**BIG DATA MANAGEMENT**

**POST GRADUATE DIPLOMA**

**IN DATA ENGINEERING**

## ASSIGNMENT 3

**SUBMITTED BY:**

**NIRAJ BHAGCHANDANI [G23AI2087]**

****

**SUBMISSION DATE: 10th December, 2024**

**DEPARTMENT OF AIDE**

**INDIAN INSTITUTE OF TECHNOLOGY, JODHPUR**

**ASSIGNMENT - 3**

Full Code:

BigDataAssign.java

import java.sql.\*;

class BigDataAssign{

    private Connection connection;

    private String url = "jdbc:mysql://g23ai2087-instance.cojx0qdcaqlm.us-east-1.rds.amazonaws.com";

    //private String url = "jdbc:mysql://localhost/db\_g23ai2087";

    private String user = "admin";

    private String password = "z8vm6IFzsMwcgSj0mtto";

    //private String user = "root";

    //private String password = "";

    private String db = "db\_g23ai2087";

    private Statement stmt;

    private ResultSet rs;

    public void resultSetMetaDataToString(String table){

        String query = "SELECT table\_schema, table\_name, column\_name, ordinal\_position, data\_type,numeric\_precision, column\_type, column\_default, is\_nullable, column\_comment FROM information\_schema.columns WHERE table\_name = '"+table+"' order by ordinal\_position";

        try{

            ResultSet rs = this.executeMe(query,"Query");

            this.print(rs,"Metadata: "+table);

        }catch(Exception e){

            System.out.println("Error: Generating Metadata - " +e.getMessage());

        }

    }

    public void queryOne(){

        String query = """

            SELECT name, annualRevenue, numEmployees

            FROM company

            WHERE numEmployees > 10000 OR annualRevenue < 1000000

            ORDER BY name ASC

            """;

        try{

            this.rs = this.executeMe(query,"Query");

            this.print(rs, "Query One");

        }catch(Exception e){

            System.out.println("Error Executing Query: " + e.getMessage());

        }

    }

    public void queryTwo(){

        String query = """

            SELECT c.name, c.ticker,

                   MIN(s.lowPrice) AS lowestPrice,

                   MAX(s.highPrice) AS highestPrice,

                   AVG(s.closePrice) AS avgClosingPrice,

                   AVG(s.volume) AS avgVolume

            FROM company c

            JOIN stockprice s ON c.id = s.companyId

            WHERE s.priceDate BETWEEN '2022-08-22' AND '2022-08-26'

            GROUP BY c.id, c.name, c.ticker

            ORDER BY avgVolume DESC

            """;

        try{

            this.rs = this.executeMe(query,"Query");

            this.print(rs, "Query Two");

        }catch(Exception e){

            System.out.println("Error Executing Query: " + e.getMessage());

        }

    }

    public void queryThree(){

        String query = """

        SELECT c.name, c.ticker, s.closePrice

        FROM company c

        LEFT JOIN stockprice s ON c.id = s.companyId

        AND s.priceDate = '2022-08-30'

        WHERE (s.closePrice IS NULL OR s.closePrice >= 0.9 \* (

                    SELECT AVG(closePrice)

                    FROM stockprice

                    WHERE priceDate BETWEEN '2022-08-15' AND '2022-08-19'

                ))

        ORDER BY c.name ASC;

        """;

        try{

            this.rs = this.executeMe(query,"Query");

            this.print(rs, "Query Two");

        }catch(Exception e){

            System.out.println("Error Executing Query: " + e.getMessage());

        }

    }

    public void createDatabase(){

        String sql = "CREATE DATABASE IF NOT EXISTS db\_g23ai2087";

        this.executeMe(sql, "Update");

        System.out.println("createDatabase() executed successfully");

    }

    public ResultSet executeMe(String query, String flag){

        try{

            if(flag == "Update"){

                int status = this.stmt.executeUpdate(query);

            }else if(flag == "Query"){

                this.rs = this.stmt.executeQuery(query);

            }

        }catch (SQLException e) {

            System.out.println("Error Executing Query: " + e.getMessage());

        }

        return this.rs;

    }

    public void createTable(){

        String select = "USE "+db;

        String createCompany = """

                CREATE TABLE company (

                    id INT PRIMARY KEY,

                    name VARCHAR(50),

                    ticker CHAR(10),

                    annualRevenue DECIMAL(15, 2),

                    numEmployees INT

                )

                """;

            String createStockPrice = """

                CREATE TABLE stockprice (

                    companyId INT,

                    priceDate DATE,

                    openPrice DECIMAL(10, 2),

                    highPrice DECIMAL(10, 2),

                    lowPrice DECIMAL(10, 2),

                    closePrice DECIMAL(10, 2),

                    volume INT,

                    PRIMARY KEY (companyId, priceDate),

                    FOREIGN KEY (companyId) REFERENCES company(id) ON DELETE CASCADE

                )

                """;

            try{

                this.executeMe(select,"Update");

                this.executeMe(createCompany,"Update");

                this.executeMe(createStockPrice,"Update");

                System.out.println("\nTable Created Successfully");

            }catch(Exception e){

                System.out.println("Error: Creating Database - " +e.getMessage());

            }

    }

    public void dropTables(){

        try{

            String query = "DROP TABLE stockprice";

            this.executeMe(query,"Update");

            query = "DROP TABLE company";

            this.executeMe(query,"Update");

            System.out.println("Tables Deleted Successfully");

        }catch(Exception e){

            System.out.println("Error: Creating Database - " +e.getMessage());

        }

    }

    public void print(ResultSet rs, String table){

        int count = 0;

        String str = "";

        try{

                str += "\n================================================================\n";

                ResultSetMetaData metaData = rs.getMetaData();

                int columnCount = metaData.getColumnCount();

                str += table + ": Columns Found: " +columnCount;

                str += "\n================================================================\n";

                for(int i = 1; i <= columnCount; i++){

                    str += metaData.getColumnName(i);

                    if(i == columnCount) continue;

                    str += ",";

                }

                str += "\n================================================================\n";

                while(rs.next()){

                    for(int i = 1; i <= columnCount; i++){

                        str += rs.getString(i);

                        if(i == columnCount) continue;

                        str += ",";

                    }

                    count++;

                    str +="\n";

                }

            }catch(Exception e){

                System.out.println("Error: Result Set to String Conversion: - " +e.getMessage());

            }

            str += "================================================================\n";

            str += "Records found in table: "+count+"\n";

            str += "================================================================\n";

            System.out.println(str);

    }

    public void resultSetToString(String table){

        String query = "SELECT \* FROM "+table;

        try{

            ResultSet rs = this.executeMe(query,"Query");

            this.print(rs,"Table - "+table);

        }catch(Exception e){

            System.out.println("Error: Result Set to String Conversion: - " +e.getMessage());

        }

    }

    public void dropDB(){

        try{

            String query = "DROP database "+ this.db;

            this.executeMe(query,"Update");

            System.out.println("Database Dropped Successfully");

        }catch(Exception e){

            System.out.println("Error: Creating Database - " +e.getMessage());

        }

    }

    public void insertData(){

        String company = """

            INSERT INTO company (id,name,ticker,annualRevenue,numEmployees)

            VALUES

            (1, 'Apple', 'AAPL', 387540000000.00 , 154000),

            (2, 'GameStop', 'GME', 611000000.00, 12000),

            (3, 'Handy Repair', null, 2000000, 50),

            (4, 'Microsoft', 'MSFT', '198270000000.00' , 221000),

            (5, 'StartUp', null, 50000, 3)

        """;

        String stockprices ="""

                INSERT INTO stockprice

                (companyId,priceDate,openPrice,highPrice,lowPrice,closePrice,volume)

                VALUES (1, '2022-08-15', 171.52, 173.39, 171.35, 173.19, 54091700),

                (1, '2022-08-16', 172.78, 173.71, 171.66, 173.03, 56377100),

                (1, '2022-08-17', 172.77, 176.15, 172.57, 174.55, 79542000),

                (1, '2022-08-18', 173.75, 174.90, 173.12, 174.15, 62290100),

                (1, '2022-08-19', 173.03, 173.74, 171.31, 171.52, 70211500),

                (1, '2022-08-22', 169.69, 169.86, 167.14, 167.57, 69026800),

                (1, '2022-08-23', 167.08, 168.71, 166.65, 167.23, 54147100),

                (1, '2022-08-24', 167.32, 168.11, 166.25, 167.53, 53841500),

                (1, '2022-08-25', 168.78, 170.14, 168.35, 170.03, 51218200),

                (1, '2022-08-26', 170.57, 171.05, 163.56, 163.62, 78823500),

                (1, '2022-08-29', 161.15, 162.90, 159.82, 161.38, 73314000),

                (1, '2022-08-30', 162.13, 162.56, 157.72, 158.91, 77906200),

                (2, '2022-08-15', 39.75, 40.39, 38.81, 39.68, 5243100),

                (2, '2022-08-16', 39.17, 45.53, 38.60, 42.19, 23602800),

                (2, '2022-08-17', 42.18, 44.36, 40.41, 40.52, 9766400),

                (2, '2022-08-18', 39.27, 40.07, 37.34, 37.93, 8145400),

                (2, '2022-08-19', 35.18, 37.19, 34.67, 36.49, 9525600),

                (2, '2022-08-22', 34.31, 36.20, 34.20, 34.50, 5798600),

                (2, '2022-08-23', 34.70, 34.99, 33.45, 33.53, 4836300),

                (2, '2022-08-24', 34.00, 34.94, 32.44, 32.50, 5620300),

                (2, '2022-08-25', 32.84, 32.89, 31.50, 31.96, 4726300),

                (2, '2022-08-26', 31.50, 32.38, 30.63, 30.94, 4289500),

                (2, '2022-08-29', 30.48, 32.75, 30.38, 31.55, 4292700),

                (2, '2022-08-30', 31.62, 31.87, 29.42, 29.84, 5060200),

                (4, '2022-08-15', 291.00, 294.18, 290.11, 293.47, 18085700),

                (4, '2022-08-16', 291.99, 294.04, 290.42, 292.71, 18102900),

                (4, '2022-08-17', 289.74, 293.35, 289.47, 291.32, 18253400),

                (4, '2022-08-18', 290.19, 291.91, 289.08, 290.17, 17186200),

                (4, '2022-08-19', 288.90, 289.25, 285.56, 286.15, 20557200),

                (4, '2022-08-22', 282.08, 282.46, 277.22, 277.75, 25061100),

                (4, '2022-08-23', 276.44, 278.86, 275.40, 276.44, 17527400),

                (4, '2022-08-24', 275.41, 277.23, 275.11, 275.79, 18137000),

                (4, '2022-08-25', 277.33, 279.02, 274.52, 278.85, 16583400),

                (4, '2022-08-26', 279.08, 280.34, 267.98, 268.09, 27532500),

                (4, '2022-08-29', 265.85, 267.40, 263.85, 265.23, 20338500),

                (4, '2022-08-30', 266.67, 267.05, 260.66, 262.97, 22767100)

        """;

        try{

            this.executeMe(company,"Update");

            this.executeMe(stockprices,"Update");

        }catch(Exception e){

            System.out.println("Error: Inserting Data: "+e.getMessage());

        }

    }

    public void connect(){

        try {

            Class.forName("com.mysql.jdbc.Driver");

            connection = DriverManager.getConnection(this.url, this.user, this.password);

            System.out.println("Connected to the Server.");

            this.stmt = connection.createStatement();

        } catch (Exception e) {

            System.out.println("Error connecting to the database: " + e.getMessage());

        }

    }

    public Connection getConnection(){

        return this.connection;

    }

    public Statement getStatement(){

        return this.stmt;

    }

    public void disconnect() {

        try {

            if (this.connection != null && !this.connection.isClosed()) {

                this.connection.close();

                System.out.println("Disconnected from the database.");

            }

        } catch (SQLException e) {

            System.out.println("Error disconnecting from the database: " + e.getMessage());

        }

    }

}

ExecuteAssignment.java

import java.util.Scanner;

import java.lang.\*;

/\*

D:\IIT - Jodhpur\BigData>javac -cp mysql.jar;. \*.java

D:\IIT - Jodhpur\BigData>java -cp mysql.jar;. ExecuteAssignment

 \*/

class ExecuteAssignment{

    private BigDataAssign bda;

    public BigDataAssign getBda(){

        return this.bda;

    }

    public ExecuteAssignment(){

        System.out.println("Hello World");

        this.bda = new BigDataAssign();

        bda.connect();

        bda.createDatabase();

    }

    public static void main(String args[]){

        ExecuteAssignment e = new ExecuteAssignment();

        Scanner scanner = new Scanner(System.in);

        boolean exit = false;

        while (!exit) {

            System.out.println("\nMenu:");

            System.out.println("1. Connect to Database");

            System.out.println("2. Create Database");

            System.out.println("3. Create Table");

            System.out.println("4. Insert into tables");

            System.out.println("5. queryOne");

            System.out.println("6. queryTwo");

            System.out.println("7. queryThree");

            System.out.println("8. Drop Tables");

            System.out.println("9. Delete Database");

            System.out.println("10. Result Set ToString");

            System.out.println("11. Result Set Meta Data To String");

            System.out.println("12. Exit");

            System.out.print("Enter your choice: ");

            int choice = scanner.nextInt();

            switch (choice) {

                case 1 :

                    System.out.println("Connecting the Database...\n");

                    e.bda.connect();

                    break;

                case 2 :

                    e.getBda().createDatabase();

                    System.out.println("Database Created Successfully ...\n");

                    break;

                case 3 :

                    System.out.println("Creating the Tables...\n");

                    e.getBda().createTable();

                    break;

                case 4 :

                    System.out.println("Inserting Data...");

                    e.getBda().insertData();

                    break;

                case 5 :

                    System.out.println("Executing Simple One Query");

                    e.getBda().queryOne();

                    break;

                case 6 :

                    System.out.println("Executing Simple Two Query");

                    e.getBda().queryTwo();

                    break;

                case 7 :

                    System.out.println("Executing Simple Three Query");

                    e.getBda().queryThree();

                    break;

                case 8 :

                    System.out.println("Drop Tables");

                    e.getBda().dropTables();

                    break;

                case 9 :

                    System.out.println("Dropping Database");

                    e.getBda().dropDB();

                    break;

                case 10 :

                    System.out.println("Result Set to Data String");

                    e.getBda().resultSetToString("company");

                    e.getBda().resultSetToString("stockprice");

                    break;

                case 11 :

                    e.getBda().resultSetMetaDataToString("company");

                    e.getBda().resultSetMetaDataToString("stockprice");

                    break;

                case 12 :

                    exit = true;

                    break;

                default :

                    System.out.println("Invalid choice. Try again.");

                    break;

            }

            //scanner.close();

        }

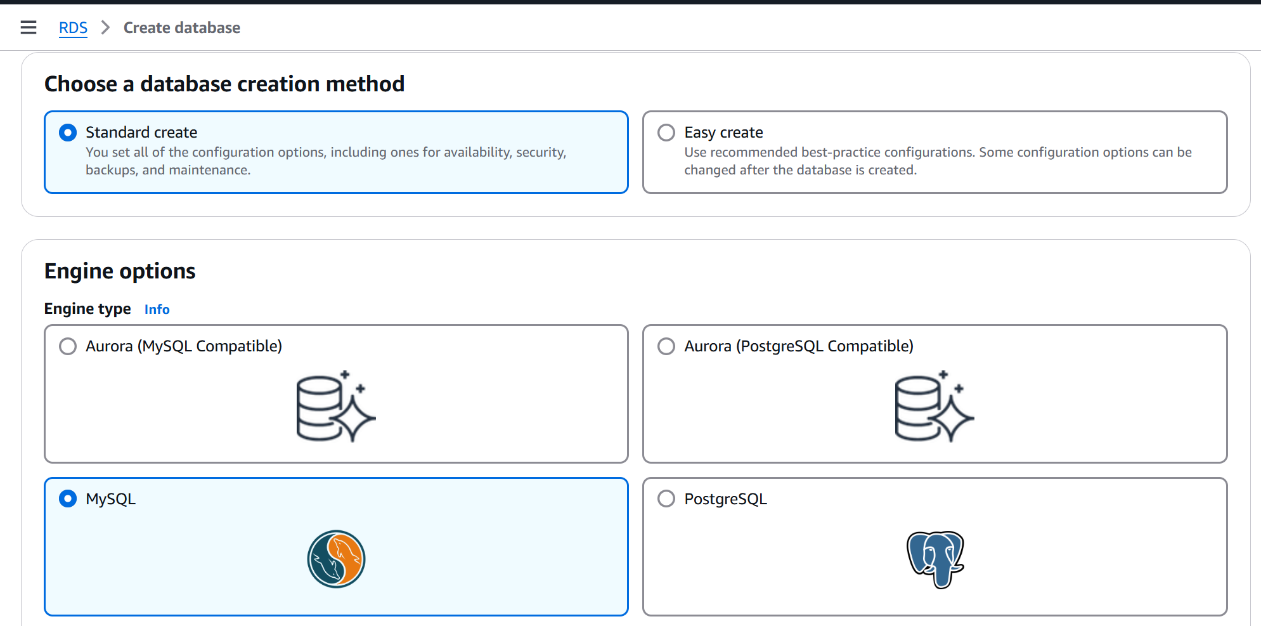
    }

}

Extend the Amazon RDS connector code in java to do the following in each of the respective functions.

**Step 1:** Choose a database creation method.  
You can select either:

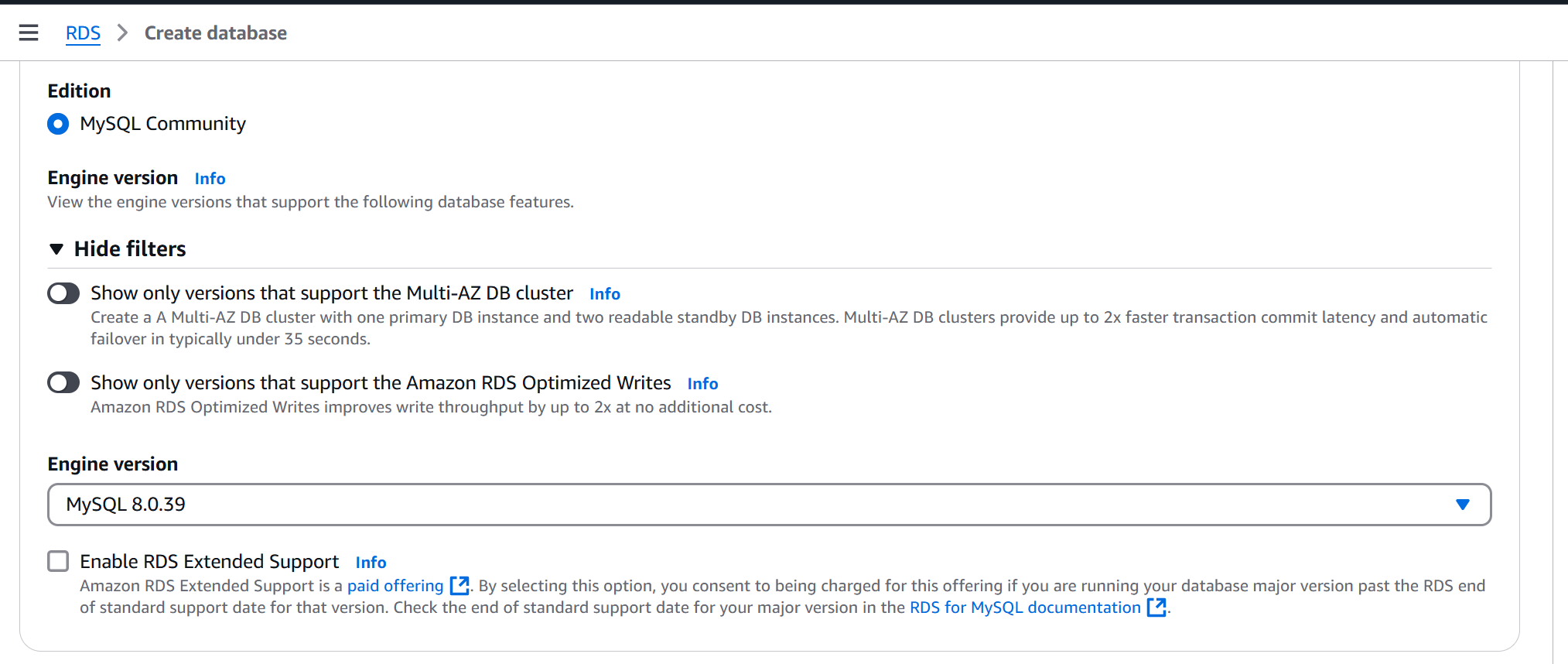
* **Standards create:** Allows detailed configuration of availability, security, backups, and maintenance.
* **Easy create:** Provides recommended best-practice configurations for a simplified setup.



*Fig.3.1 RDS database creation interface showing database creation methods (Standard create and Easy create) and engine options (Aurora MySQL/PostgreSQL compatible, MySQL, and PostgreSQL).*

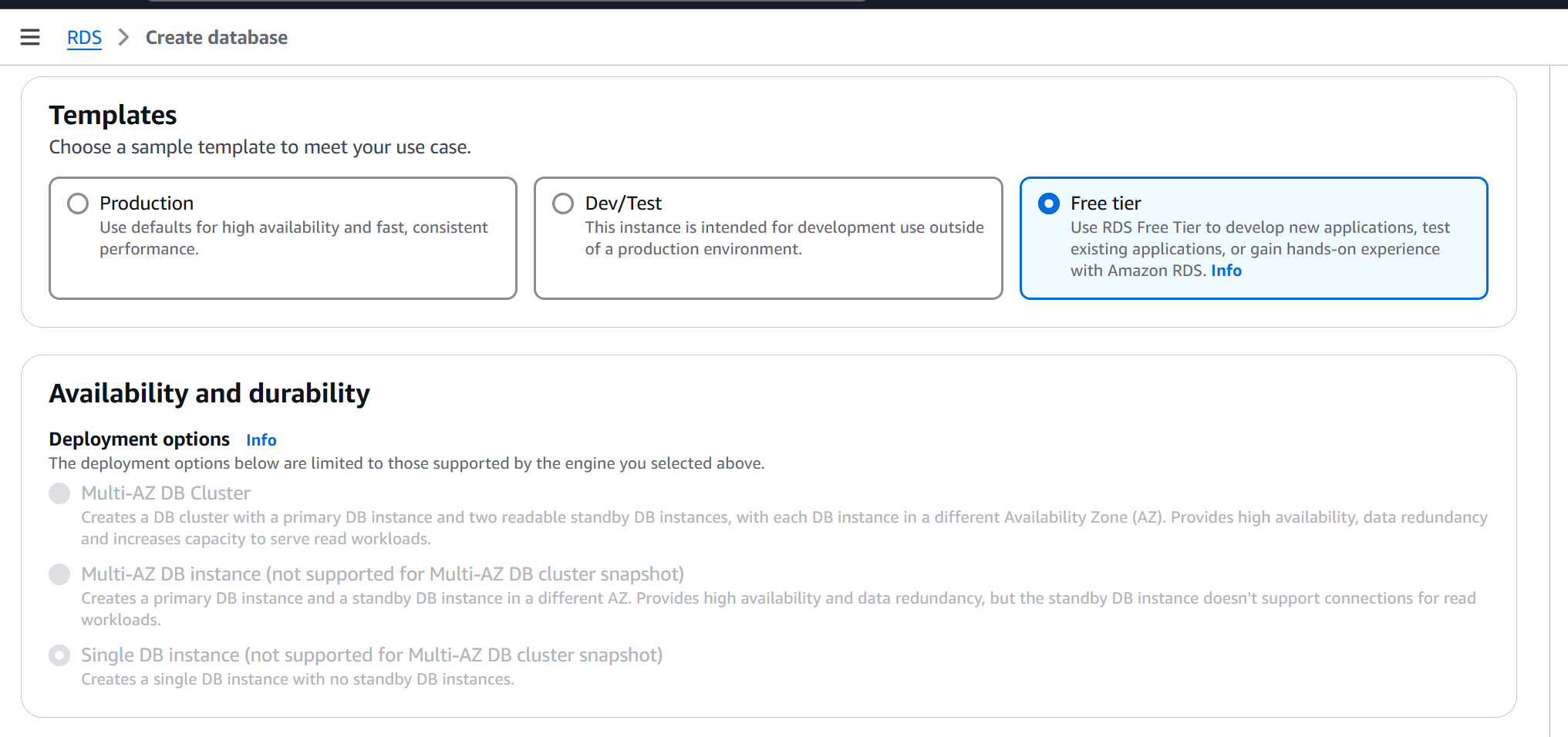
**Step 2:** Select the database edition and engine version.

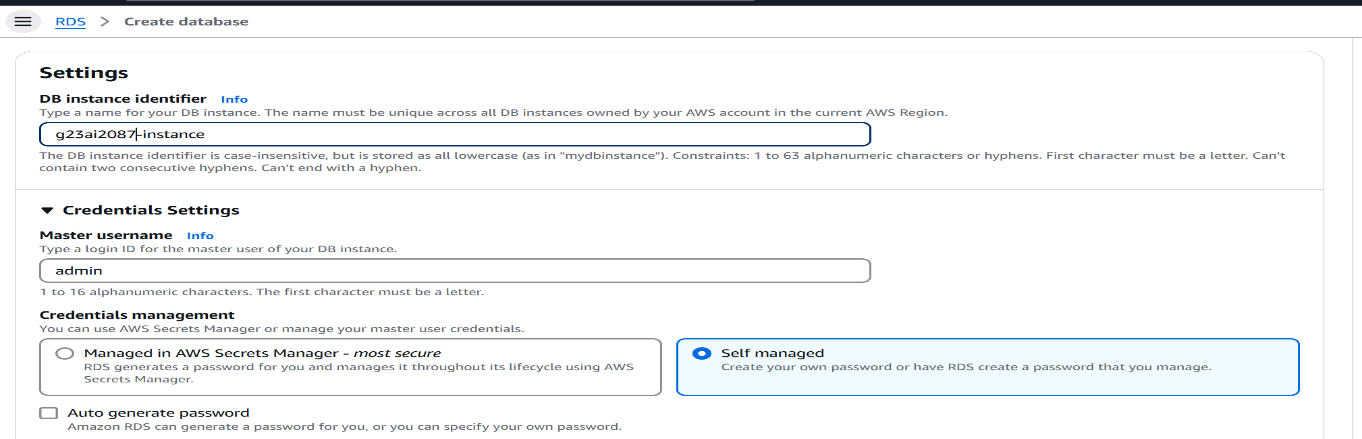
* Choose the **MySQL Community** edition.
* Optionally, apply filters like Multi-AZ DB clusters or Amazon RDS Optimized Writes.
* Select the required **engine version** (e.g., MySQL 8.0.39).
* You can also enable **RDS Extended Support** if needed.



*Fig.3.2* *Configuration options for selecting the database edition, engine version, filters, and enabling RDS Extended Support in the RDS database creation process.*

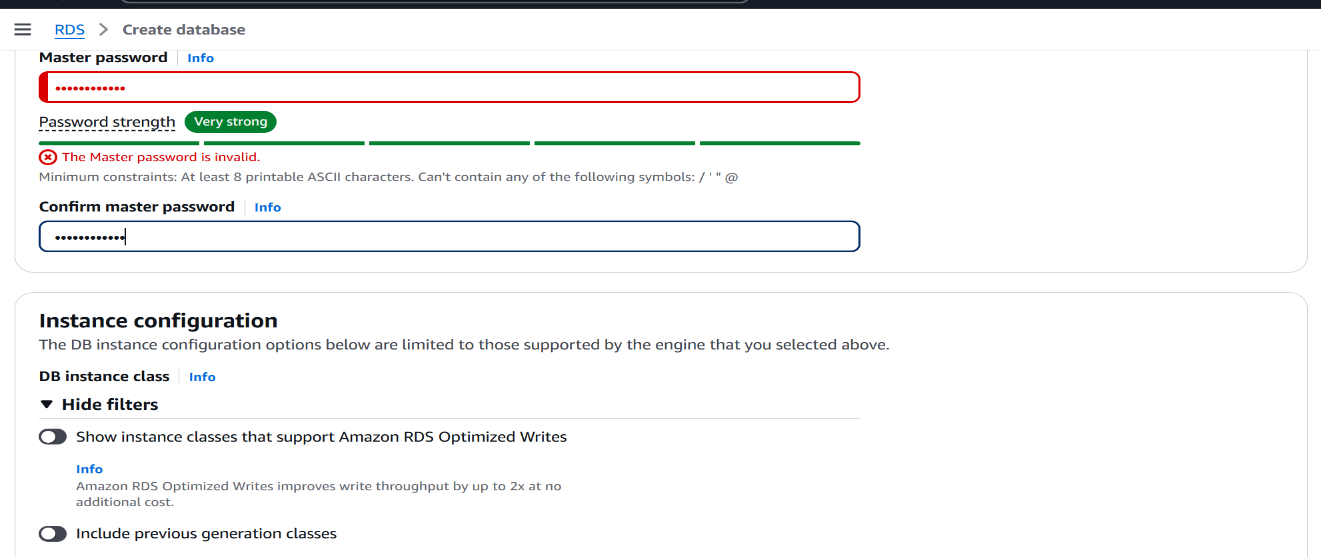
**Step 3:** Select a template (Production, Dev/Test, or Free Tier) and configure deployment options (Multi-AZ DB Cluster, Multi-AZ DB Instance, or Single DB Instance) based on availability and durability needs.

*Fig.3.3 Template and deployment option configurations in the RDS database creation process.*

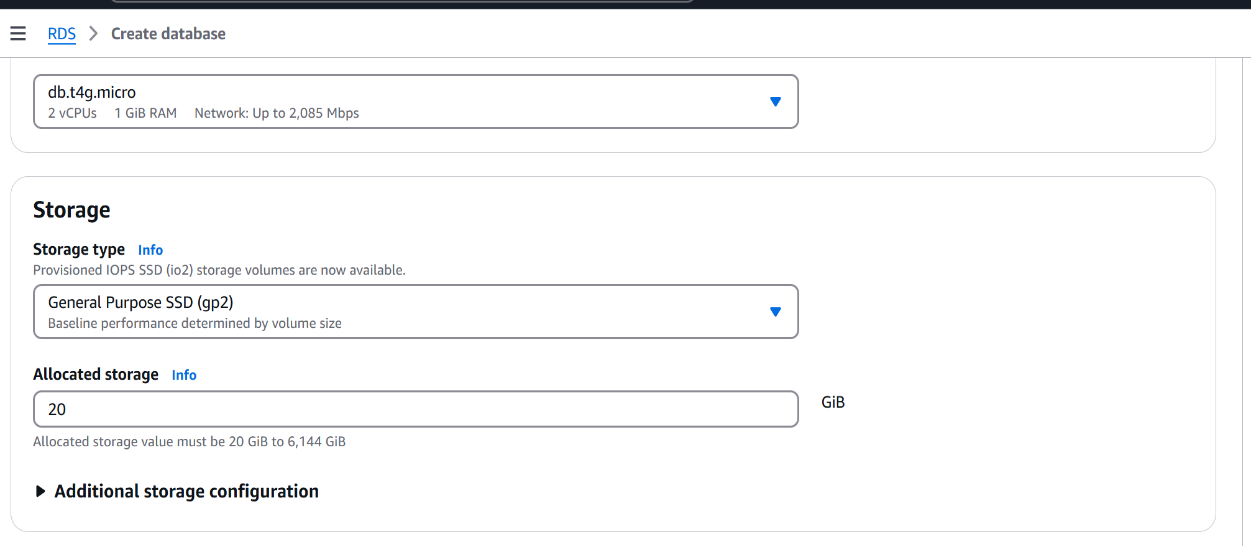
*****Step 4:*** *Configure the database settings by specifying the DB instance identifier, master username, and password. Choose credentials management as either* ***Self-managed*** *or* ***Managed in AWS Secrets Manager****.*

*Fig.* *3.4 Settings configuration for DB instance identifier, master username, and credentials management in the RDS database creation process.*

**Step 5:** Set the master password and confirm it, ensuring it meets the required constraints. Configure the instance settings by selecting the DB instance class and optional features such as Amazon RDS Optimized Writes.

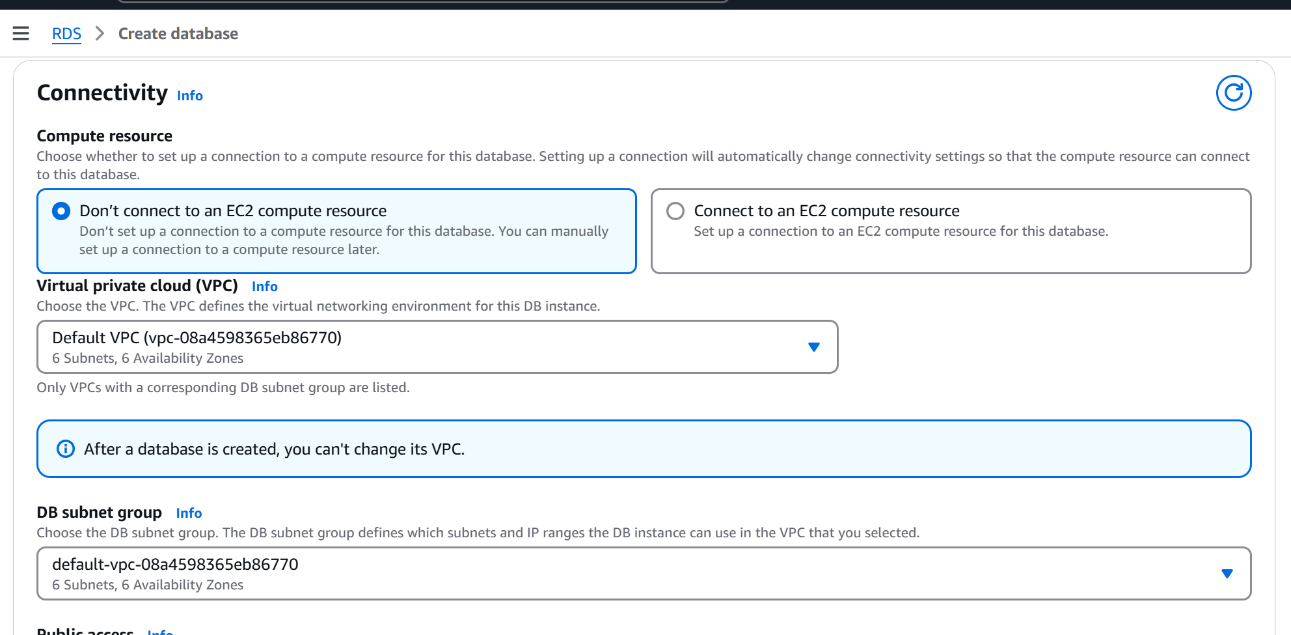


*Fig.3.5 Configuration of master password and DB instance class with optional settings for Amazon RDS Optimized Writes in the RDS database creation process.*

****Step 6:** Configure instance type and storage. Select the DB instance class (e.g., db.t4g.micro) and define storage settings, including storage type (e.g., General Purpose SSD) and allocated storage size.

*Fig.3.6 Configuration of DB instance type and storage settings, including storage type and allocated storage size, in the RDS database creation process*

**Step 7:** Configure connectivity by selecting the VPC, DB subnet group, and whether to connect to an EC2 compute resource.



*Fig.3.7 Connectivity settings for VPC, DB subnet group, and EC2 compute resource in the RDS database creation process.*

A screenshot of a computer

Description automatically generated***Step 8:*** *Set public access, select or create a VPC security group, and choose an Availability Zone.*

*Fig.3.8 Public access and VPC security group settings in RDS database setup.*

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Description automatically generated**Step 9:** Configure additional settings by specifying the database name, parameter group, option group, and enabling automated backups.

*Fig. 3.9 Additional configuration for database options and backup settings in the RDS database setup.*

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Description automatically generated**Step 10:** Set backup and encryption options. Configure the backup retention period, window, and enable encryption with an AWS KMS key.

*Fig.3.10 Backup and encryption settings, including retention period, backup replication, and encryption options in the RDS database setup.*

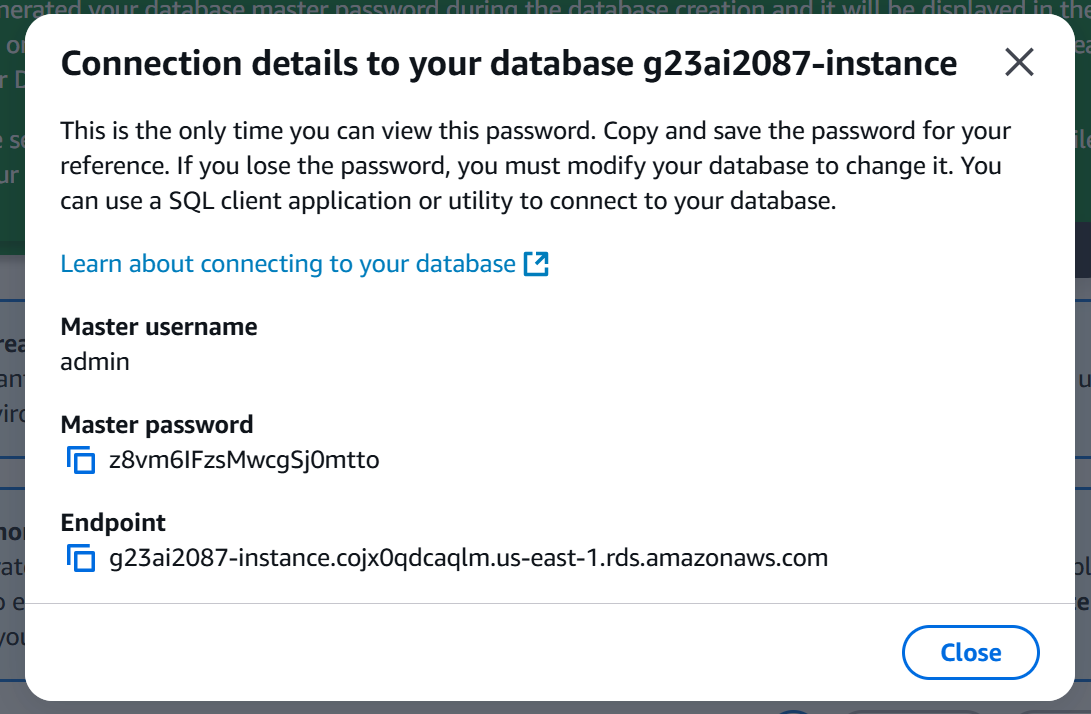
**Step 11:** Review the estimated monthly costs, enable deletion protection if needed, and click **Create database** to finalize the setup.

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*Fig.3.11 Final review of estimated monthly costs and deletion protection before creating the RDS database.*

**Step 12:** Save the connection details, including the master username, password, and endpoint. This information is displayed only once and is required to connect to your database.



*3.12 Connection details, including username, password, and endpoint, for the newly created RDS database instance.*

1. connect() : to connect to the RDS database

public void connect(){

        try {

            Class.forName("com.mysql.jdbc.Driver");

            connection = DriverManager.getConnection(this.url, this.user, this.password);

            System.out.println("Connected to the Server.");

            this.stmt = connection.createStatement();

        } catch (Exception e) {

            System.out.println("Error connecting to the database: " + e.getMessage());

        }

    }

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*Fig3.13 Command prompt displaying database operations menu and successful execution of a Java program for MySQL interactions.*

1. drop() : to drop the table from the database

public void dropTables(){

        try{

            String query = "DROP TABLE stockprice";

            this.executeMe(query,"Update");

            query = "DROP TABLE company";

            this.executeMe(query,"Update");

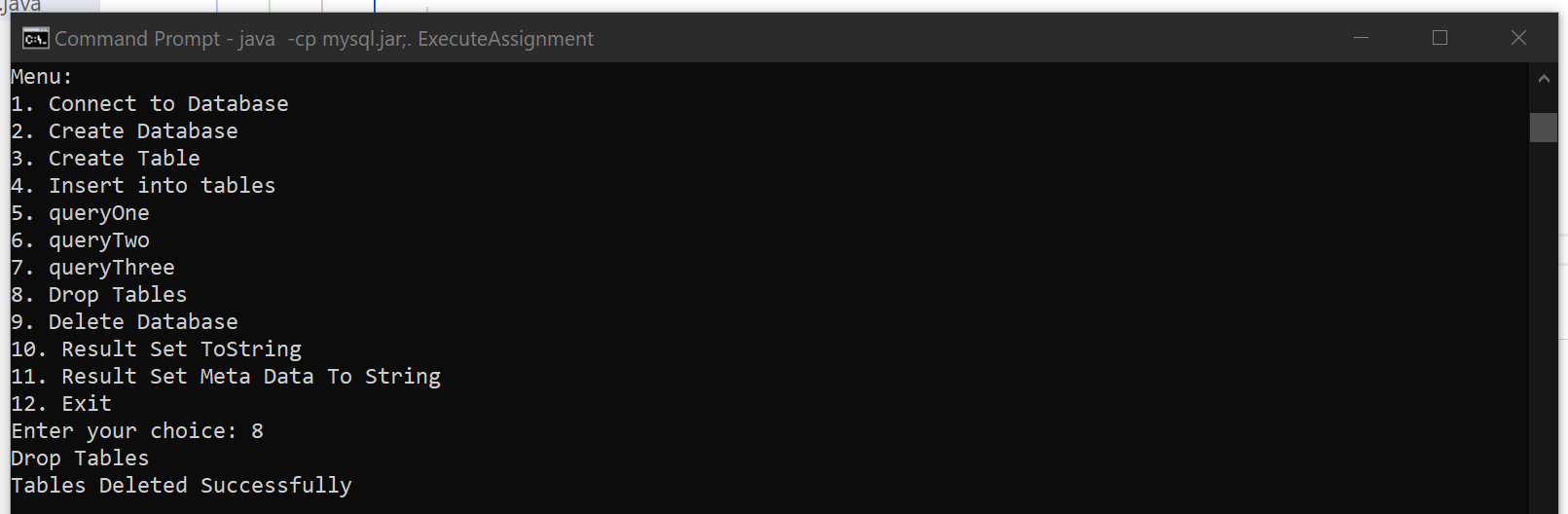
            System.out.println("Tables Deleted Successfully");

        }catch(Exception e){

            System.out.println("Error: Creating Database - " +e.getMessage());

        }

    }



*Fig.3.14 Command prompt showing successful deletion of tables using a Java program for MySQL database operations.*

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*Fig.3.15 Command prompt showing successful database deletion using a Java program for MySQL database operations.*

1. create() : creates the following table in the database: [10] \* Creates the table in the database. \* Table name: company \* Fields: \* - id - integer, must be primary key \* - name - variable character field up to size 50 \* - ticker - character field always of size 10 \* - annualRevenue - must hold up to 999,999,999,999.99 exactly \* - numEmployees - integer \* \* Table name: stockprice \* Fields: \* - companyId - integer \* - priceDate - date of stock price \* - openPrice - opening price must hold up to 99999999.99 \* - highPrice - high price must hold up to 99999999.99 \* - lowPrice - low price must hold up to 99999999.99 \* - closePrice - closing price must hold up to 99999999.99 \* - volume - number of shares traded, integer \* - primary key must be companyId and priceDate \* - add an appropriate foreign key

public void createTable(){

        String createCompany = """

                CREATE TABLE company (

                    id INT PRIMARY KEY,

                    name VARCHAR(50),

                    ticker CHAR(10),

                    annualRevenue DECIMAL(15, 2),

                    numEmployees INT

                )

                """;

            String createStockPrice = """

                CREATE TABLE stockprice (

                    companyId INT,

                    priceDate DATE,

                    openPrice DECIMAL(10, 2),

                    highPrice DECIMAL(10, 2),

                    lowPrice DECIMAL(10, 2),

                    closePrice DECIMAL(10, 2),

                    volume INT,

                    PRIMARY KEY (companyId, priceDate),

                    FOREIGN KEY (companyId) REFERENCES company(id) ON DELETE CASCADE

                )

                """;

            try{

                this.executeMe(createCompany,"Update");

                this.executeMe(createStockPrice,"Update");

                System.out.println("\nTable Created Successfully");

            }catch(Exception e){

                System.out.println("Error: Creating Database - " +e.getMessage());

            }

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Description automatically generated    }

*Fig.3.16 Command prompt showing successful database creation using a Java program for MySQL database operations.*

*A computer screen with a black background

Description automatically generatedFig.3.17 Command prompt showing successful table creation using a Java program for MySQL database operations.*

4. insert() : Inserts test records in the database: [10] \* Data for company table: 1, 'Apple', 'AAPL', 387540000000.00 , 154000 2, 'GameStop', 'GME', 611000000.00, 12000 3, 'Handy Repair', null, 2000000, 50 4, 'Microsoft', 'MSFT', '198270000000.00' , 221000 5, 'StartUp', null, 50000, 3 \* \* Data for stockprice table: 1, '2022-08-15', 171.52, 173.39, 171.35, 173.19, 54091700 1, '2022-08-16', 172.78, 173.71, 171.66, 173.03, 56377100 1, '2022-08-17', 172.77, 176.15, 172.57, 174.55, 79542000 1, '2022-08-18', 173.75, 174.90, 173.12, 174.15, 62290100 1, '2022-08-19', 173.03, 173.74, 171.31, 171.52, 70211500 1, '2022-08-22', 169.69, 169.86, 167.14, 167.57, 69026800 1, '2022-08-23', 167.08, 168.71, 166.65, 167.23, 54147100 1, '2022-08-24', 167.32, 168.11, 166.25, 167.53, 53841500 1, '2022-08-25', 168.78, 170.14, 168.35, 170.03, 51218200 1, '2022-08-26', 170.57, 171.05, 163.56, 163.62, 78823500 1, '2022-08-29', 161.15, 162.90, 159.82, 161.38, 73314000 1, '2022-08-30', 162.13, 162.56, 157.72, 158.91, 77906200 2, '2022-08-15', 39.75, 40.39, 38.81, 39.68, 5243100 2, '2022-08-16', 39.17, 45.53, 38.60, 42.19, 23602800 2, '2022-08-17', 42.18, 44.36, 40.41, 40.52, 9766400 2, '2022-08-18', 39.27, 40.07, 37.34, 37.93, 8145400 2, '2022-08-19', 35.18, 37.19, 34.67, 36.49, 9525600 2, '2022-08-22', 34.31, 36.20, 34.20, 34.50, 5798600 2, '2022-08-23', 34.70, 34.99, 33.45, 33.53, 4836300 2, '2022-08-24', 34.00, 34.94, 32.44, 32.50, 5620300 2, '2022-08-25', 32.84, 32.89, 31.50, 31.96, 4726300 2, '2022-08-26', 31.50, 32.38, 30.63, 30.94, 4289500 2, '2022-08-29', 30.48, 32.75, 30.38, 31.55, 4292700 2, '2022-08-30', 31.62, 31.87, 29.42, 29.84, 5060200 4, '2022-08-15', 291.00, 294.18, 290.11, 293.47, 18085700 4, '2022-08-16', 291.99, 294.04, 290.42, 292.71, 18102900 4, '2022-08-17', 289.74, 293.35, 289.47, 291.32, 18253400 4, '2022-08-18', 290.19, 291.91, 289.08, 290.17, 17186200 4, '2022-08-19', 288.90, 289.25, 285.56, 286.15, 20557200 4, '2022-08-22', 282.08, 282.46, 277.22, 277.75, 25061100 4, '2022-08-23', 276.44, 278.86, 275.40, 276.44, 17527400 4, '2022-08-24', 275.41, 277.23, 275.11, 275.79, 18137000 4, '2022-08-25', 277.33, 279.02, 274.52, 278.85, 16583400 4, '2022-08-26', 279.08, 280.34, 267.98, 268.09, 27532500 4, '2022-08-29', 265.85, 267.40, 263.85, 265.23, 20338500 4, '2022-08-30', 266.67, 267.05, 260.66, 262.97, 22767100

Code:

public void insertData(){

        String company = """

            INSERT INTO company (id,name,ticker,annualRevenue,numEmployees)

            VALUES

            (1, 'Apple', 'AAPL', 387540000000.00 , 154000),

            (2, 'GameStop', 'GME', 611000000.00, 12000),

            (3, 'Handy Repair', null, 2000000, 50),

            (4, 'Microsoft', 'MSFT', '198270000000.00' , 221000),

            (5, 'StartUp', null, 50000, 3)

        """;

        String stockprices ="""

             INSERT INTO stockprice

             (companyId,priceDate,openPrice,highPrice,lowPrice,closePrice,volume)

                VALUES (1, '2022-08-15', 171.52, 173.39, 171.35, 173.19, 54091700),

                (1, '2022-08-16', 172.78, 173.71, 171.66, 173.03, 56377100),

                (1, '2022-08-17', 172.77, 176.15, 172.57, 174.55, 79542000),

                (1, '2022-08-18', 173.75, 174.90, 173.12, 174.15, 62290100),

                (1, '2022-08-19', 173.03, 173.74, 171.31, 171.52, 70211500),

                (1, '2022-08-22', 169.69, 169.86, 167.14, 167.57, 69026800),

                (1, '2022-08-23', 167.08, 168.71, 166.65, 167.23, 54147100),

                (1, '2022-08-24', 167.32, 168.11, 166.25, 167.53, 53841500),

                (1, '2022-08-25', 168.78, 170.14, 168.35, 170.03, 51218200),

                (1, '2022-08-26', 170.57, 171.05, 163.56, 163.62, 78823500),

                (1, '2022-08-29', 161.15, 162.90, 159.82, 161.38, 73314000),

                (1, '2022-08-30', 162.13, 162.56, 157.72, 158.91, 77906200),

                (2, '2022-08-15', 39.75, 40.39, 38.81, 39.68, 5243100),

                (2, '2022-08-16', 39.17, 45.53, 38.60, 42.19, 23602800),

                (2, '2022-08-17', 42.18, 44.36, 40.41, 40.52, 9766400),

                (2, '2022-08-18', 39.27, 40.07, 37.34, 37.93, 8145400),

                (2, '2022-08-19', 35.18, 37.19, 34.67, 36.49, 9525600),

                (2, '2022-08-22', 34.31, 36.20, 34.20, 34.50, 5798600),

                (2, '2022-08-23', 34.70, 34.99, 33.45, 33.53, 4836300),

                (2, '2022-08-24', 34.00, 34.94, 32.44, 32.50, 5620300),

                (2, '2022-08-25', 32.84, 32.89, 31.50, 31.96, 4726300),

                (2, '2022-08-26', 31.50, 32.38, 30.63, 30.94, 4289500),

                (2, '2022-08-29', 30.48, 32.75, 30.38, 31.55, 4292700),

                (2, '2022-08-30', 31.62, 31.87, 29.42, 29.84, 5060200),

                (4, '2022-08-15', 291.00, 294.18, 290.11, 293.47, 18085700),

                (4, '2022-08-16', 291.99, 294.04, 290.42, 292.71, 18102900),

                (4, '2022-08-17', 289.74, 293.35, 289.47, 291.32, 18253400),

                (4, '2022-08-18', 290.19, 291.91, 289.08, 290.17, 17186200),

                (4, '2022-08-19', 288.90, 289.25, 285.56, 286.15, 20557200),

                (4, '2022-08-22', 282.08, 282.46, 277.22, 277.75, 25061100),

                (4, '2022-08-23', 276.44, 278.86, 275.40, 276.44, 17527400),

                (4, '2022-08-24', 275.41, 277.23, 275.11, 275.79, 18137000),

                (4, '2022-08-25', 277.33, 279.02, 274.52, 278.85, 16583400),

                (4, '2022-08-26', 279.08, 280.34, 267.98, 268.09, 27532500),

                (4, '2022-08-29', 265.85, 267.40, 263.85, 265.23, 20338500),

                (4, '2022-08-30', 266.67, 267.05, 260.66, 262.97, 22767100)

        """;

        try{

            this.executeMe(company,"Update");

            this.executeMe(stockprices,"Update");

        }catch(Exception e){

            System.out.println("Error: Inserting Data: "+e.getMessage());

        }

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*Fig.3.18 Command prompt showing the initiation of data insertion into tables using a Java program for MySQL database operations.*

5. delete() [5] Delete all stock price records where the date is before 2022-08-20 or the company is GameStop

 public void dropTables(){

        try{

            String query = "DROP TABLE stockprice";

            this.executeMe(query,"Update");

            query = "DROP TABLE company";

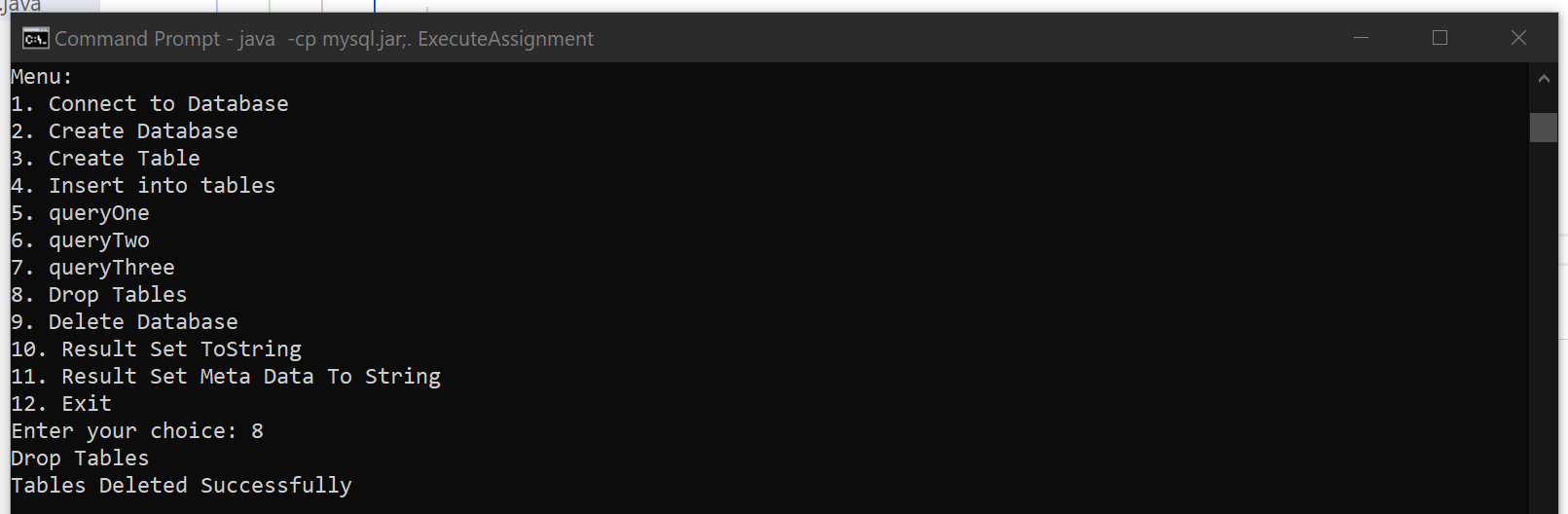
            this.executeMe(query,"Update");

            System.out.println("Tables Deleted Successfully");

        }catch(Exception e){

            System.out.println("Error: Creating Database - " +e.getMessage());

        }

    }

*Fig.3.19 Command prompt showing successful deletion of tables using a Java program for MySQL database management.*

6. queryOne(): //TODO for returning ResultSet [5] Query returns company info (name, revenue, employees) that have more than 10000 employees or annual revenue less that 1 million dollars. Order by company name ascending.

public void queryOne(){

        String query = """

            SELECT name, annualRevenue, numEmployees

            FROM company

            WHERE numEmployees > 10000 OR annualRevenue < 1000000

            ORDER BY name ASC

            """;

        try{

            this.rs = this.executeMe(query,"Query");

            this.print(rs, "Query One");

        }catch(Exception e){

            System.out.println("Error Executing Query: " + e.getMessage());

        }

    }

*A screenshot of a computer

Description automatically generatedFig.3.20 Command prompt displaying the execution of a query to retrieve and display table data, including company names, annual revenue, and number of employees.*

7. queryTwo() ://TODO for returning ResultSet [5] Query returns the company name and ticker and calculates the lowest price, highest price, average closing price, and average volume in the week of August 22nd to 26th inclusive. Order by average volume descending.

public void queryTwo(){

        String query = """

            SELECT c.name, c.ticker,

                   MIN(s.lowPrice) AS lowestPrice,

                   MAX(s.highPrice) AS highestPrice,

                   AVG(s.closePrice) AS avgClosingPrice,

                   AVG(s.volume) AS avgVolume

            FROM company c

            JOIN stockprice s ON c.id = s.companyId

            WHERE s.priceDate BETWEEN '2022-08-22' AND '2022-08-26'

            GROUP BY c.id, c.name, c.ticker

            ORDER BY avgVolume DESC

            """;

        try{

            this.rs = this.executeMe(query,"Query");

            this.print(rs, "Query Two");

        }catch(Exception e){

            System.out.println("Error Executing Query: " + e.getMessage());

        }

    }

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*Fig.3.21 Command prompt displaying the execution of a query to retrieve stock data, including company name, ticker, price details, and average trading volume.*

8. queryThree() : //TODO for returning ResultSet [5] Query returns a list of all companies that displays their name, ticker, and closing stock price on August 30, 2022 (if exists). Only show companies where their closing stock price on August 30, 2022 is no more than 10% below the closing average for the week of August 15th to 19th inclusive. That is, if closing price is currently 100, the average closing price must be <= 110. Companies without a stock ticker should always be shown in the list. Order by company name ascending.

public void queryThree(){

        String query = """

        SELECT c.name, c.ticker, s.closePrice

        FROM company c

        LEFT JOIN stockprice s ON c.id = s.companyId

        AND s.priceDate = '2022-08-30'

        WHERE (s.closePrice IS NULL OR s.closePrice >= 0.9 \* (

                    SELECT AVG(closePrice)

                    FROM stockprice

                    WHERE priceDate BETWEEN '2022-08-15' AND '2022-08-19'

                ))

        ORDER BY c.name ASC;

        """;

        try{

            this.rs = this.executeMe(query,"Query");

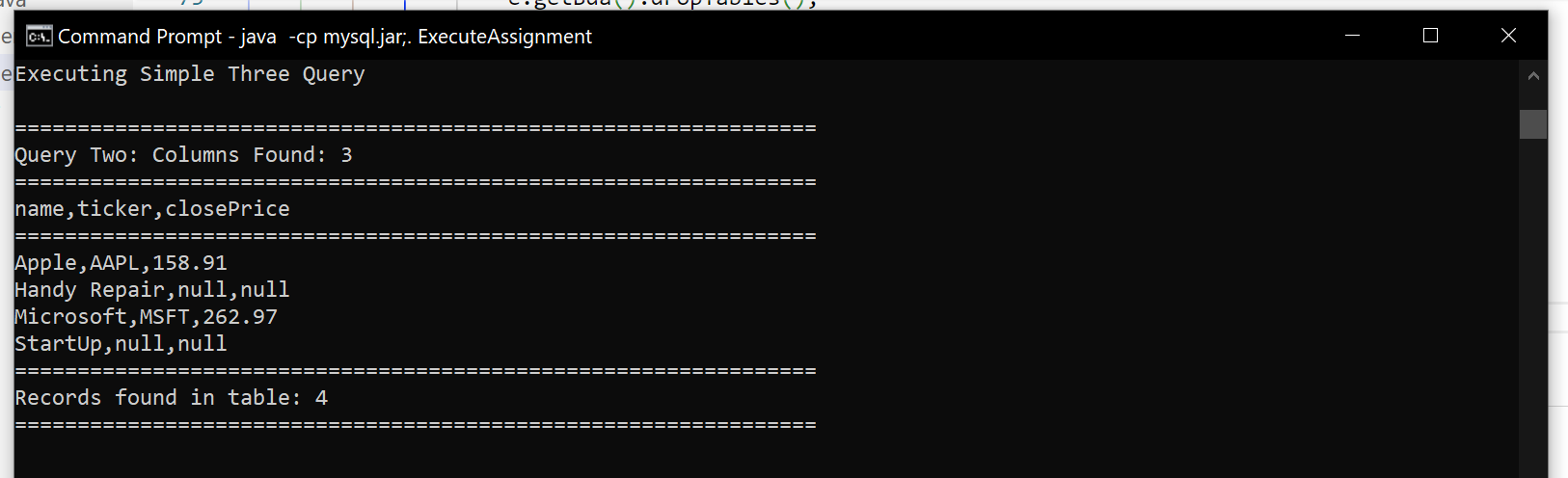
            this.print(rs, "Query Two");

        }catch(Exception e){

            System.out.println("Error Executing Query: " + e.getMessage());

        }

    }



*Fig.3.22 Command prompt displaying the execution of a query retrieving company names, tickers, and closing prices, with some missing values in the dataset.*

9. resultSetToString(): converts a ResultSet obtained front he queries to String (Given)

public void resultSetToString(String table){

        String query = "SELECT \* FROM "+table;

        try{

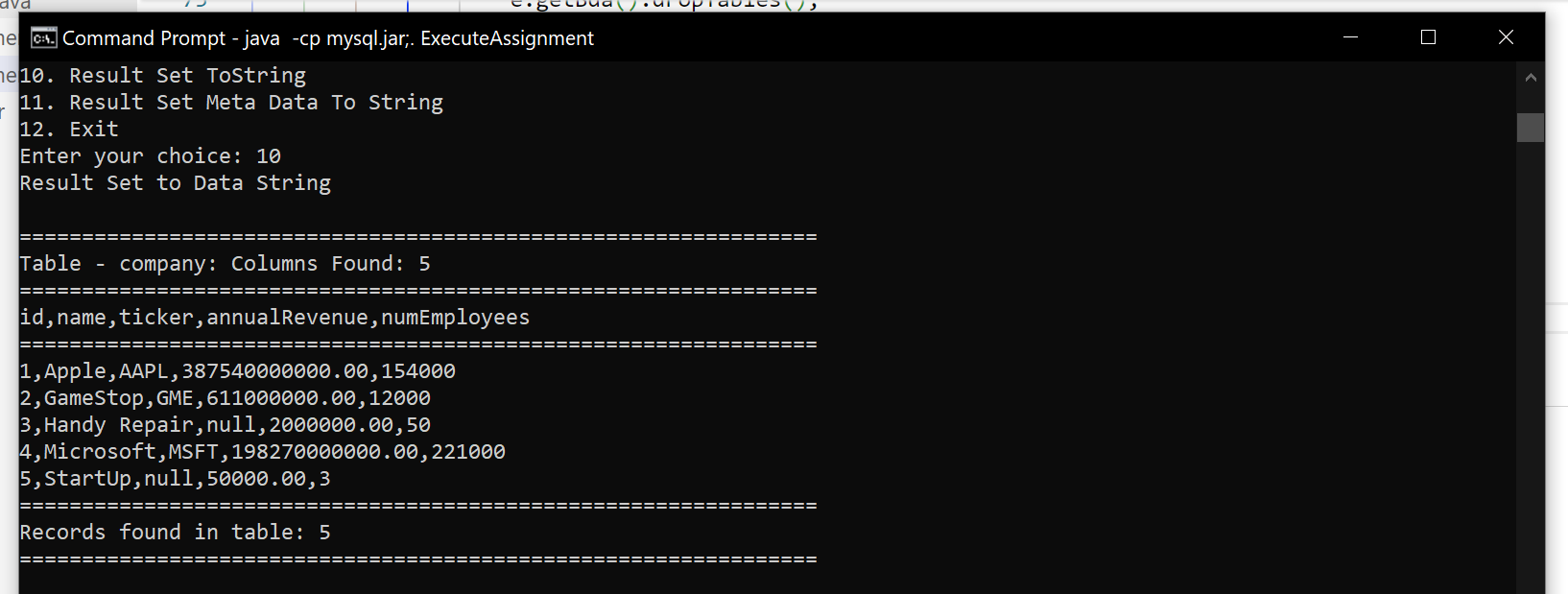
            ResultSet rs = this.executeMe(query,"Query");

            this.print(rs,"Table - "+table);

        }catch(Exception e){

            System.out.println("Error: Result Set to String Conversion: - " +e.getMessage());

        }

    }

*Fig.3.23 Command prompt displaying the result set converted to a data string, showing company details including ID, name, ticker, annual revenue, and number of employees.*

10. resultSetMetaDataToString() : converts resultSetMetaData to String or the String of the metadata (Schema)

public void resultSetMetaDataToString(String table){

        String query = "SELECT table\_schema, table\_name, column\_name, ordinal\_position, data\_type,numeric\_precision, column\_type, column\_default, is\_nullable, column\_comment FROM information\_schema.columns WHERE table\_name = '"+table+"' order by ordinal\_position";

        try{

            ResultSet rs = this.executeMe(query,"Query");

            this.print(rs,"Metadata: "+table);

        }catch(Exception e){

            System.out.println("Error: Generating Metadata - " +e.getMessage());

        }

A screenshot of a computer

Description automatically generated    }

*Fig.3.24 Command prompt displaying table data with stock price details, including company ID, date, open price, high price, low price, close price, and trading volume.*

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*Fig.3.25 Command prompt showing the successful deletion of a database and the program menu with the option to exit.*