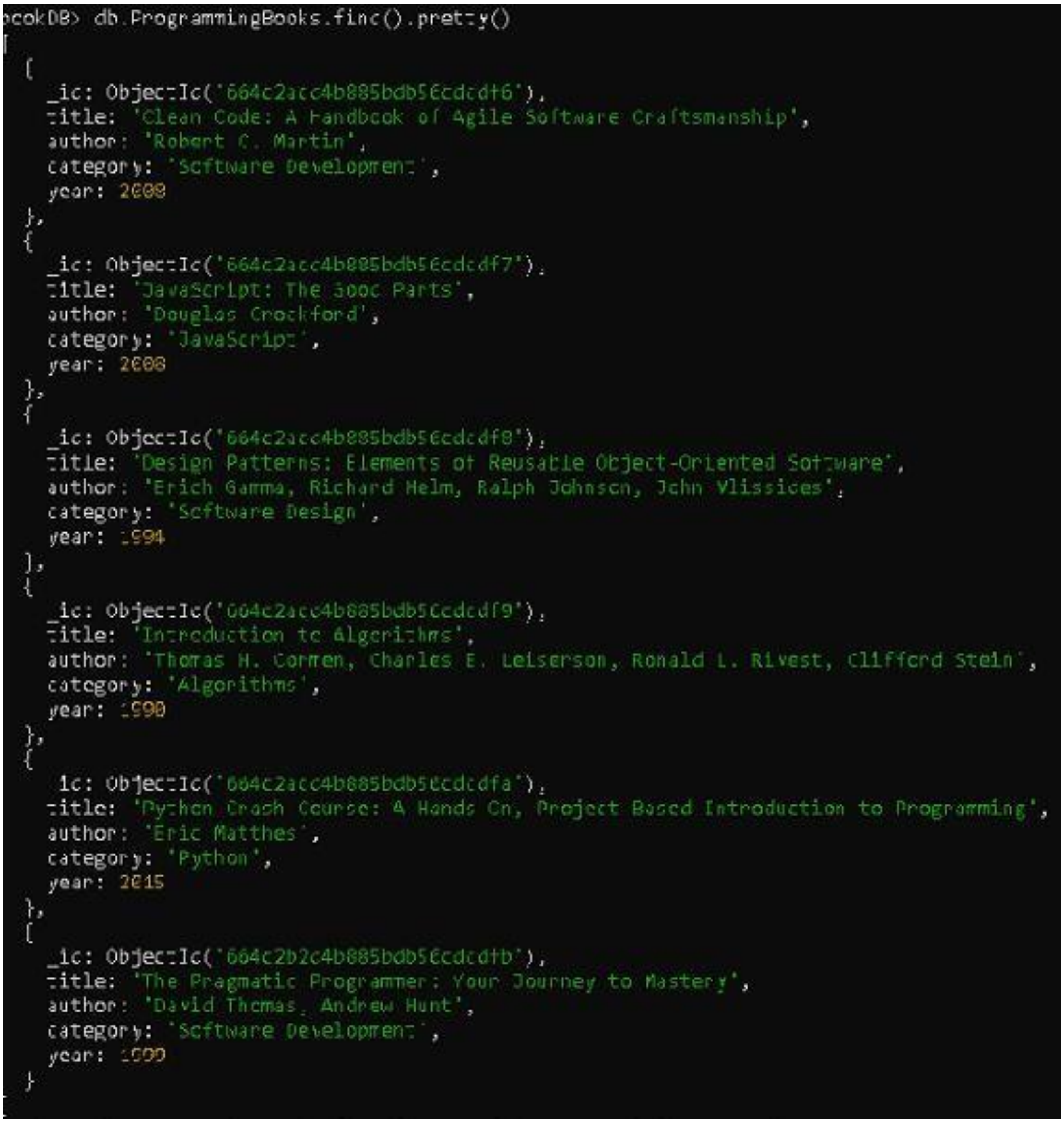
```
db.ProgrammingBooks.insertOne({
  title: "The Pragmatic Programmer: Your Journey to Mastery",
  author: "David Thomas, Andrew Hunt",
  category: "Software Development",
  year: 1999})
```



```
bookDB>  db.ProgrammingBooks.insertOne({
...   title: "The Pragmatic Programmer: Your Journey to Mastery",
...   author: "David Thomas, Andrew Hunt",
...   category: "Software Development",
...   year: 1999
... })
{
  acknowledged: true,
  insertedId: ObjectId('664c2b2d4b885bdb56cdcdfb')
}
bookDB>
```

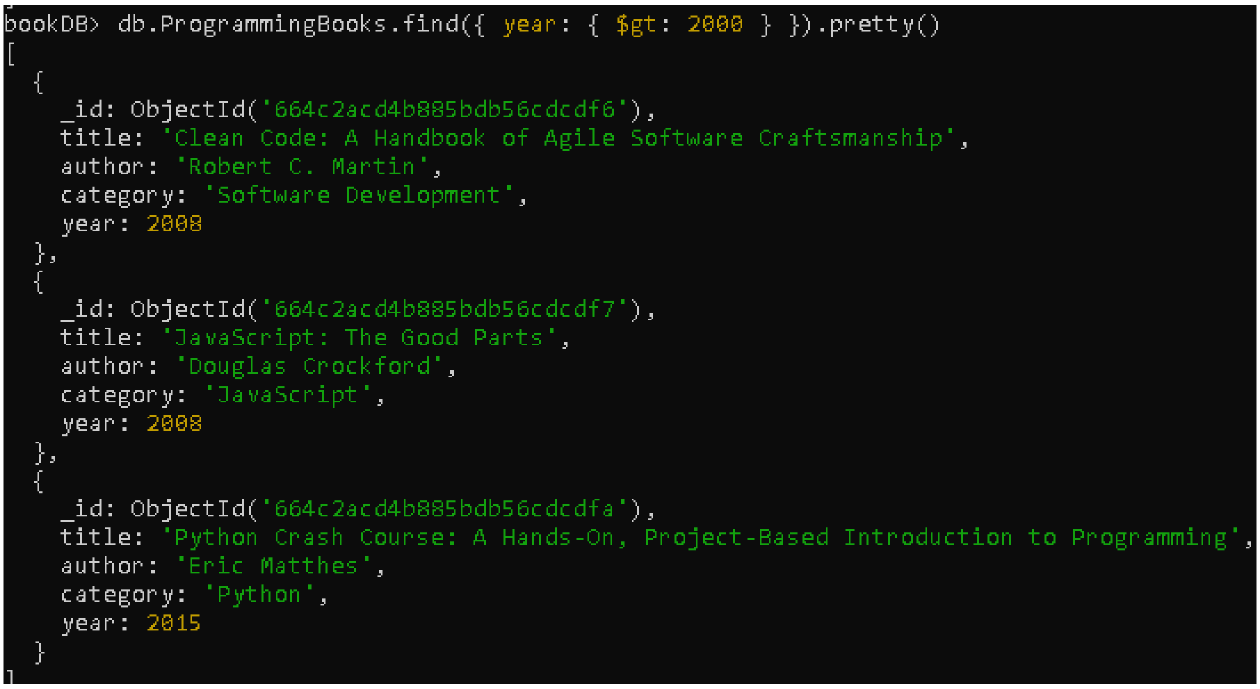
Read (Query) Operations
a. Find All Documents
To retrieve all documents from the **ProgrammingBooks** collection:

```
db.ProgrammingBooks.find(). pretty ()
```



```
bookDB> db.ProgrammingBooks.find().pretty()
[
  {
    _id: ObjectId('664c2acc4b885bdb5ecdcdf6'),
    title: 'Clean Code: A Handbook of Agile Software Craftsmanship',
    author: 'Robert C. Martin',
    category: 'Software Development',
    year: 2008
  },
  {
    _id: ObjectId('664c2acc4b885bdb5ecdcdf7'),
    title: 'JavaScript: The Good Parts',
    author: 'Douglas Crockford',
    category: 'JavaScript',
    year: 2008
  },
  {
    _id: ObjectId('664c2acc4b885bdb5ecdcdf8'),
    title: 'Design Patterns: Elements of Reusable Object-Oriented Software',
    author: 'Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides',
    category: 'Software Design',
    year: 1994
  },
  {
    _id: ObjectId('664c2acc4b885bdb5ecdcdf9'),
    title: 'Introduction to Algorithms',
    author: 'Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein',
    category: 'Algorithms',
    year: 1990
  },
  {
    _id: ObjectId('664c2acc4b885bdb5ecdcdfa'),
    title: 'Python Crash Course: A Hands-On, Project-Based Introduction to Programming',
    author: 'Eric Matthes',
    category: 'Python',
    year: 2015
  },
  {
    _id: ObjectId('664c2b2c4b885bdb5ecdcdfb'),
    title: 'The Pragmatic Programmer: Your Journey to Mastery',
    author: 'David Thomas, Andrew Hunt',
    category: 'Software Development',
    year: 1999
  }
]
```

Find Documents Matching a Condition
To find books published after the year 2000:
db.ProgrammingBooks.find({year: { $gt: 2000 } }). pretty ()

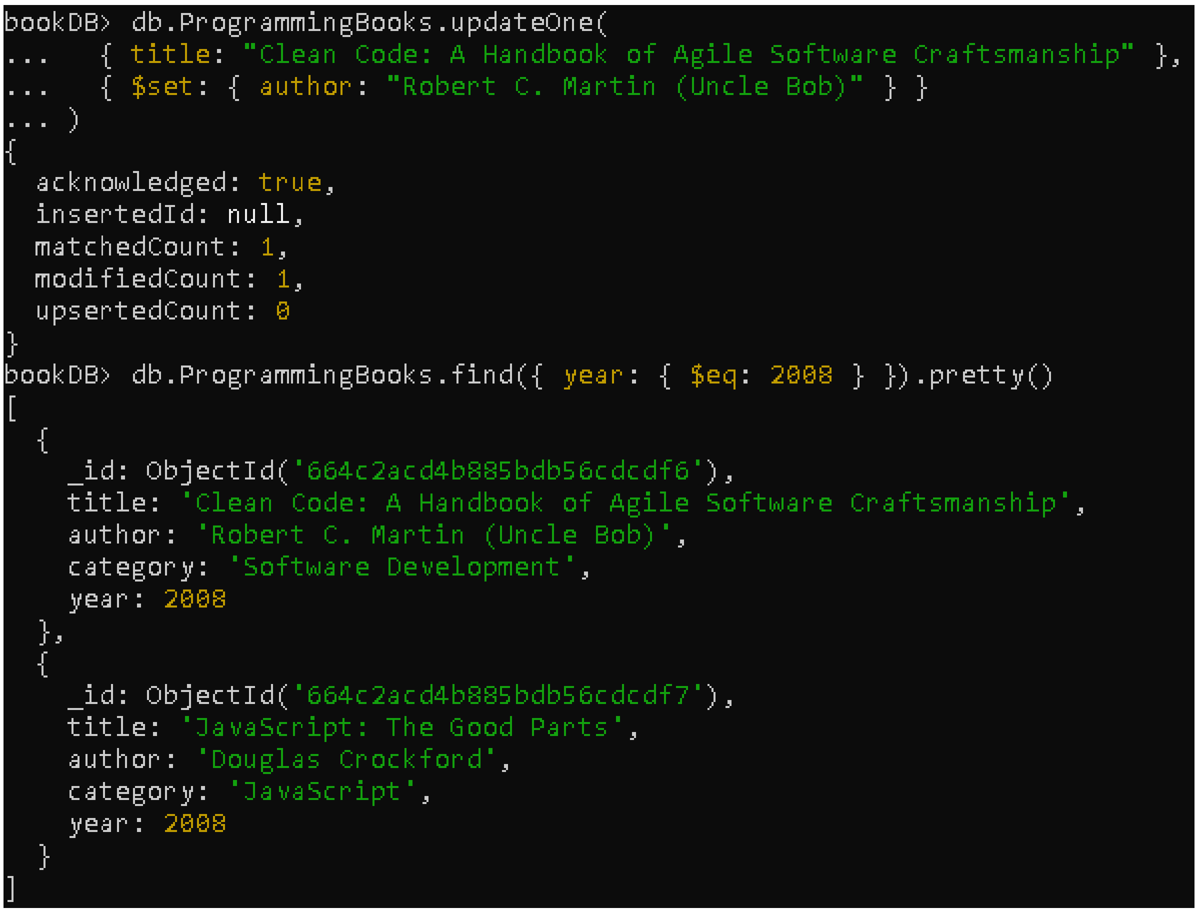


```
bookDB> db.ProgrammingBooks.find({ year: { $gt: 2000 } }).pretty()
[
  {
    _id: ObjectId('664c2acd4b885bdb56cdcdf6'),
    title: 'Clean Code: A Handbook of Agile Software Craftsmanship',
    author: 'Robert C. Martin',
    category: 'Software Development',
    year: 2008
  },
  {
    _id: ObjectId('664c2acd4b885bdb56cdcdf7'),
    title: 'JavaScript: The Good Parts',
    author: 'Douglas Crockford',
    category: 'JavaScript',
    year: 2008
  },
  {
    _id: ObjectId('664c2acd4b885bdb56cdcdfa'),
    title: 'Python Crash Course: A Hands-On, Project-Based Introduction to Programming',
    author: 'Eric Matthes',
    category: 'Python',
    year: 2015
  }
]
```

Update Operations
a. Update a Single Document
To update a specific book (e.g., change the author of a book):

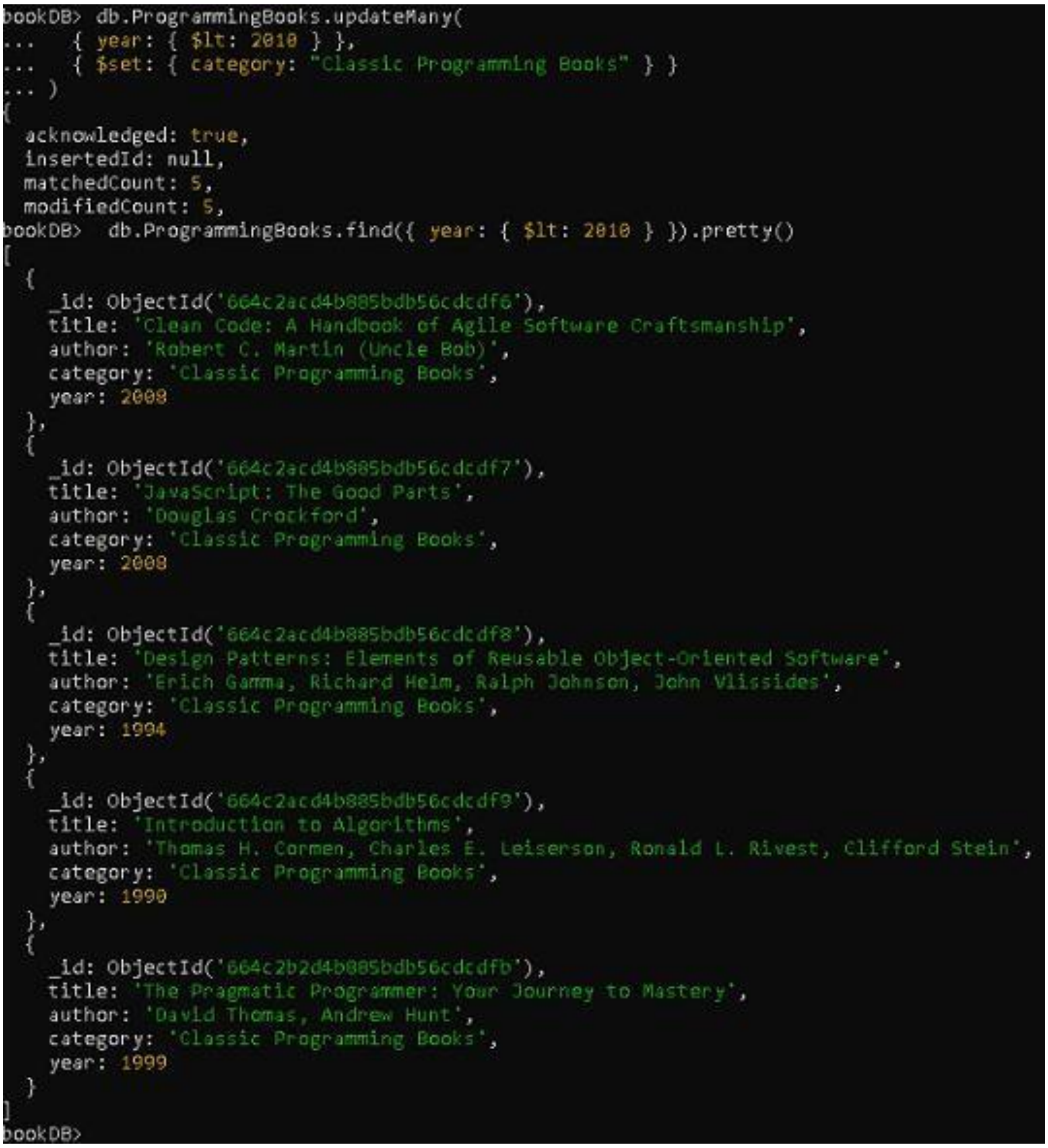
```
db.ProgrammingBooks.updateOne(
  { title: "Clean Code: A Handbook of Agile Software Craftsmanship" },
  { $set: { author: "Robert C. Martin (Uncle Bob)" } }
)
```

//verify by displaying books published in year 2008
db.ProgrammingBooks.find({ year: { $eq: 2008 } }).pretty()



```
bookDB> db.ProgrammingBooks.updateOne(
...   { title: "Clean Code: A Handbook of Agile Software Craftsmanship" },
...   { $set: { author: "Robert C. Martin (Uncle Bob)" } }
... )
{
  acknowledged: true,
  insertedId: null,
  matchedCount: 1,
  modifiedCount: 1,
  upsertedCount: 0
}
bookDB> db.ProgrammingBooks.find({ year: { $eq: 2008 } }).pretty()
[
  {
    _id: ObjectId('664c2acd4b885bdb56cdcdf6'),
    title: 'Clean Code: A Handbook of Agile Software Craftsmanship',
    author: 'Robert C. Martin (Uncle Bob)',
    category: 'Software Development',
    year: 2008
  },
  {
    _id: ObjectId('664c2acd4b885bdb56cdcdf7'),
    title: 'JavaScript: The Good Parts',
    author: 'Douglas Crockford',
    category: 'JavaScript',
    year: 2008
  }
]
```

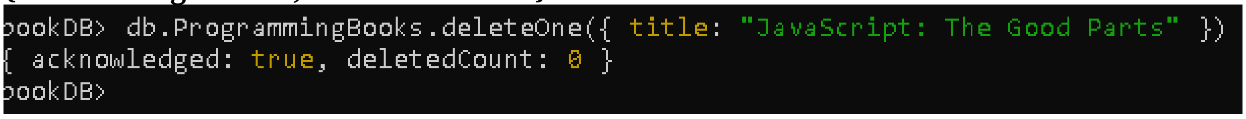
Update Multiple Documents
To update multiple books (e.g., update the category of books published before 2010):
db.ProgrammingBooks.updateMany



```
bookDB> db.ProgrammingBooks.updateMany(
...   { year: { $lt: 2010 } },
...   { $set: { category: "Classic Programming Books" } }
... )
{
  acknowledged: true,
  insertedId: null,
  matchedCount: 5,
  modifiedCount: 5,
bookDB>  db.ProgrammingBooks.find({ year: { $lt: 2010 } }).pretty()
[
  {
    _id: ObjectId('664c2acd4b885bdb56cdcdf6'),
    title: 'Clean Code: A Handbook of Agile Software Craftsmanship',
    author: 'Robert C. Martin (Uncle Bob)',
    category: 'Classic Programming Books',
    year: 2008
  },
  {
    _id: ObjectId('664c2acd4b885bdb56cdcdf7'),
    title: 'JavaScript: The Good Parts',
    author: 'Douglas Crockford',
    category: 'Classic Programming Books',
    year: 2008
  },
  {
    _id: ObjectId('664c2acd4b885bdb56cdcdf8'),
    title: 'Design Patterns: Elements of Reusable Object-Oriented Software',
    author: 'Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides',
    category: 'Classic Programming Books',
    year: 1994
  },
  {
    _id: ObjectId('664c2acd4b885bdb56cdcdf9'),
    title: 'Introduction to Algorithms',
    author: 'Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein',
    category: 'Classic Programming Books',
    year: 1990
  },
  {
    _id: ObjectId('664c2b2d4b885bdb56cdcdfb'),
    title: 'The Pragmatic Programmer: Your Journey to Mastery',
    author: 'David Thomas, Andrew Hunt',
    category: 'Classic Programming Books',
    year: 1999
  }
]
bookDB>
```

Delete Operations

a. Delete a Single Document
To delete a specific book from the collection (e.g., delete a book by title):
db.ProgrammingBooks.deleteOne({ title: "JavaScript: The Good Parts" })
{ acknowledged: true, deletedCount: 1 }

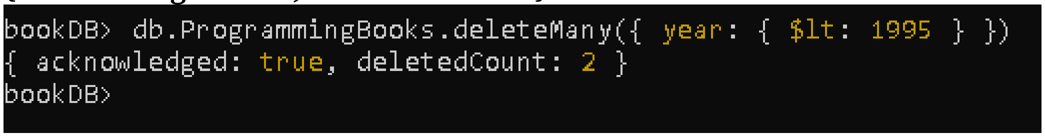


```
bookDB> db.ProgrammingBooks.deleteOne({ title: "JavaScript: The Good Parts" })
{ acknowledged: true, deletedCount: 0 }
bookDB>
```

You can check whether the specified document is deleted by displaying the contents of the collection.

b. Delete Multiple Documents
To delete multiple books based on a condition (e.g., delete all books published before 1995):

db.ProgrammingBooks.deleteMany({ year: { $lt: 1995 } })
{ acknowledged: true, deletedCount: 2 }

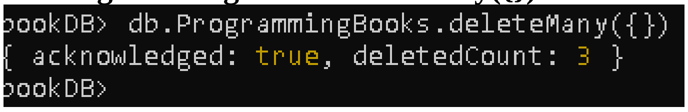


```
bookDB> db.ProgrammingBooks.deleteMany({ year: { $lt: 1995 } })
{ acknowledged: true, deletedCount: 2 }
bookDB>
```

You can check whether the specified documents were deleted by displaying the contents of the collection.

c. Delete All Documents in the Collection:
To delete all documents in a collection (e.g., **ProgrammingBooks**), use the **deleteMany()** method with an empty filter **{}**:

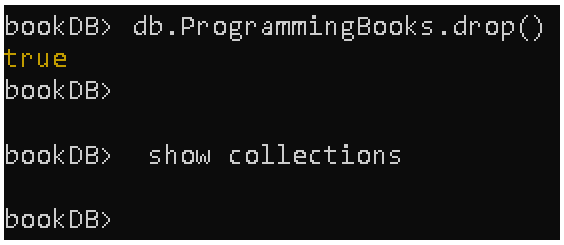
db.ProgrammingBooks.deleteMany({})



```
bookDB> db.ProgrammingBooks.deleteMany({})
{ acknowledged: true, deletedCount: 3 }
bookDB>
```

//verify by displaying the collection
db.ProgrammingBooks.find().pretty()

Delete the Collection Using drop():
To delete a collection named ProgrammingBooks, use the drop() method with the name of the collection:



```
bookDB> db.ProgrammingBooks.drop()
true
bookDB>

bookDB>  show collections

bookDB>
```

Viva Questions

1. *What is SQL?*

   Structured Query Language

2. *What is database?*

   A database is a logically coherent collection of data with some inherent meaning, representing some aspect of real world and which is designed, built and populated with data for a specific purpose.

3. *What is DBMS?*

   It is a collection of programs that enables user to create and maintain a database. In other words, it is general-purpose software that provides the users with the processes of defining, constructing and manipulating the database for various applications.

4. *What is a Database system?*

   The database and DBMS software together is called as Database system.

5. *What are Advantages of DBMS?*

- Redundancy is controlled.
- Unauthorized access is restricted.
- Providing multiple user interfaces.
- Enforcing integrity constraints.
- Providing backup and recovery.

6. *What are Disadvantages in File Processing System?*

- Data redundancy &inconsistency.
- Difficult in accessing data.
- Data isolation.
- Data integrity.
- Concurrent access is not possible.
- Security Problems.

7. *Define the "integrity rules"*

   There are two Integrity rules.

- Entity Integrity: States that “Primary key cannot have NULL value”
- Referential Integrity: States that “Foreign Key can be either a NULL value or should be Primary Key value of other relation.

8. *What is a view? How it is related to data independence?*
A view may be thought of as a virtual table, that is, a table that does not really exist in its own right but is instead derived from one or more underlying base table. In other words, there is no stored file that direct represents the view instead a definition of view is storedin data dictionary. Growth and restructuring of base tables is not reflected in views. Thus the view can insulate users from the effects of restructuring and growth in the database. Hence accounts for logical data independence.

9. *What is Data Model?*

A collection of conceptual tools for describing data, data relationships, data semantics and constraints.

10. *What is E-R model?*

This data model is based on real world that consists of basic objects called entities and of relationship among these objects. Entities are described in a database by a set of attributes.

11. *What is Object Oriented model?*

This model is based on collection of objects. An object contains values stored in instance variables within the object. An object also contains bodies of code that operate on the object. These bodies of code are called methods. Objects that contain same types of values and the same methods are grouped together into classes.

12. *What is an Entity?*

It is an 'object' in the real world with an independent existence.

13. *What is an Entity type?*

It is a collection (set) of entities that have same attributes.

14. *What is an attribute?*

It is a particular property, which describes the entity.

15. *What is degree of a Relation?*

It is the number of attribute of its relation schema.

16. *What is Relationship?*

It is an association among two or more entities.

17. *What is DDL (Data Definition Language)?*

A data base schema is specified by a set of definitions expressed by a special language called DDL.

18. *What is DML (Data Manipulation Language)?*

This language that enable user to access or manipulate data as organized by appropriate

data model.

19. *What is normalization?*

It is a process of analyzing the given relation schemas based on their Functional Dependencies (FDs) and primary key to achieve the properties

- Minimizing redundancy
- Minimizing insertion, deletion and update anomalies.

20. *What are partial, alternate, artificial, compound and natural key?*

Partial Key:

It is a set of attributes that can uniquely identify weak entities and that are related to same owner entity. It is sometime called as Discriminator.

Alternate Key:

All Candidate Keys excluding the Primary Key are known as Alternate Keys.

Artificial Key:

If no obvious key, either standalone or compound is available, then the last resort is to simply create a key, by assigning a unique number to each record or occurrence. Then this is known as developing an artificial key.

Compound Key:

If no single data element uniquely identifies occurrences within a construct, then combining multiple elements to create a unique identifier for the construct is known as creating a compound key.

Natural Key:

When one of the data elements stored within a construct is utilized as the primary key, then it is called the natural key.

21. *What is meant by query optimization?*

The phase that identifies an efficient execution plan for evaluating a query that has the least estimated cost is referred to as query optimization.

22. *What is a query?*

A query with respect to DBMS relates to user commands that are used to interact with a data base. The query language can be classified into data definition language and data manipulation language.

23. *What is MongoDB?*

MongoDB is a cross-platform document-based database. Categorized as a NoSQL database, MongoDB avoids the conventional table-oriented relational database structure in support of the JSON-like documents with the dynamic schemas, making the data integration in specific kinds of applications quicker and simpler. MongoDB was developed by a software company "10gen", in October 2007 as an element of the planned platform as the service product. After that, the company was shifted to a freeware deployment model in 2009, providing sales assistance and other services.

24. *What are the features of MongoDB?*

Following are the important features of MongoDB:

- A compliant data model in the format of documents.
- Agile and extremely scalable database.
- Quicker than traditional databases.
- Demonstrative query language

25. *What is the use of MongoDB?*

- Generally, we use MongoDB as the main data store for the operational requirements with live needs. Generally, MongoDB is suitable for 80% of the applications which we develop today. MongoDB is simple to operate and extent in ways that are tough if they are not possible with the relational databases.
- MongoDB stands out in various use cases where the relational databases are not suitable, like applications with semi-structured, structured, along with the big scalability needs or themulti-datacenter deployments.
- MongoDB cannot be suitable for some applications. For instance, applications that needcomplex transactions and scan-based applications that access huge subsets of the data largely cannot be suitable for MongoDB.
- Some general uses of MongoDB comprise product catalogs, mobile apps, content management, real-time personalization, and applications providing individual viewsthroughout several systems.