DBMS

Database Management System with MySQL

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Overview of DBMS

Database

A database is a collection of related data which represents some aspect of the real world. A database system is designed to be built and populated with data for a certain task.

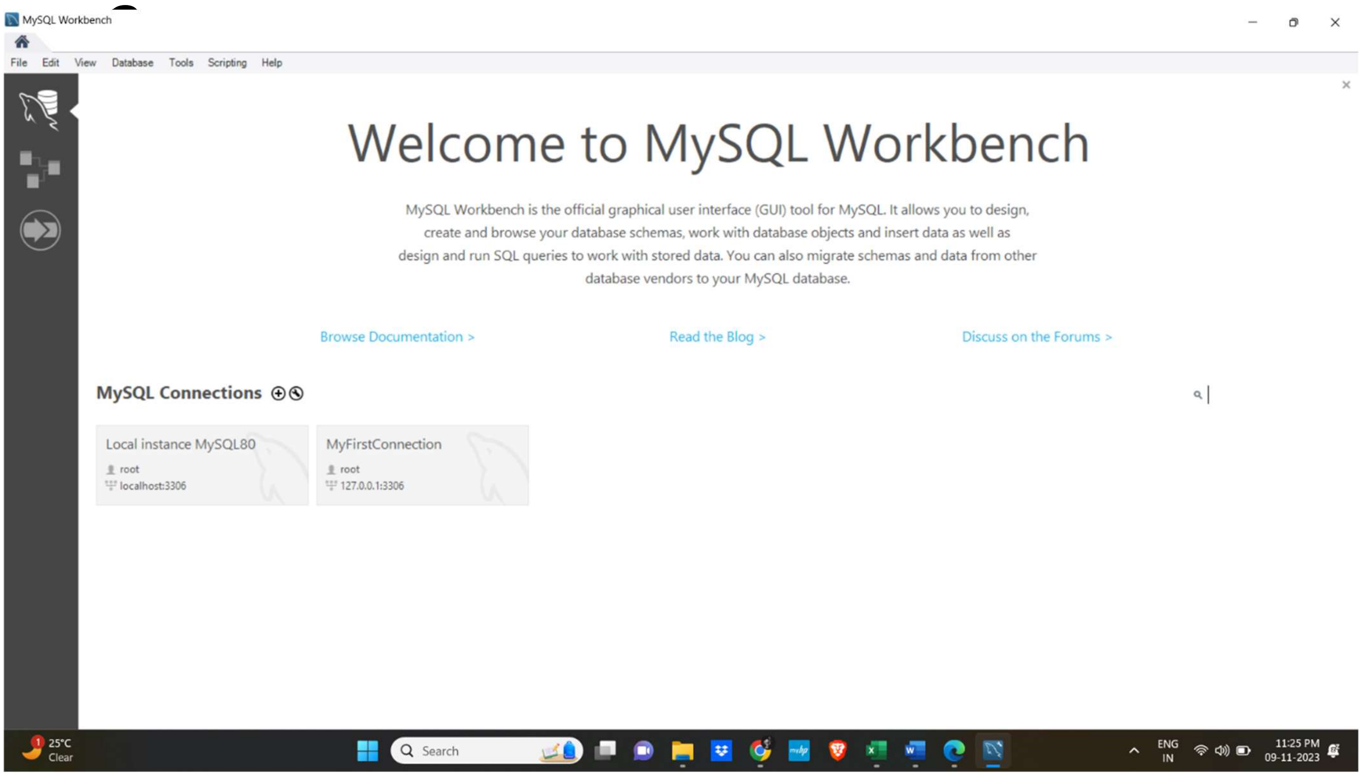
Database Management System

DBMS is a software for storing and retrieving users' data while considering appropriate security measures. It consists of a group of programs which manipulate the database. The DBMS accepts the request for data from an application and instructs the operating system to provide the specific data.

MYSQL

MySQL is structured query language which is also relational database management system. By using different types of data languages, we can insert, remove and retrieve data in efficient manner with help of MySQL.

Overview of Workbench



Welcome to MySQL Workbench

MySQL Workbench is the official graphical user interface (GUI) tool for MySQL. It allows you to design, create and browse your database schemas, work with database objects and insert data as well as design and run SQL queries to work with stored data. You can also migrate schemas and data from other database vendors to your MySQL database.

Browse Documentation > Read the Blog > Discuss on the Forums >

MySQL Connections

Local instance MySQL80	MyFirstConnection
root	root
localhost:3306	127.0.0.1:3306

Workbench features

Connection

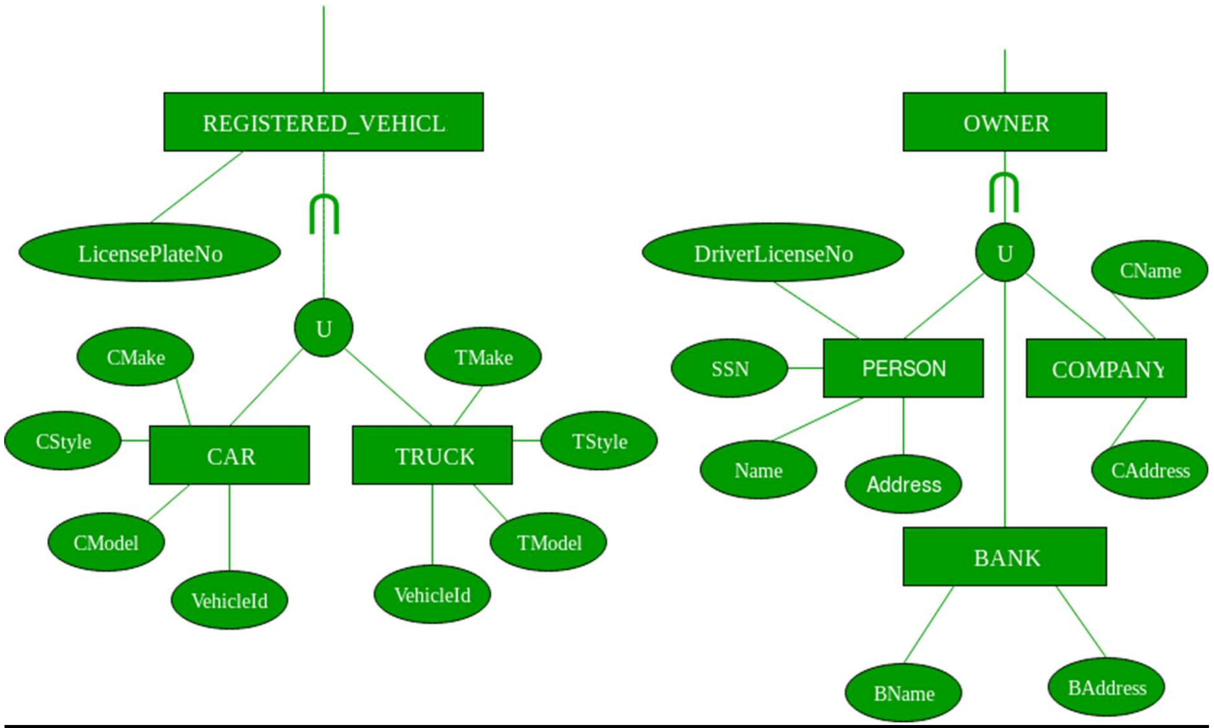
Model

Scripting

Database Design

EER Diagram

Database design can be done through applying significant constrains on database like applying primary key, foreign key, data length constraints. All these types of constrains can be visibly represented by EER diagram which is enhanced entity relation diagram.



EER diagram also includes concepts of

Generalization & specialization..

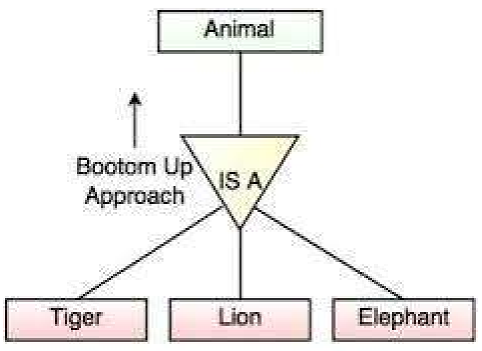


Fig. Generalization

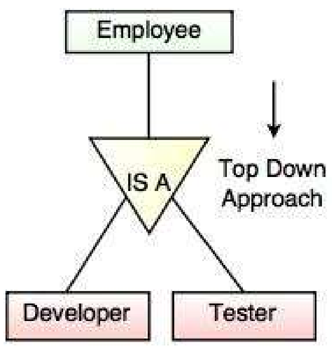


Fig. Specialization

SQL Basics

Data Sorting

```
-- Sorting of Data

-- Here data is sorted by ID then FirstName then LastName
in ascending order

SELECT
     Id,
    FirstName,
    LastName
FROM
     MyFirstTable
ORDER BY
     Id, FirstName, LastName ASC;

-- Here data is sorted by ID then FirstName then LastName
in decending order

SELECT
     Id,
    FirstName,
    LastName
FROM
     MyFirstTable
ORDER BY
     Id, FirstName, LastName DESC;
```

Null Value & Keyword

There is three type of values null values, non null values & empty values.

Null values are values which are not provided to database, It will not displayed when select query is fired.

Empty values are values which is empty string, It represents that value is not there or not provided, It will displayed when select query is fired.

Not null is keyword which implements a functionality in which specification and insertion of values are compulsory otherwise it will generate errors, It does not support null values.

By default columns are treated in such a way that it allows null values.

```
ALTER TABLE
    MyFirstTable
ADD
    Address varchar(255) NOT NULL;
```

Auto Increment

```
-- Create Table which contains one auto increment field
-- Auto Increment strats from 1001 with increment of 1
-- while both contains 1 as default values.
```

```
CREATE TABLE
     Employee (
          Id int PRIMARY KEY AUTO_INCREMENT,
          FirstName varchar(255),
        LastName varchar(255),
        Organization varchar(255),
        Salary int
    ) AUTO_INCREMENT = 1001;
```

Data Languages

DDL

- Data Definition Language is a set of SQL commands used to define, modify, and manage the structure of a database.
- It includes commands like
- CREATE (used to create objects like tables, indexes, etc.)
- ALTER (used to modify existing objects)
- DROP (used to delete objects)
- TRUNCATE (used to remove all records from a table), and
- RENAME (used to rename objects).

DML

- Data Manipulation Language is a set of SQL commands used to manage data within a database.
- It includes commands like
- SELECT (used to retrieve data)

  INSERT (used to add new records),

  UPDATE (used to modify existing records),

  DELETE (used to remove records).

DCL

- Data Control Language is a set of SQL commands used to control access to data within a database.
- It includes commands like
- **GRANT** (used to provide specific privileges to users or roles),
- **REVOKE** (used to revoke privileges), and
- **DENY** (used to deny access).

TCL

- Transaction Control Language is a set of SQL commands used to manage transactions within a database.
- It includes commands like
- **COMMIT** (used to save changes made during the current transaction)
- **ROLLBACK** (used to undo changes made during the current transaction), and
- **SAVEPOINT** (used to set points within a transaction to which you can later roll back).

DQL

- Data Query Language is a subset of SQL that is used to query and retrieve data from a database.
- The primary command in DQL is **SELECT**, which is used to fetch data from one or more tables based on specified criteria.
- Example: **SELECT * FROM table_name WHERE condition;**

Limit

```
SELECT
      ProductID,
     ProductName,
     Price
FROM
      Products
LIMIT           -- Selecting first 50 records
      50
OFFSET          -- Neglecting first 10 records
      10;
```

Aggregate Functions

```
-- Count

SELECT
      COUNT(OrderId)
FROM
      Orders;
```

```sql
-- Sum

SELECT
    SUM(Price)
FROM
    Products
WHERE
    Price < 100;

-- Average

SELECT
    AVG(Price)
FROM
    Products;

-- Minimum

SELECT
    MIN(Price)
FROM
    Products
WHERE
    PRICE > 100;
```

```sql
-- Maximum

SELECT
	MAX(Price)
FROM
	Products
WHERE
	PRICE < 200;
```

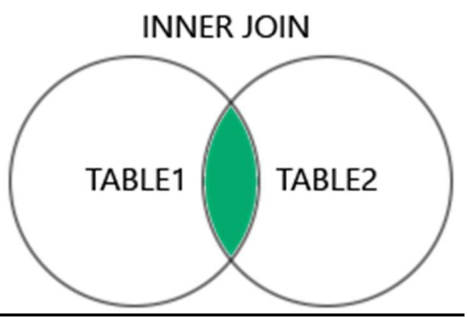
Sub Queries

```
-- Find details of product whose price is more than avg.
price

SELECT
     ProductID,
    ProductName,
    Price
FROM
     Products
WHERE
     ProductID
IN
     (SELECT
          ProductID
      FROM
          products
       WHERE
          price > (SELECT AVG(Price) FROM Products)
     );
```

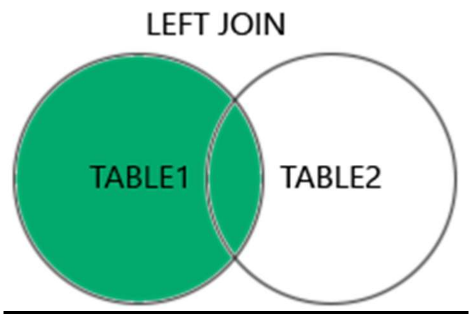
```
-- Corelated Subqueries

SELECT
     ProductID,
    ProductName,
    Price
FROM
     Products v_product
WHERE
     Price > (SELECT
                  AVG(Price)
             FROM
                  Products
    );
```

There are operators like IN, NOT IN, EXIST which is used while implementing subqueries.

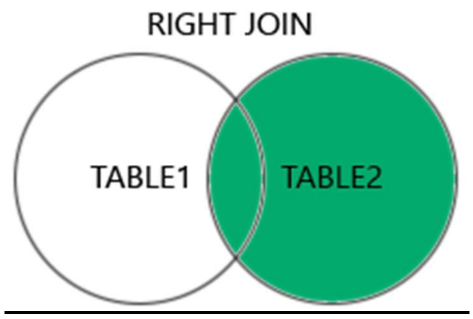
Joins



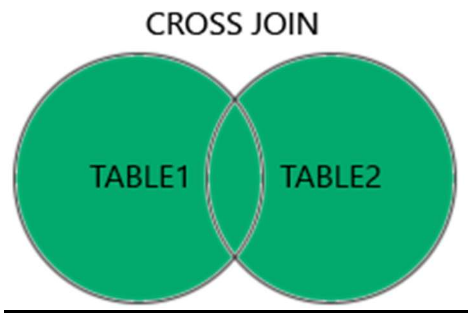
```
SELECT
      Orders.OrderID,
     Customers.CustomerID,
     OrderDate
FROM
      Customers
INNER JOIN
      Orders
ON
      Orders.CustomerID = Customers.CustomerID;
```



```
SELECT
      Orders.OrderID,
     Customers.CustomerID,
     OrderDate
FROM
      Customers
LEFT JOIN
      Orders
ON
      Orders.CustomerID = Customers.CustomerID;
```



```
SELECT
      Orders.OrderID,
     Customers.CustomerID,
     OrderDate
FROM
      Customers
RIGHT JOIN
      Orders
ON
      Orders.CustomerID = Customers.CustomerID;
```



```
SELECT
       Orders.OrderID,
     Customers.CustomerID,
     OrderDate
FROM
       Customers
CROSS JOIN
       Orders
ON
       Orders.CustomerID = Customers.CustomerID;
```

Unions

-- Union

It displays all unique values of dataset after performing union operation.

In simple words, It returns a set.

No duplication of values in union.

```
SELECT
     'Shipper' AS Type,
    ShipperID,
    ShipperName
FROM
     Shippers
UNION SELECT
     'Supplier' AS Type,
     SupplierID,
    SupplierName
FROM
     Suppliers;
```

```
-- Union All
```

It displays all values (with duplication) which represents data combination of both queries.

As it allows duplicate values, It may or may not be a set.

```
SELECT
     'Shipper' AS Type,
    ShipperID,
    ShipperName
FROM
     Shippers
UNION SELECT
     'Supplier' AS Type,
     SupplierID,
    SupplierName
FROM
     Suppliers;
```

Index

An index is a database object that improves the speed of data retrieval operations on a table. It serves as a mechanism to optimize query performance by allowing the database engine to quickly locate and access the rows of a table.

Purpose of Indexing:

- Faster Data Retrieval:

  Indexes provide a faster way to look up and retrieve specific rows from a table, especially when dealing with large datasets.

- Query Optimization:

  Indexes optimize the execution of SELECT, JOIN, and WHERE clauses in SQL queries.

```
CREATE INDEX
    Index_ID
ON
    Customers(CustomerID);

-- Unique Index
-- Doesn’t allow duplicate values

CREATE UNIQUE INDEX
    Index_Contact
ON
    Customers(CustomerID, ContactName);
```

View

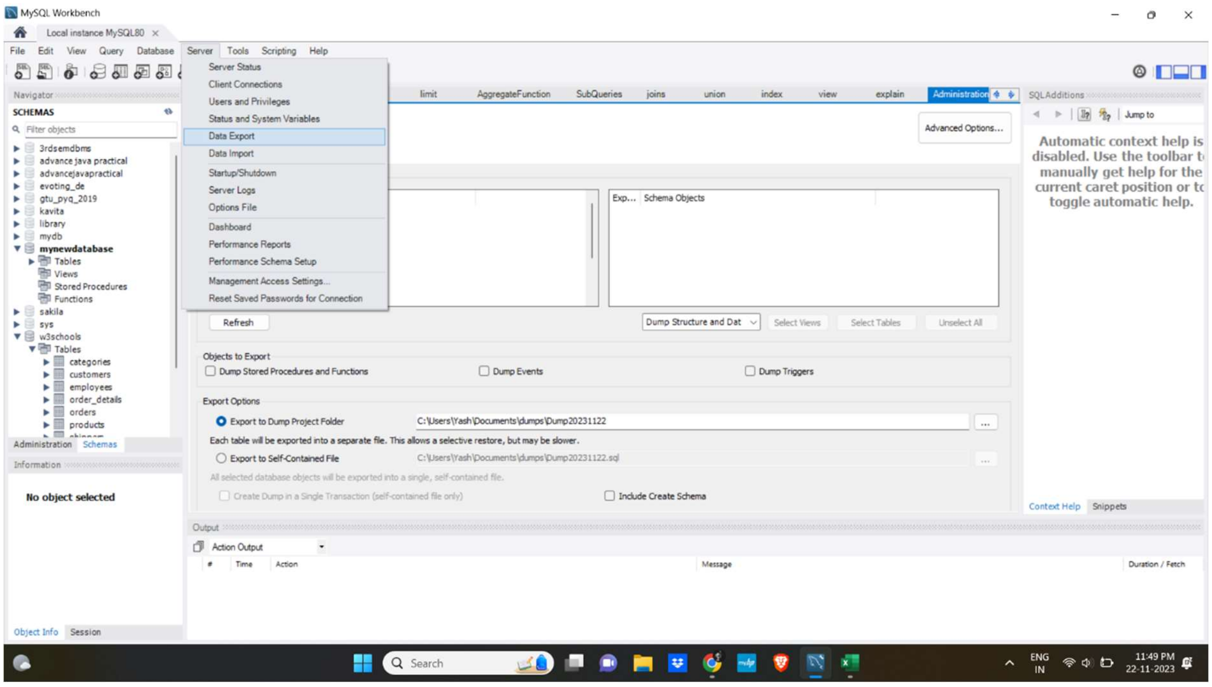
```
-- view

-- view is a virtual table which is based on sql statements and conditions.

-- view has rows and columns as real tables which can be initialized or created as well as updated and dropped


-- create view

-- France Customers

CREATE VIEW

      v_franceCustomers

AS

SELECT

      CustomerID,

     CustomerName,

     City

FROM

      Customers

WHERE

      Country = 'France';


-- How to use view


SELECT

      CustomerID,

     CustomerName,

     City

FROM

      v_franceCustomers;
```

```
-- UPDATE VIEW

CREATE OR REPLACE VIEW
      v_franceCustomers
AS
SELECT
      CustomerID,
     CustomerName,
     City,
     Address
FROM
      Customers
WHERE
      Country = 'France';


-- Drop(Discard) View

DROP VIEW
      v_franceCustomers;
```

Backup, Restore, Explain

Backup

Backing up a MySQL database is crucial for data protection and disaster recovery. The mysqldump utility is commonly used to create backups in MySQL.



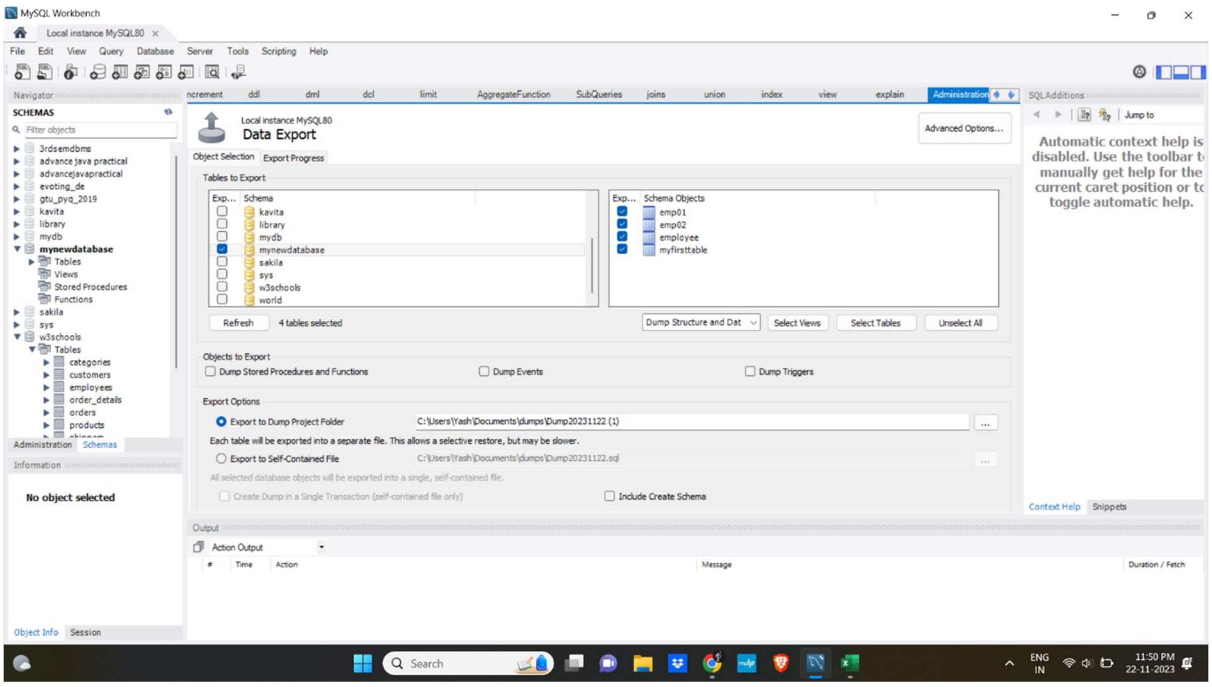
Exp... Schema Objects

Objects to Export
☐ Dump Stored Procedures and Functions ☐ Dump Events ☐ Dump Triggers

Export Options
● Export to Dump Project Folder C:\Users\Yash\Documents\dumps\Dump20231122
Each table will be exported into a separate file. This allows a selective restore, but may be slower.
○ Export to Self-Contained File C:\Users\Yash\Documents\dumps\Dump20231122.sql
All selected database objects will be exported into a single, self-contained file.
☐ Create Dump in a Single Transaction (self-contained file only) ☐ Include Create Schema

No object selected

Automatic context help is disabled. Use the toolbar to manually get help for the current caret position or to toggle automatic help.



Local instance MySQL80
Data Export

Tables to Export

Exp...	Schema
☐	kavita
☐	library
☐	mydb
☑	mynewdatabase
☐	sakila
☐	sys
☐	w3schools
☐	world

Exp...	Schema Objects
☑	emp01
☑	emp02
☑	employee
☑	myfirsttable

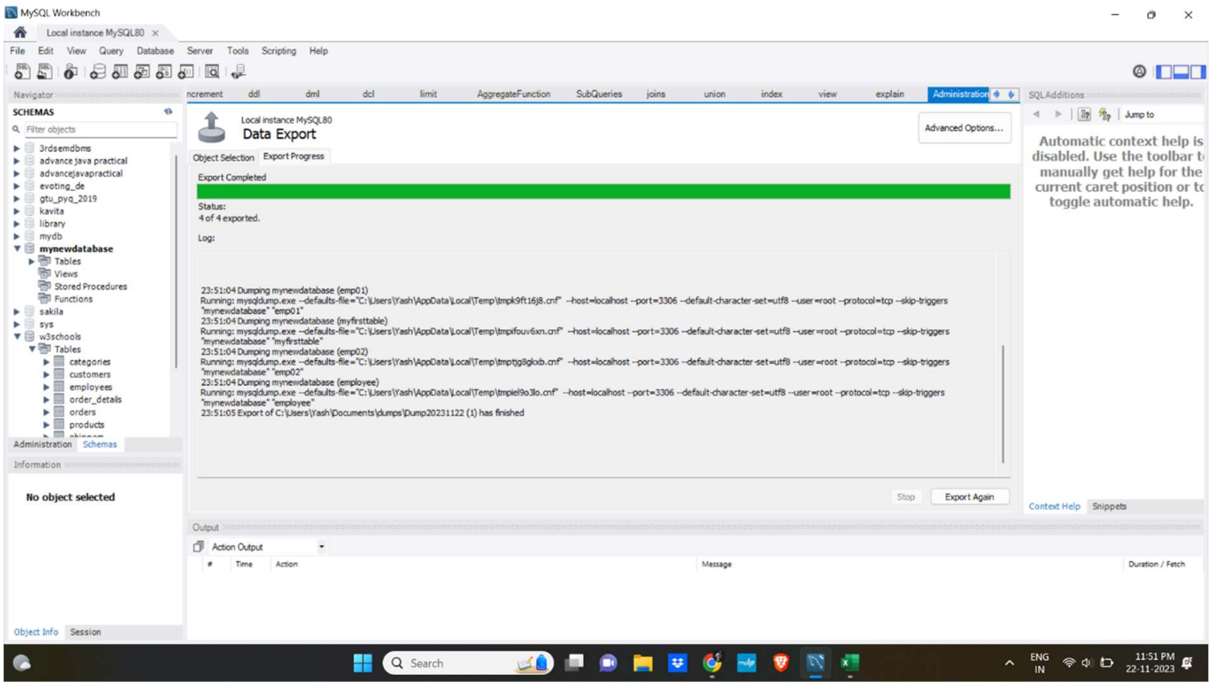
4 tables selected — Dump Structure and Dat

Objects to Export
☐ Dump Stored Procedures and Functions ☐ Dump Events ☐ Dump Triggers

Export Options
● Export to Dump Project Folder C:\Users\Yash\Documents\dumps\Dump20231122 (1)
Each table will be exported into a separate file. This allows a selective restore, but may be slower.
○ Export to Self-Contained File C:\Users\Yash\Documents\dumps\Dump20231122.sql
All selected database objects will be exported into a single, self-contained file.
☐ Create Dump in a Single Transaction (self-contained file only) ☐ Include Create Schema

No object selected

Automatic context help is disabled. Use the toolbar to manually get help for the current caret position or to toggle automatic help.


Local instance MySQL80

Data Export

Export Completed

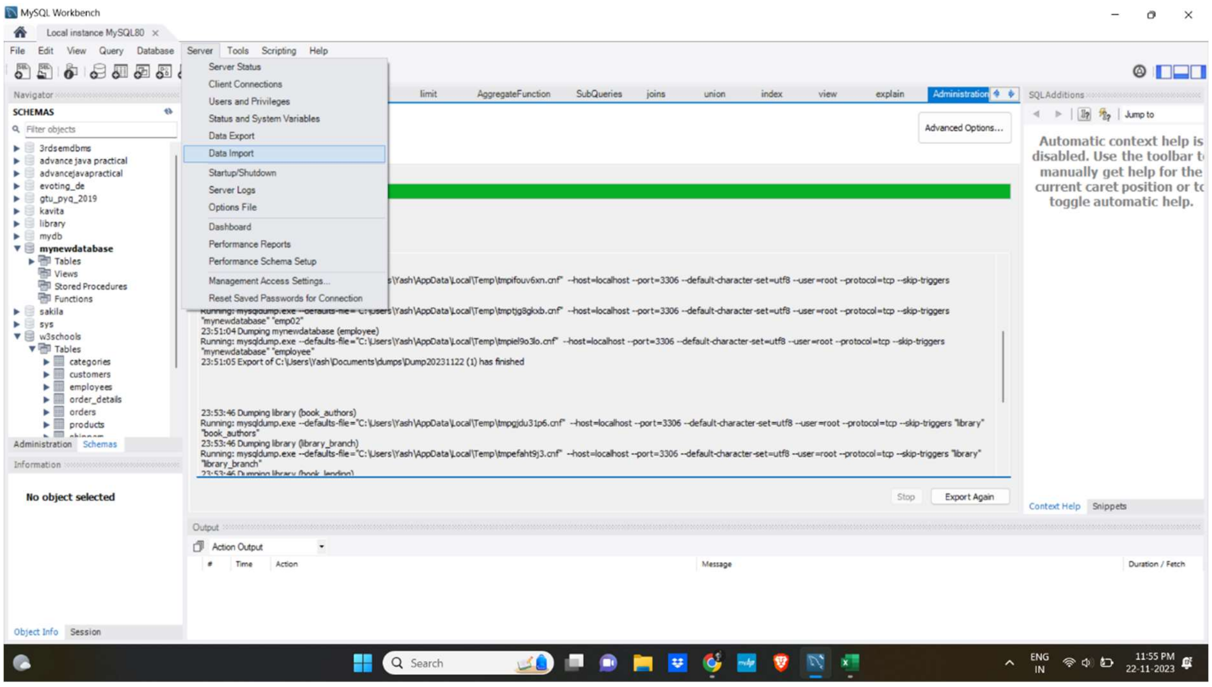
Status:
4 of 4 exported.

Log:

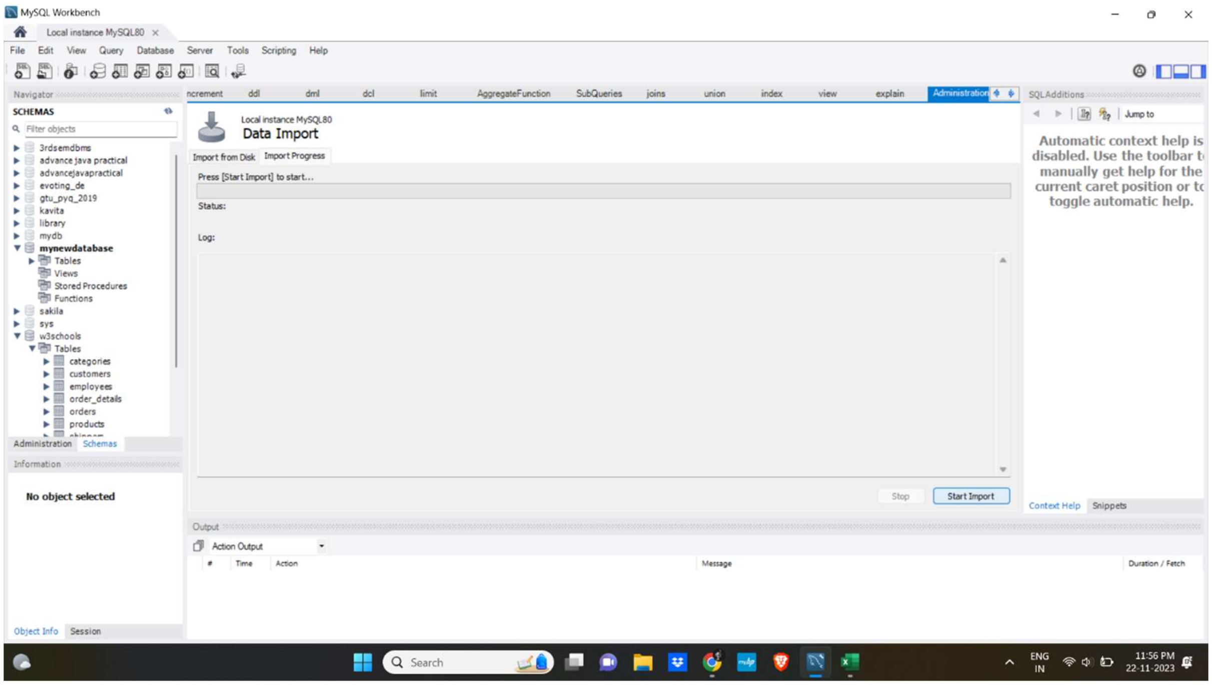
```
23:51:04 Dumping mynewdatabase (emp01)
Running: mysqldump.exe --defaults-file="C:\Users\Yash\AppData\Local\Temp\tmpk9ft16j8.cnf"  --host=localhost --port=3306 --default-character-set=utf8 --user=root --protocol=tcp --skip-triggers
"mynewdatabase" "emp01"
23:51:04 Dumping mynewdatabase (myfirsttable)
Running: mysqldump.exe --defaults-file="C:\Users\Yash\AppData\Local\Temp\tmpifouv6xn.cnf"  --host=localhost --port=3306 --default-character-set=utf8 --user=root --protocol=tcp --skip-triggers
"mynewdatabase" "myfirsttable"
23:51:04 Dumping mynewdatabase (emp02)
Running: mysqldump.exe --defaults-file="C:\Users\Yash\AppData\Local\Temp\tmptjg8gkxb.cnf"  --host=localhost --port=3306 --default-character-set=utf8 --user=root --protocol=tcp --skip-triggers
"mynewdatabase" "emp02"
23:51:04 Dumping mynewdatabase (employee)
Running: mysqldump.exe --defaults-file="C:\Users\Yash\AppData\Local\Temp\tmpiel9o3lo.cnf"  --host=localhost --port=3306 --default-character-set=utf8 --user=root --protocol=tcp --skip-triggers
"mynewdatabase" "employee"
23:51:05 Export of C:\Users\Yash\Documents\dumps\Dump20231122 (1) has finished
```

Restore

Restoring a MySQL database involves recreating the database from a backup.



```
s\Yash\AppData\Local\Temp\tmpifouv6xn.cnf"  --host=localhost --port=3306 --default-character-set=utf8 --user=root --protocol=tcp --skip-triggers

Running: mysqldump.exe --defaults-file="C:\Users\Yash\AppData\Local\Temp\tmptjg8gkxb.cnf"  --host=localhost --port=3306 --default-character-set=utf8 --user=root --protocol=tcp --skip-triggers
"mynewdatabase" "emp02"
23:51:04 Dumping mynewdatabase (employee)
Running: mysqldump.exe --defaults-file="C:\Users\Yash\AppData\Local\Temp\tmpiel9o3lo.cnf"  --host=localhost --port=3306 --default-character-set=utf8 --user=root --protocol=tcp --skip-triggers
"mynewdatabase" "employee"
23:51:05 Export of C:\Users\Yash\Documents\dumps\Dump20231122 (1) has finished



23:53:46 Dumping library (book_authors)
Running: mysqldump.exe --defaults-file="C:\Users\Yash\AppData\Local\Temp\tmpgjdu31p6.cnf"  --host=localhost --port=3306 --default-character-set=utf8 --user=root --protocol=tcp --skip-triggers "library"
"book_authors"
23:53:46 Dumping library (library_branch)
Running: mysqldump.exe --defaults-file="C:\Users\Yash\AppData\Local\Temp\tmpefaht9j3.cnf"  --host=localhost --port=3306 --default-character-set=utf8 --user=root --protocol=tcp --skip-triggers "library"
"library_branch"
```



Local instance MySQL80
Data Import

Press [Start Import] to start...

Status:

Log:

Explain

The EXPLAIN keyword is used to obtain information about how the MySQL optimizer executes a SQL query. It provides insights into the execution plan that MySQL has chosen for a specific query, including details about the indexes used, the order of table access, and optimization strategies.

- **id**:

  An identifier for the query within the execution plan.
- **select_type**:

  The type of SELECT query (e.g., SIMPLE, PRIMARY, SUBQUERY).
- **table**:

  The table referenced in the output row.
- **type**:

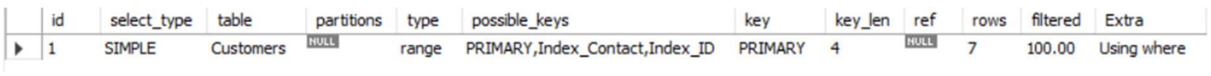
  The type of join that MySQL has chosen for the query (e.g., index scan, full table scan).
- **possible_keys**:

  The indexes that MySQL could potentially use.
- **key**:

  The index that MySQL has chosen to use.
- **rows**:

  The estimated number of rows MySQL expects to examine.

```
EXPLAIN SELECT
      CustomerID,
     CustomerName,
     City
FROM
      Customers
WHERE
      CustomerID > 85;
```



	id	select_type	table	partitions	type	possible_keys	key	key_len	ref	rows	filtered	Extra
▸	1	SIMPLE	Customers	NULL	range	PRIMARY,Index_Contact,Index_ID	PRIMARY	4	NULL	7	100.00	Using where