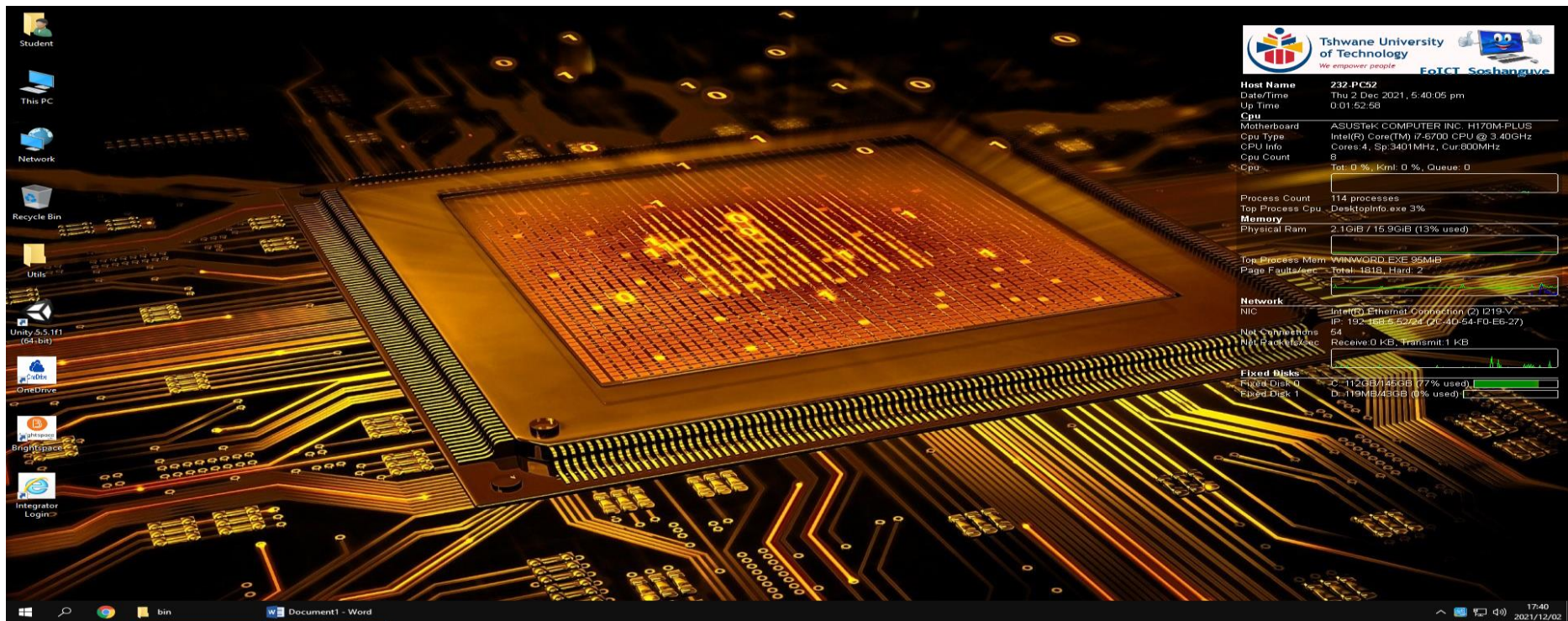


Tutorial

The purpose of this tutorial is to demonstrate a client-server application that interacts with the database. The application was developed in lab 10-232 in Soshanguve South campus.

A. Server machine details

The Server



The IP Address:

192.168.5.52

```
Administrator: Command Prompt
Microsoft Windows [Version 10.0.17134.1304]
(c) 2018 Microsoft Corporation. All rights reserved.

d:\>ipconfig

Windows IP Configuration

Ethernet adapter Ethernet 5:

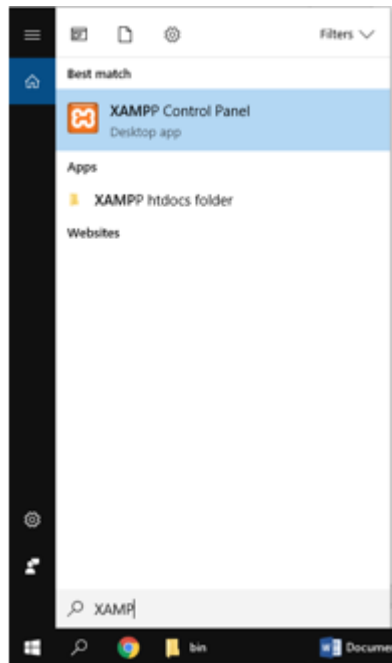
    Connection-specific DNS Suffix  . : tut.ac.za
    IPv4 Address. . . . . : 192.168.5.52
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 192.168.5.254

d:\>_
```

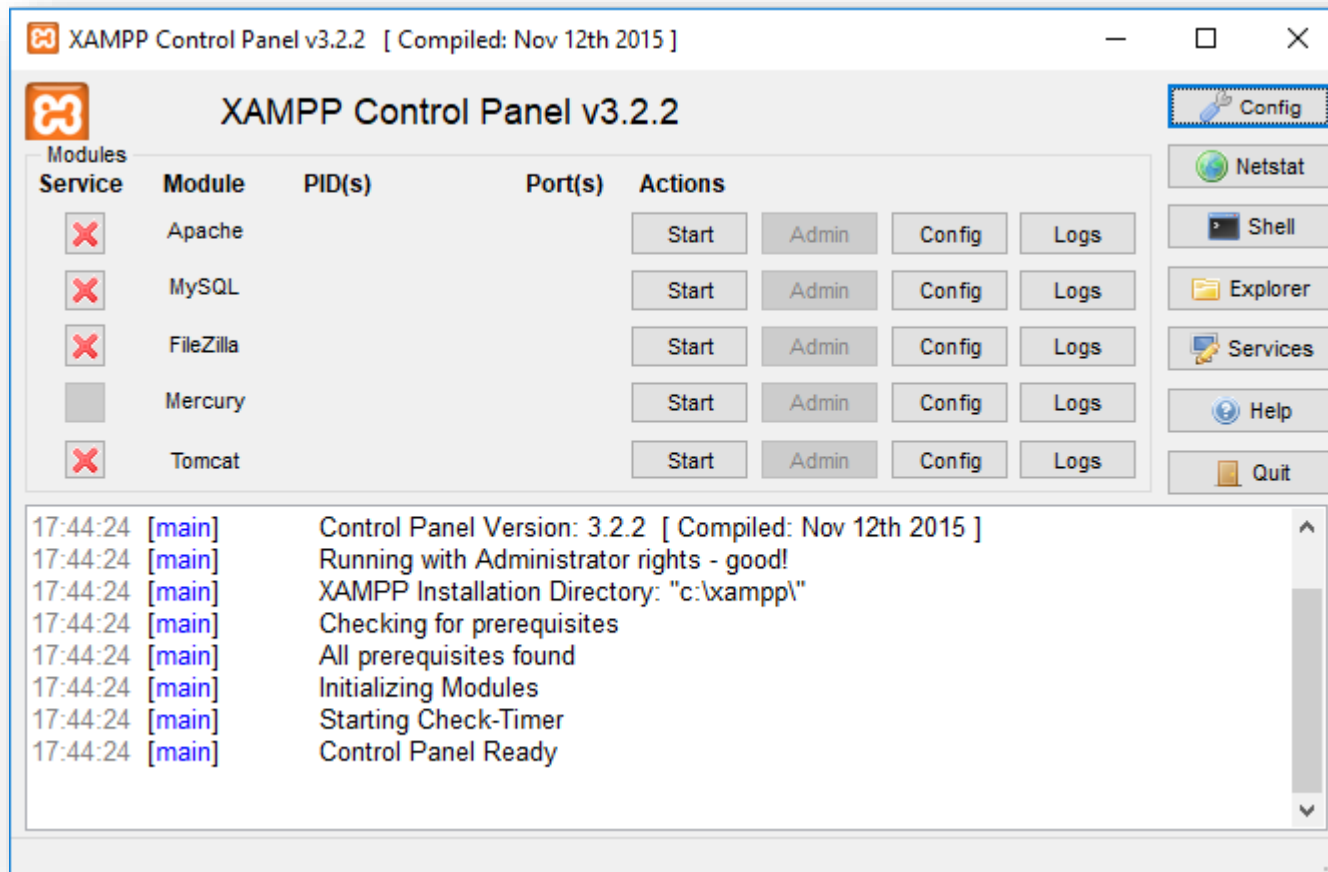
B. Start MySQL

Step 1

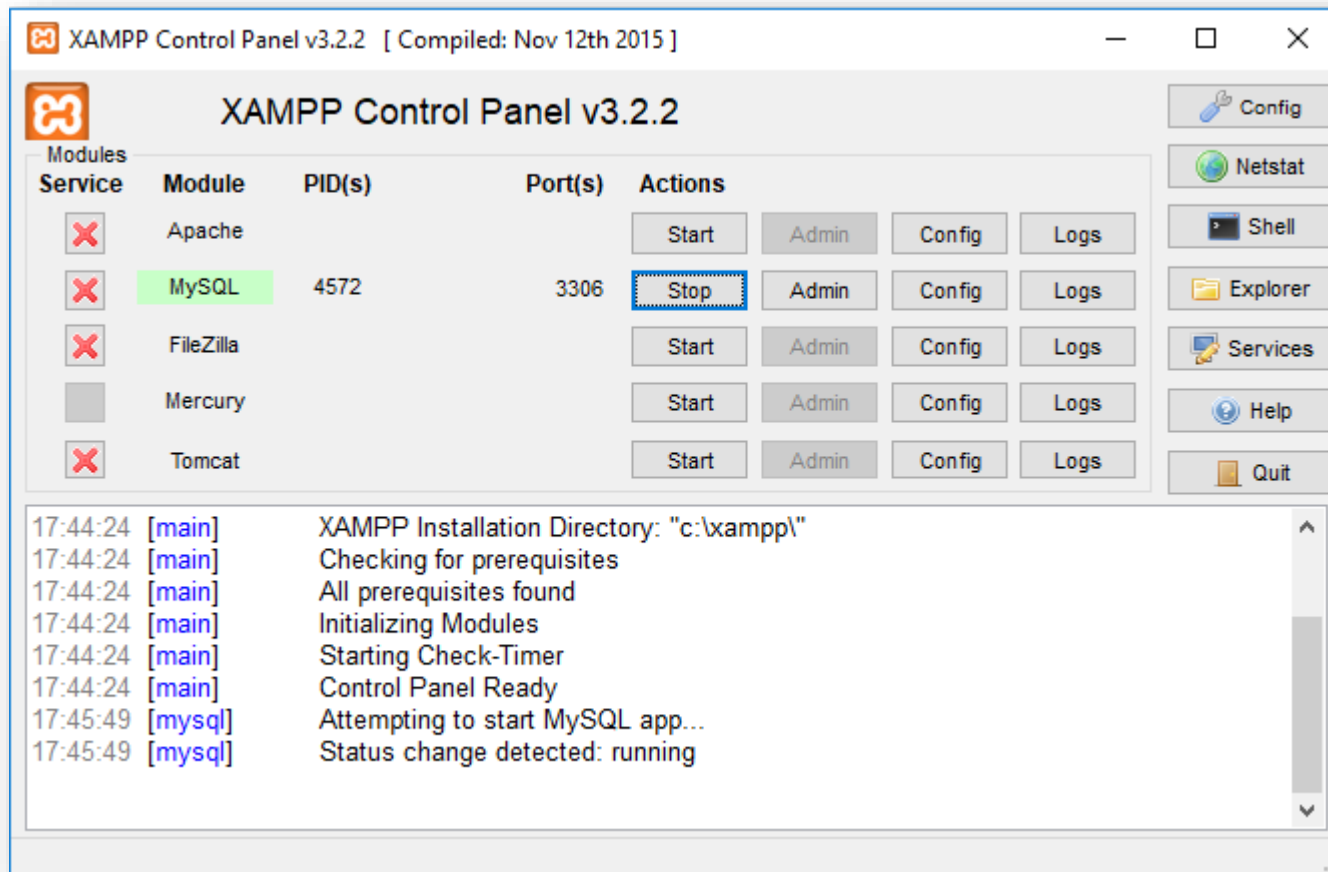
Search for XAMP



Click on XAMP Control Panel



Click on the **Start** button opposite **MySQL**.

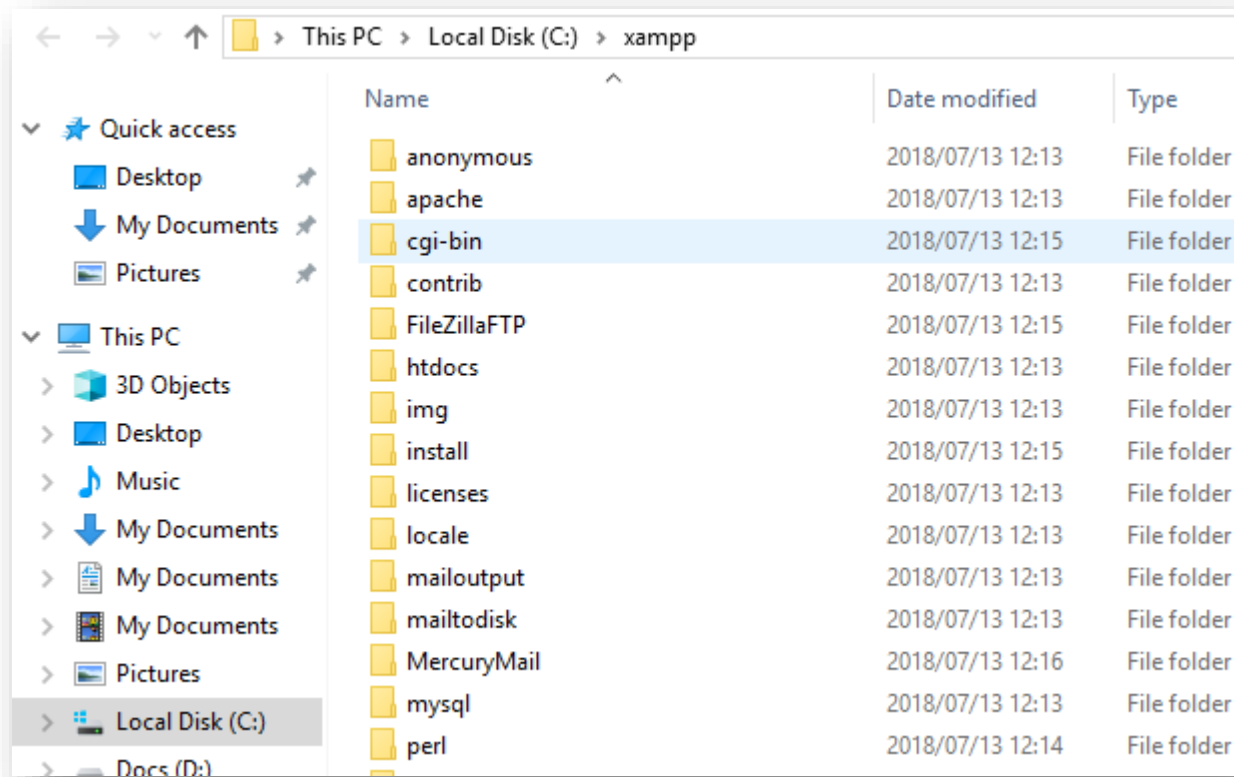


MySQL has started.

C. Access MySQL via the command line

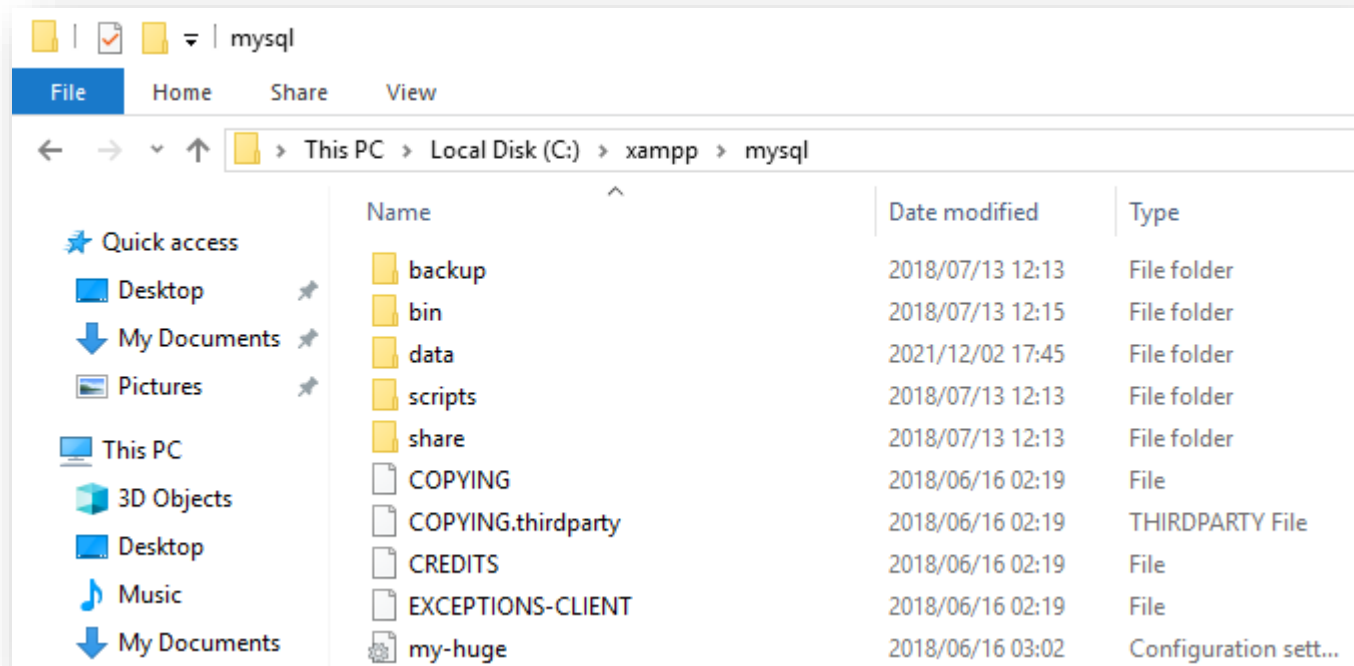
Step 1

Still on the XAMP window, click on Explorer folder.



Step 2

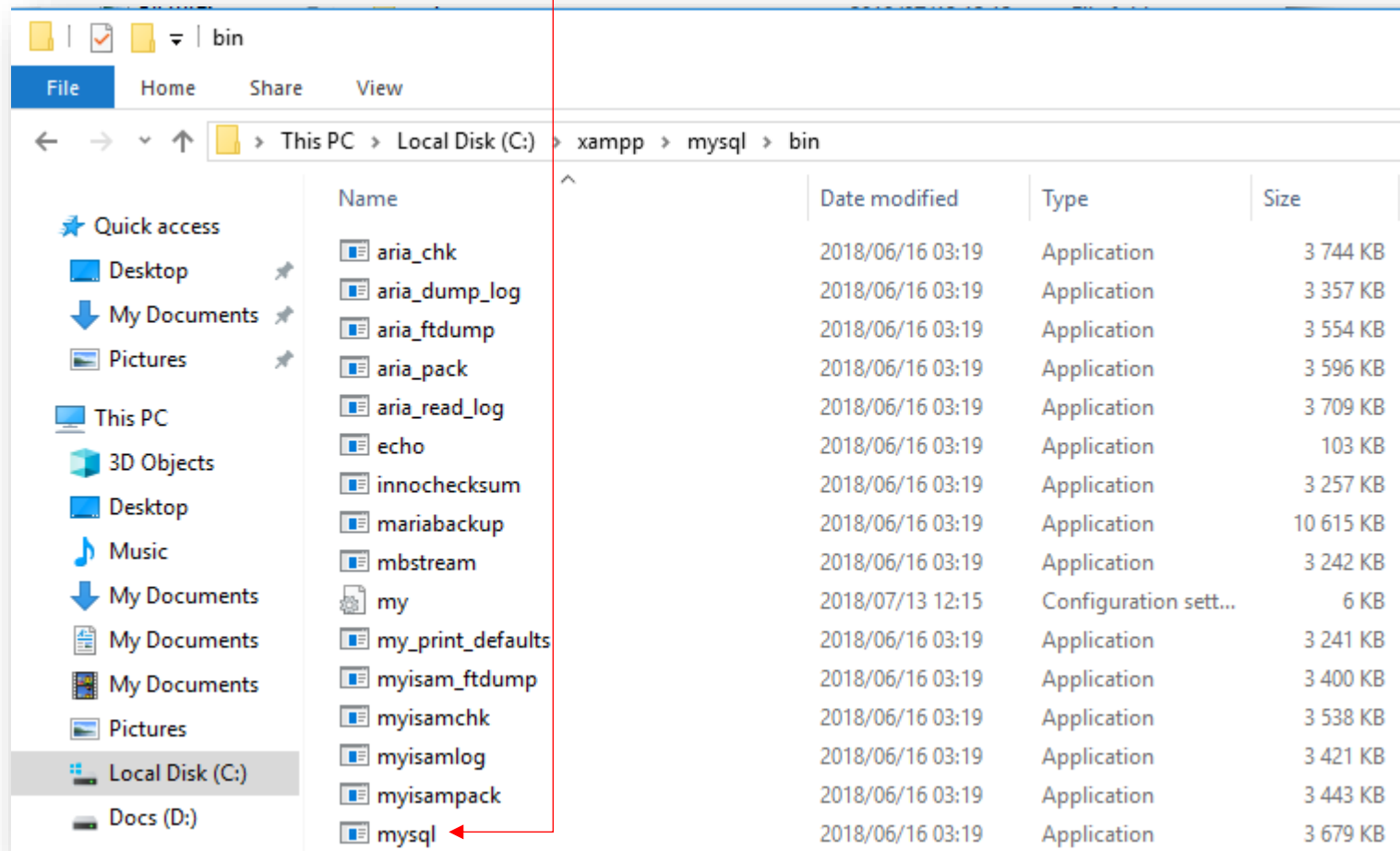
Open the **mysql** folder.



Step 3

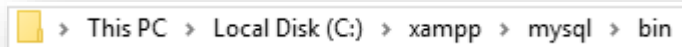
Open the **bin** folder.

WE ARE GOING
TO USE THIS APP.



Step 4

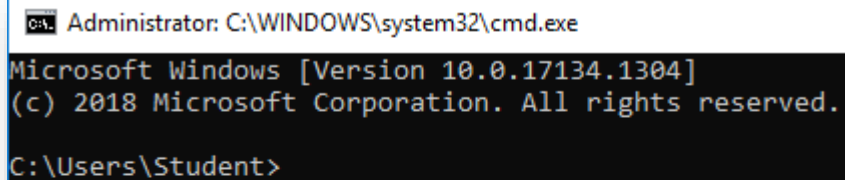
Copy the address.



> This PC > Local Disk (C:) > xampp > mysql > bin

Step 5

Start the command line.

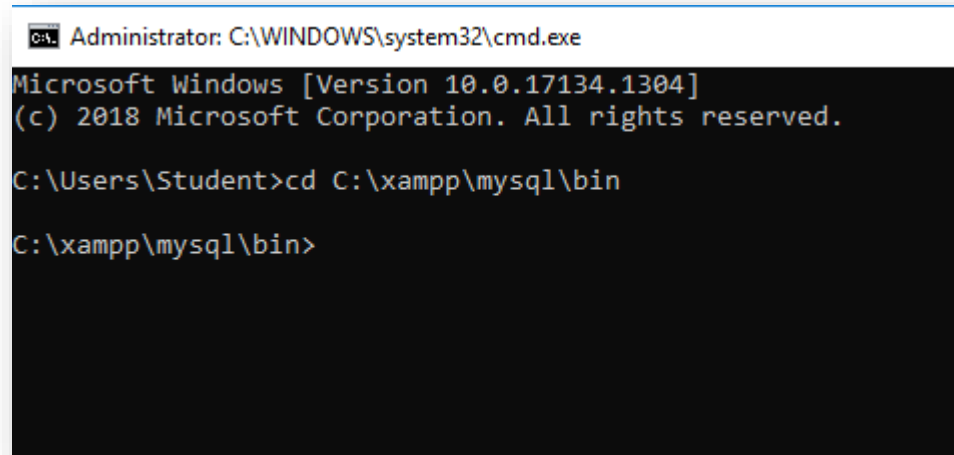


```
Administrator: C:\WINDOWS\system32\cmd.exe
Microsoft Windows [Version 10.0.17134.1304]
(c) 2018 Microsoft Corporation. All rights reserved.

C:\Users\Student>
```

Step 6

Change directory to the copied location.

A screenshot of a Windows Command Prompt window. The title bar at the top reads "Administrator: C:\WINDOWS\system32\cmd.exe". The window has a black background with white text. The first two lines are the standard Windows startup messages: "Microsoft Windows [Version 10.0.17134.1304]" and "(c) 2018 Microsoft Corporation. All rights reserved.". The third line shows the current directory as "C:\Users\Student" followed by a prompt character ">". The fourth line shows the command "cd C:\xampp\mysql\bin" being entered. The fifth line shows the prompt character ">" at the new directory "C:\xampp\mysql\bin", indicating the command was successful.

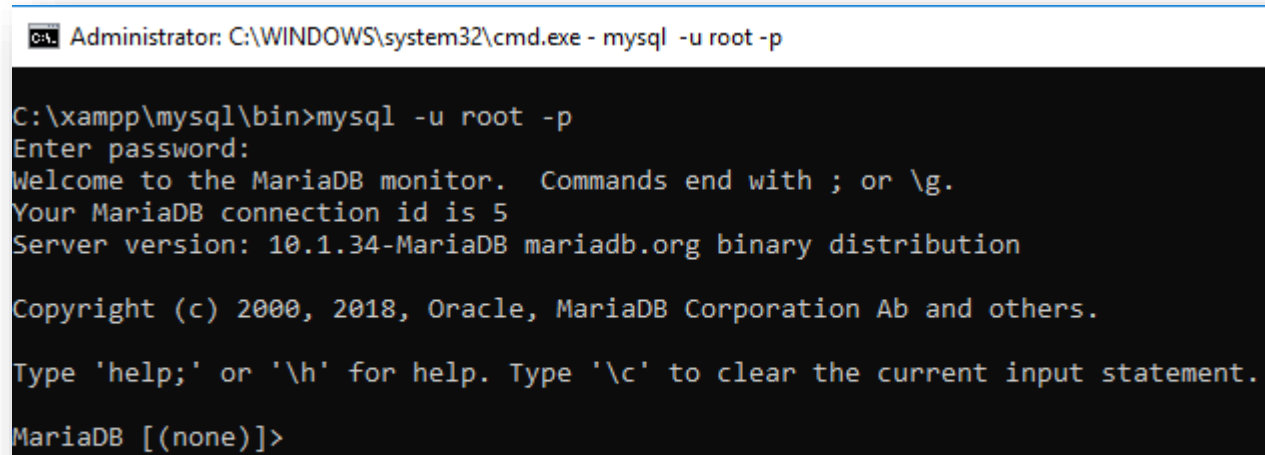
```
Administrator: C:\WINDOWS\system32\cmd.exe
Microsoft Windows [Version 10.0.17134.1304]
(c) 2018 Microsoft Corporation. All rights reserved.

C:\Users\Student>cd C:\xampp\mysql\bin

C:\xampp\mysql\bin>
```

Step 7

Login to MySQL server as the **root** user. Type **mysql -u root -p**. When prompted for password, just press the enter button.



```
Administrator: C:\WINDOWS\system32\cmd.exe - mysql -u root -p

C:\xampp\mysql\bin>mysql -u root -p
Enter password:
Welcome to the MariaDB monitor.  Commands end with ; or \g.
Your MariaDB connection id is 5
Server version: 10.1.34-MariaDB mariadb.org binary distribution

Copyright (c) 2000, 2018, Oracle, MariaDB Corporation Ab and others.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

MariaDB [(none)]>
```

Step 8

Create a new user called **student** with **123** as the password.

```
MariaDB [(none)]> CREATE USER 'student'@'localhost' IDENTIFIED BY '123';  
Query OK, 0 rows affected (0.00 sec)  
  
MariaDB [(none)]>
```

Step 9

Grant the user all the privileges.

```
MariaDB [(none)]> GRANT ALL PRIVILEGES ON *.* TO 'student'@'localhost';  
Query OK, 0 rows affected (0.00 sec)  
  
MariaDB [(none)]>
```

Step 10

Reload the privileges.

```
MariaDB [(none)]> FLUSH PRIVILEGES;  
Query OK, 0 rows affected (0.00 sec)  
  
MariaDB [(none)]>
```

Step 11

Create a database called **items_db**.

```
MariaDB [(none)]> CREATE DATABASE items_db;  
Query OK, 1 row affected (0.00 sec)  
  
MariaDB [(none)]>
```

Step 12

Use the database.

```
MariaDB [(none)]> USE items_db;  
Database changed  
MariaDB [items_db]>
```

Step 13

Create a table called **items_tbl**.

```
MariaDB [(none)]> USE items_db;  
Database changed  
MariaDB [items_db]> CREATE TABLE items_tbl  
-> (  
-> id INT NOT NULL PRIMARY KEY,  
-> description VARCHAR(50) NOT NULL,  
-> price DEC(6,2) NOT NULL  
-> )  
-> ;  
Query OK, 0 rows affected (0.23 sec)  
  
MariaDB [items_db]>
```

Step 14

Populate the table with data.

```
MariaDB [items_db]> INSERT INTO items_tbl  
-> VALUES  
-> (111, "OMO", 35.90),  
-> (222, "SURF", 45.50),  
-> (333, "COLGATE", 25.90)  
-> ;  
Query OK, 3 rows affected (0.04 sec)  
Records: 3  Duplicates: 0  Warnings: 0  
  
MariaDB [items_db]>
```

Step 15

Display all the data.

```
MariaDB [items_db]> SELECT * FROM items_tbl;  
+-----+-----+-----+  
| id | description | price |  
+-----+-----+-----+  
| 111 | OMO        | 35.90 |  
| 222 | SURF       | 45.50 |  
| 333 | COLGATE    | 25.90 |  
+-----+-----+-----+  
3 rows in set (0.00 sec)  
  
MariaDB [items_db]>
```

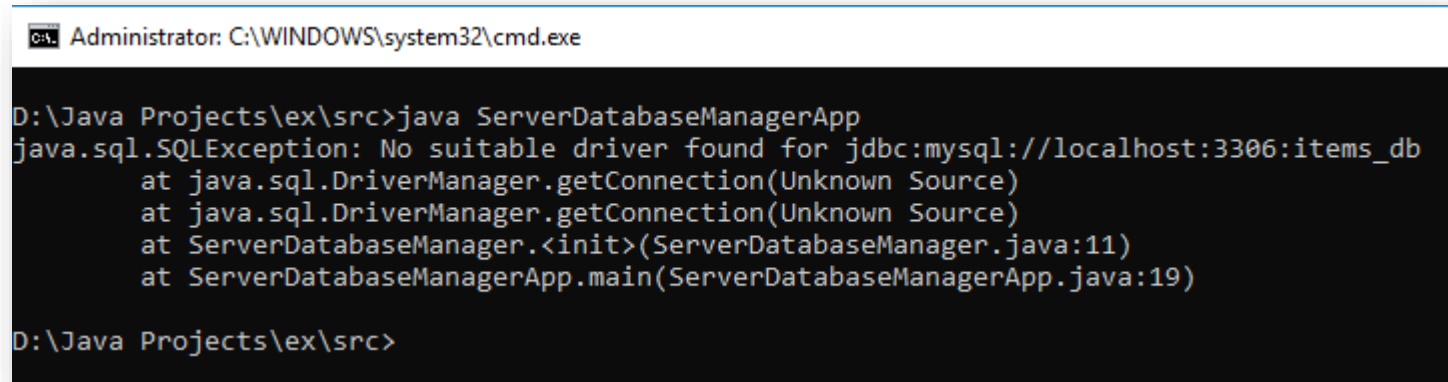
D. Create the Server application

ServerDatabaseManager.java

```
1  import java.sql.Connection;
2  import java.sql.ResultSet;
3  import java.sql.PreparedStatement;
4  import java.sql.DriverManager;
5  import java.sql.SQLException;
6
7  public class ServerDatabaseManager {
8      private Connection connection;
9
10     public ServerDatabaseManager(String url, String username, String password) throws SQLException {
11         connection = DriverManager.getConnection(url, username, password);
12     }
13
14     public ResultSet.getItems(String queryStatement) throws SQLException {
15         ResultSet results;
16         PreparedStatement statement;
17
18         statement = connection.prepareStatement(queryStatement);
19         results = statement.executeQuery();
20
21         return results;
22     }
23 }
24
```


ServerDatabaseManagerApp

When running the application you are likely to get the following exception.

A screenshot of a Windows command prompt window. The title bar reads "Administrator: C:\WINDOWS\system32\cmd.exe". The command prompt shows the execution of a Java application, which results in a SQLException. The exception message is "java.sql.SQLException: No suitable driver found for jdbc:mysql://localhost:3306:items_db". The stack trace includes the following lines: "at java.sql.DriverManager.getConnection(Unknown Source)", "at java.sql.DriverManager.getConnection(Unknown Source)", "at ServerDatabaseManager.<init>(ServerDatabaseManager.java:11)", and "at ServerDatabaseManagerApp.main(ServerDatabaseManagerApp.java:19)". The prompt then returns to the directory "D:\Java Projects\ex\src>".

```
Administrator: C:\WINDOWS\system32\cmd.exe

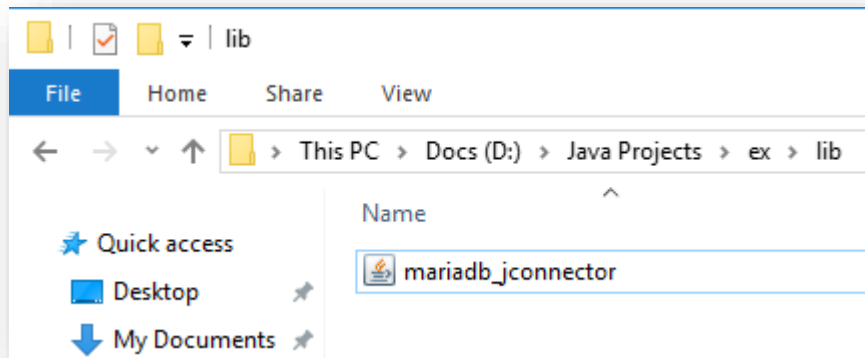
D:\Java Projects\ex\src>java ServerDatabaseManagerApp
java.sql.SQLException: No suitable driver found for jdbc:mysql://localhost:3306:items_db
    at java.sql.DriverManager.getConnection(Unknown Source)
    at java.sql.DriverManager.getConnection(Unknown Source)
    at ServerDatabaseManager.<init>(ServerDatabaseManager.java:11)
    at ServerDatabaseManagerApp.main(ServerDatabaseManagerApp.java:19)

D:\Java Projects\ex\src>
```

Download the following J-Connector drivers (classes):

mariadb-java-client-2.7.4

Store in the D drive and rename to **mariadb_jconnector**

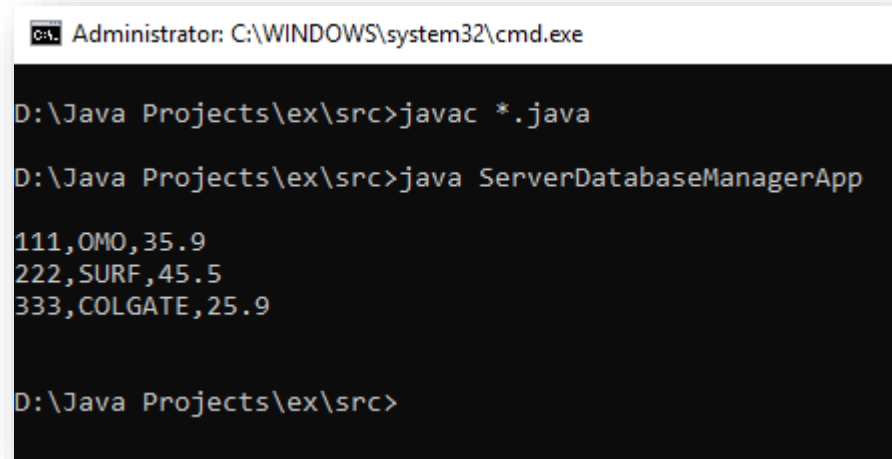


On the command line, set the **classpath** to this jar file.

```
Administrator: C:\WINDOWS\system32\cmd.exe

D:\Java Projects\ex\src>set classpath=.;D:\Java Projects\ex\lib\mariadb_jconnector.jar
D:\Java Projects\ex\src>
```

Compile and run your classes again



```
Administrator: C:\WINDOWS\system32\cmd.exe

D:\Java Projects\ex\src>javac *.java

D:\Java Projects\ex\src>java ServerDatabaseManagerApp

111,OMO,35.9
222,SURF,45.5
333,COLGATE,25.9

D:\Java Projects\ex\src>
```

The image shows a Windows command prompt window titled "Administrator: C:\WINDOWS\system32\cmd.exe". The prompt is at "D:\Java Projects\ex\src>". The user enters "javac *.java" to compile the code. Then, they enter "java ServerDatabaseManagerApp" to run the program. The program outputs three lines of data: "111,OMO,35.9", "222,SURF,45.5", and "333,COLGATE,25.9". The prompt returns to "D:\Java Projects\ex\src>" after the execution.

E. Modify the server application to accept requests.

```
import java.sql.Connection;
```

```
import java.sql.ResultSet;
```

```
import java.sql.PreparedStatement;
```

```
import java.sql.DriverManager;
```

```
import java.sql.SQLException;
```

```
import java.net.ServerSocket;
```

```
import java.net.Socket;
```

```
import java.io.*;
```

```
public class ServerDatabaseManagerApp {
```

```
    public static void main(String[] args) {
```

```
        String url = "jdbc:mysql://localhost:3306/items_db";
```

```
        String username = "student";
```

```
        String password = "123";
```

```
        String queryStatement = "SELECT * FROM items_tbl";
```

```
        String data = "";
```

```
        ServerDatabaseManager sdbM = null;
```

```
        ResultSet results;
```

```
        ServerSocket s = null;
```

```
Socket socket = null;

BufferedReader in = null;

PrintWriter out = null;

String response;

//open connection
try {
    s = new ServerSocket(9191);

    System.out.println("s = " + s);

    socket = s.accept();

    System.out.println("socket = " + socket);

    in = new BufferedReader(new InputStreamReader(socket.getInputStream()));

    out = new PrintWriter(new BufferedWriter(new OutputStreamWriter(socket.getOutputStream())), true);

    sdbM = new ServerDatabaseManager(url, username, password);

    while(true){
        //read the query
```

```
        queryStatement = in.readLine();

        //get the items from the database
        results = sdbM.getItems(queryStatement);

        //generate response
        response = generateResponse(results);

        //send response back
        out.println(response);
    }
} catch (SQLException ex){
    ex.printStackTrace();
} catch (IOException ioe){
    ioe.printStackTrace();
} finally {
    System.out.println("GoodBye!!!");
    try {
        socket.close();
    } catch (IOException ioe){
```

```
        ioe.printStackTrace();
    }
}
}
```

```
private static String generateResponse(ResultSet results) throws SQLException {
```

```
    String data = "";
```

```
    //iterate through the items
```

```
    while(results.next()){
```

```
        int id = results.getInt("id");
```

```
        String desc = results.getString("description");
```

```
        double price = results.getDouble("price");
```

```
        data = data + id + "," + desc + "," + price + "\n";
```

```
    }
```

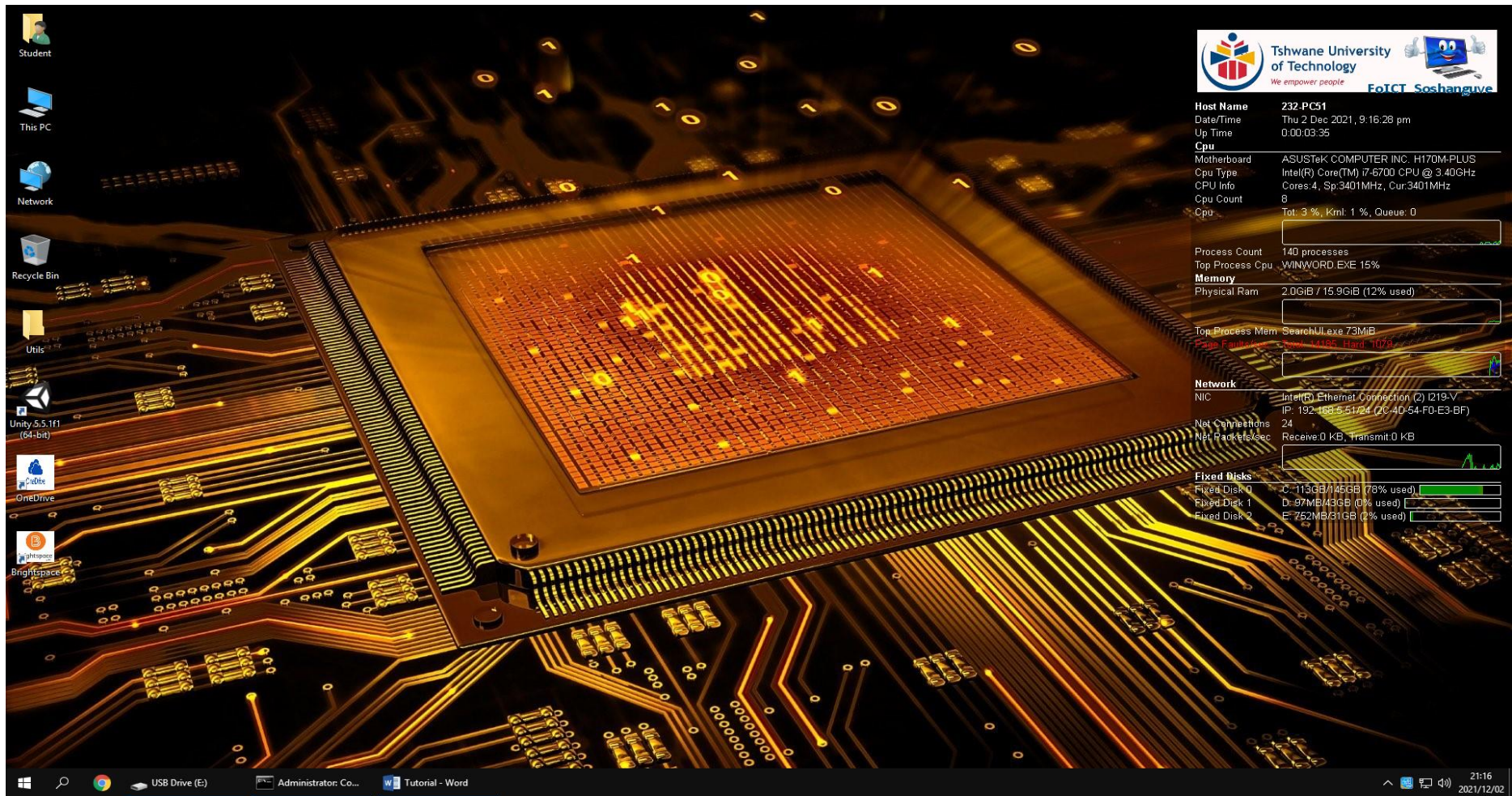
```
    return data;
```

```
}
```

```
}
```

F. The client machine details

The client: PC number 51



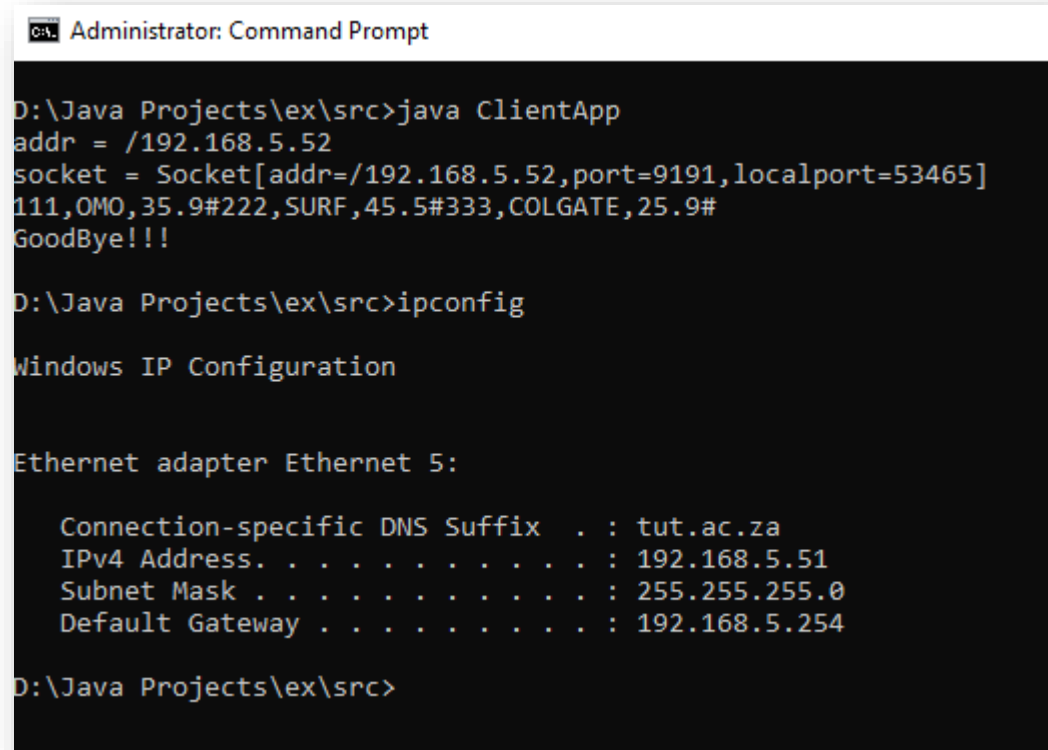
The screenshot shows a Windows 10 desktop environment. The background is a detailed, glowing orange and yellow circuit board with a central CPU chip. On the left side of the desktop, there are several icons: 'Student', 'This PC', 'Network', 'Recycle Bin', 'Utilities', 'Unity 5.5.16f1 (64-bit)', 'OneDrive', and 'Brightspace'. The taskbar at the bottom displays the Start button, a search icon, and several open applications: 'USB Drive (E:)', 'Administrator: Co...', and 'Tutorial - Word'. The system tray on the right shows the time as 21:16 and the date as 2021/12/02.

In the top right corner, there is a logo for 'Tshwane University of Technology' with the tagline 'We empower people' and 'FoICT Soshanguve'. Below the logo, a system information window is open, displaying the following details:

Host Name	
Date/Time	Thu 2 Dec 2021, 9:16:28 pm
Up Time	0:00:03:35
Cpu	
Motherboard	ASUSTeK COMPUTER INC. H170M-PLUS
Cpu Type	Intel(R) Core(TM) i7-6700 CPU @ 3.40GHz
CPU Info	Cores: 4, Sp: 3401MHz, Cur: 3401MHz
Cpu Count	8
Cpu	Tot: 3 %, Kml: 1 %, Queue: 0
Process Count	140 processes
Top Process Cpu	_WINWORD.EXE 15%
Memory	
Physical Ram	2.0GiB / 15.9GiB (12% used)
Top Process Mem	SearchUI.exe 73MiB
Page Faults/sec	Task: 14195, Hard: 1079
Network	
NIC	Intel(R) Ethernet Connection (2) I219-V
IP	192.168.5.51/24 (2C:4D:54:F0:E3:BF)
Net Connections	24
Net Packets/sec	Receive: 0 KB, Transmit: 0 KB
Fixed Disks	
Fixed Disk 0	C: 115GB / 45GB (78% used)
Fixed Disk 1	D: 97MB / 43GB (0% used)
Fixed Disk 2	E: 752MB / 31GB (2% used)

IP address

192.168.5.51



```
Administrator: Command Prompt

D:\Java Projects\ex\src>java ClientApp
addr = /192.168.5.52
socket = Socket[addr=/192.168.5.52,port=9191,localport=53465]
111,OMO,35.9#222,SURF,45.5#333,COLGATE,25.9#
GoodBye!!!

D:\Java Projects\ex\src>ipconfig

Windows IP Configuration

Ethernet adapter Ethernet 5:

    Connection-specific DNS Suffix  . : tut.ac.za
    IPv4 Address. . . . . : 192.168.5.51
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 192.168.5.254

D:\Java Projects\ex\src>
```

The code of the client PC machine

```
import java.io.*;

import java.net.*;

public class ClientApp {

    public static void main(String[] args){

        InetAddress addr = null;

        Socket socket = null;

        BufferedReader in = null;

        PrintWriter out = null;

        //query string

        String queryString = "SELECT * FROM items_tbl";

        String response;

        try {

            addr = InetAddress.getByName("192.168.5.52");

            System.out.println("addr = " + addr);

            socket = new Socket(addr, 9191);

            System.out.println("socket = " + socket);
```

```
//reading stream
in = new BufferedReader(new InputStreamReader(socket.getInputStream()));

//writing stream
out = new PrintWriter(new BufferedWriter(new OutputStreamWriter(socket.getOutputStream())), true);

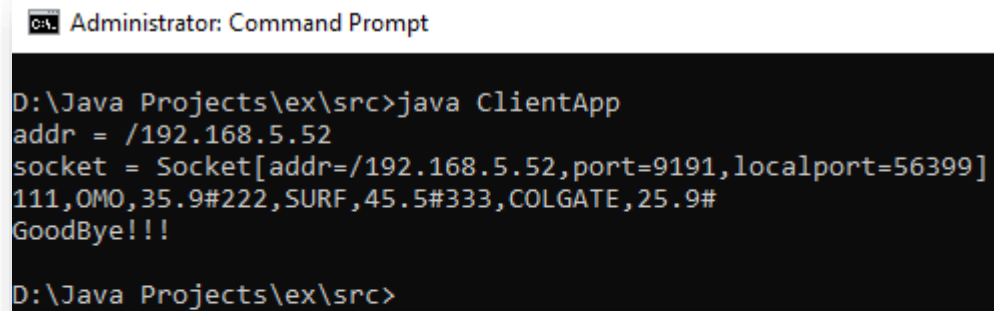
//send the sql query
out.println(queryString);

//get the response
response = in.readLine();

//display response
System.out.println(response);
} catch(IOException ioe){
    ioe.printStackTrace();
} finally {
    System.out.println("GoodBye!!!");
    try {
        socket.close();
    }
```

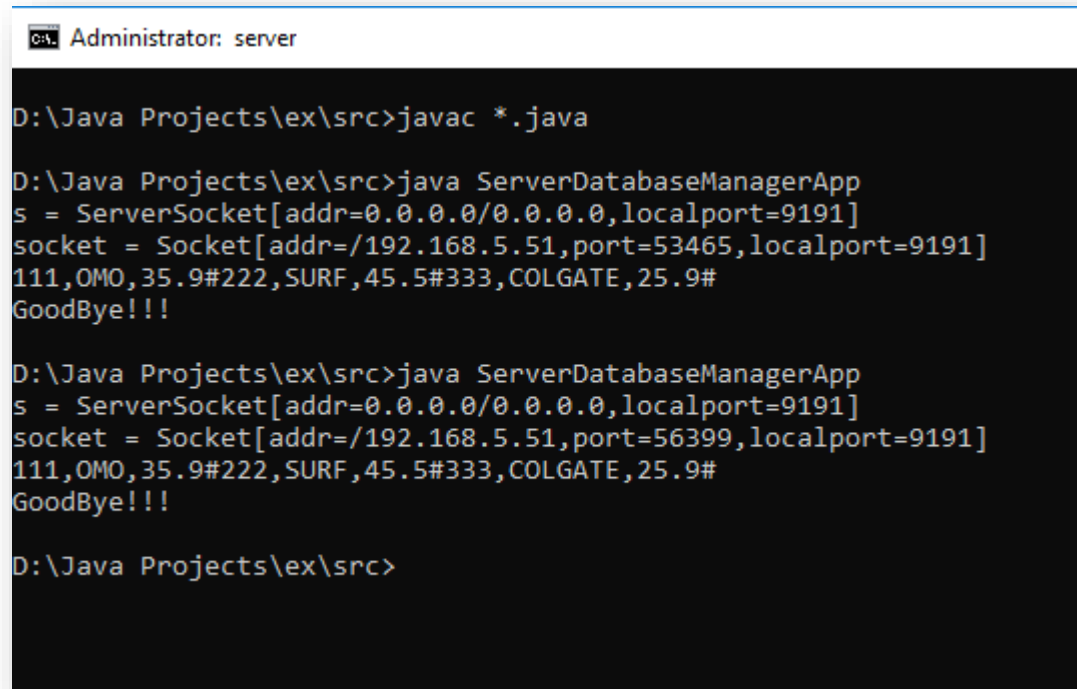
```
        } catch(IOException ioe){  
            ioe.printStackTrace();  
        }  
    }  
}  
}
```

Output:



```
Administrator: Command Prompt  
  
D:\Java Projects\ex\src>java ClientApp  
addr = /192.168.5.52  
socket = Socket[addr=/192.168.5.52,port=9191,localport=56399]  
111,OMO,35.9#222,SURF,45.5#333,COLGATE,25.9#  
GoodBye!!!  
  
D:\Java Projects\ex\src>
```

Server side output:



```
Administrator: server

D:\Java Projects\ex\src>javac *.java

D:\Java Projects\ex\src>java ServerDatabaseManagerApp
s = ServerSocket[addr=0.0.0.0/0.0.0.0,localport=9191]
socket = Socket[addr=/192.168.5.51,port=53465,localport=9191]
111,OMO,35.9#222,SURF,45.5#333,COLGATE,25.9#
GoodBye!!!

D:\Java Projects\ex\src>java ServerDatabaseManagerApp
s = ServerSocket[addr=0.0.0.0/0.0.0.0,localport=9191]
socket = Socket[addr=/192.168.5.51,port=56399,localport=9191]
111,OMO,35.9#222,SURF,45.5#333,COLGATE,25.9#
GoodBye!!!

D:\Java Projects\ex\src>
```