CSCT Cloud Server: Accessing MySQL from CSCT Cloud using CLI and GUI tools

for

Web Development and Databases *

(UFCFES-30-1)

Version 2.1

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* This guide can also be used by other modules which would like to use the MySQL server from the CSCT Cloud.

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1. About

This document provides a quick guide on how to access MySQL Server from the CSCT Cloud using both the Command Line Interface (CLI) and a Graphical User Interface (GUI) such as MySQL Workbench.

It also contains important information on deriving your database server username and password, which you will need in order to connect to the DB server and execute queries on it.

1.1 Important and pre-requisite

This guide will assume that you have already setup SSH keys by following the guide ***CSCT Cloud Server: Accessing Remote Server using Azure CLI and SSH Key*** and you have secure access to the CSCTCloud server.

If you have not setup your access to the server then please first follow that guide.

2. Configuring and accessing the database server

We'll be using the MySQL DB server. The version installed on CSCTCloud is *MySQL Community Edition*.

You'll only be able to gain access to your DB on the remote server if you're connected to it by SSH. You can use the **`az ssh`** or **`ssh`** commands on Windows in Command Prompt (or Terminal on Linux/macOS), or you can connect using VS Code.

Please refer to the first two guides *Accessing CSCT Cloud using Azure CLI and SSH Keys* and *Setting up remote development for VS Code* for detailed instructions.

If you like, you can also download and install *MySQL Community Edition* on your local machine from https://dev.mysql.com/downloads/. This will allow you to enjoy the privileges of root access (that means admin rights) to create and manipulate databases on your own machine, but this is optional.

You can use a Command Line Interface (CLI) or a Graphical User Interface (GUI) tool to gain access to the remote database server. You can learn and write your SQL statements through the CLI without needing to use a GUI, and you can also use the VS Code terminal to access and work with a MySQL database using the CLI.

2.1 Using the CLI (Command Line Interface)

The CLI allows DB users to access a DB using a terminal program; this is more convenient for students who would like to type commands and are familiar with a terminal/command prompt.

You can SSH to the remote server through the command prompt/terminal window using the following command (see also Figure 1):

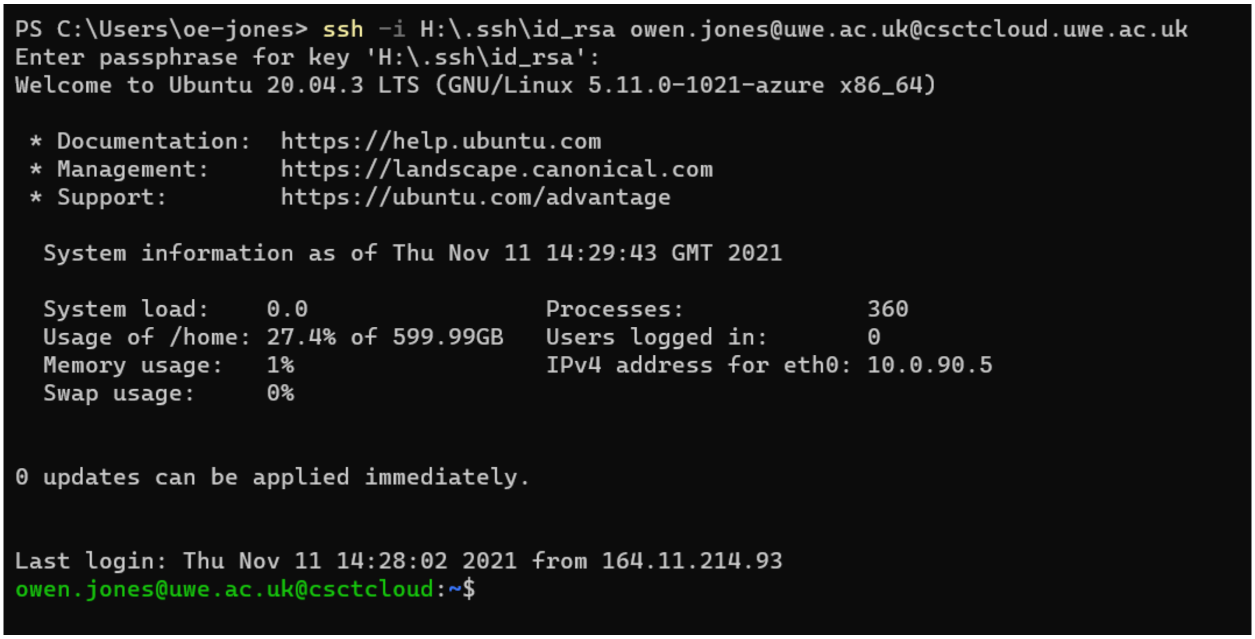
```
ssh <your UWE email>@csctcloud.uwe.ac.uk
```

If you're using a UWE lab machine

Remember, if you're using SSH from a UWE lab machine we need to tell the SSH program your keys are on your `H:\` drive, not on the local machine. We do this using the `-i` flag:

```
ssh -i H:\.ssh\id_rsa <your UWE email>@csctcloud.uwe.ac.uk
```

Make sure you enter your email address using lowercase letters only. When prompted, enter your SSH key passphrase.



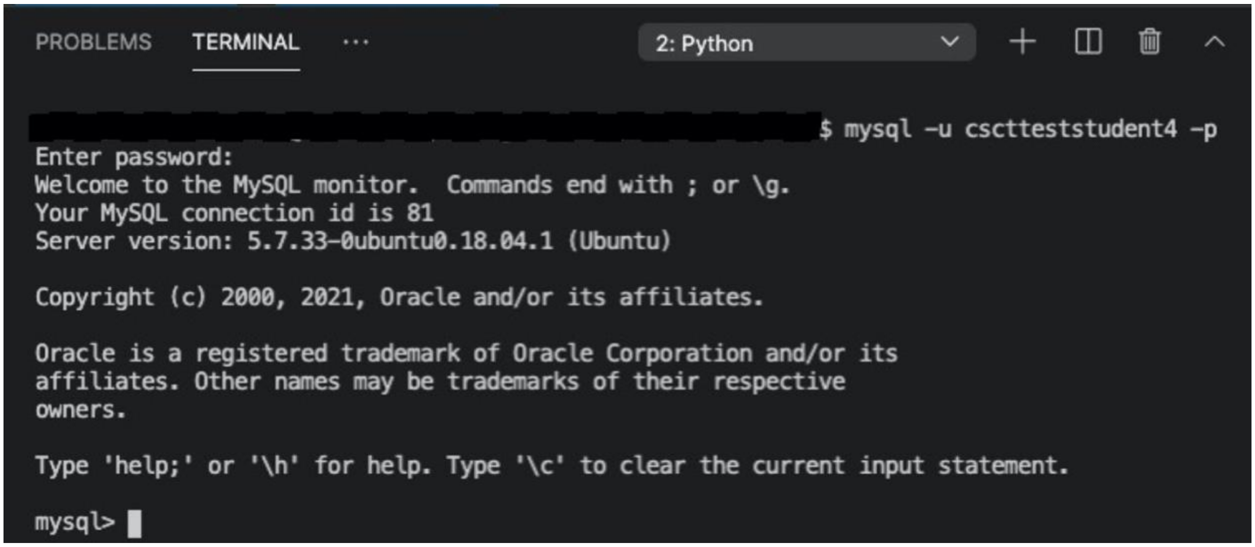
```
PS C:\Users\oe-jones> ssh -i H:\.ssh\id_rsa owen.jones@uwe.ac.uk@csctcloud.uwe.ac.uk
Enter passphrase for key 'H:\.ssh\id_rsa':
Welcome to Ubuntu 20.04.3 LTS (GNU/Linux 5.11.0-1021-azure x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

  System information as of Thu Nov 11 14:29:43 GMT 2021

  System load:     0.0                 Processes:             360
  Usage of /home:  27.4% of 599.99GB   Users logged in:       0
  Memory usage:    1%                  IPv4 address for eth0: 10.0.90.5
  Swap usage:      0%


0 updates can be applied immediately.


Last login: Thu Nov 11 14:28:02 2021 from 164.11.214.93
owen.jones@uwe.ac.uk@csctcloud:~$
```

Figure 1: Connecting to the remote server using SSH in the terminal

Once connected to the remote server you can connect to the MySQL database server using the command:

`mysql -u <your DB username> -p`

The output will be similar to the following Figure 2. **To find out your MySQL username and password, please refer to Section 3.**



```
[redacted]$ mysql -u csctteststudent4 -p
Enter password:
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 81
Server version: 5.7.33-0ubuntu0.18.04.1 (Ubuntu)

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affiliates. Other names may be trademarks of their respective
owners.

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

mysql> 
```
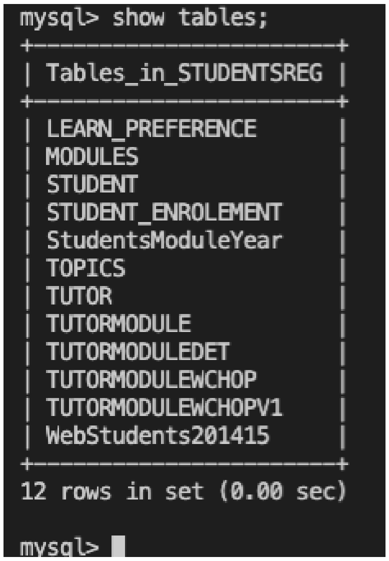
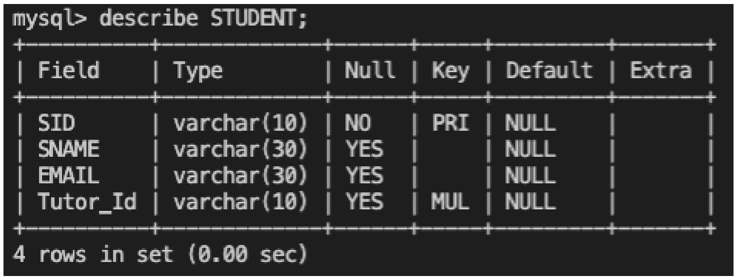

Figure 2: MySQL login using the CLI

Now you're in the MySQL shell, and you can run a number of different queries for which you have been granted privileges (i.e., enforcing database security) e.g., **`use STUDENTSREG;`** and then other queries — see Figure 3, Figure 4, and Figure 5.



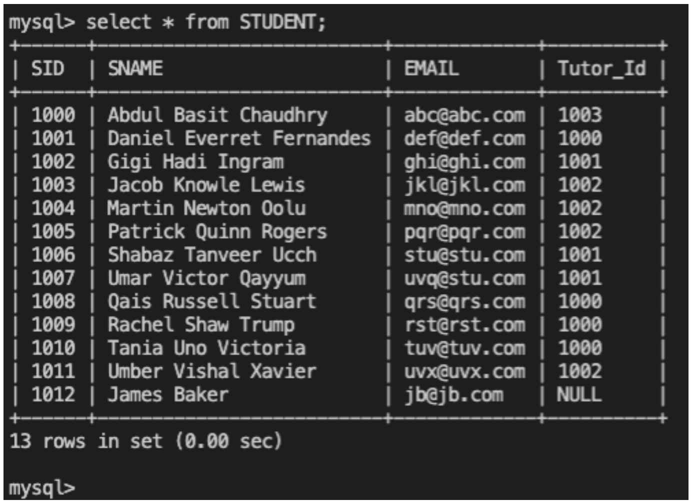
```
mysql> show tables;
+-----------------------+
| Tables_in_STUDENTSREG |
+-----------------------+
| LEARN_PREFERENCE      |
| MODULES               |
| STUDENT               |
| STUDENT_ENROLEMENT    |
| StudentsModuleYear    |
| TOPICS                |
| TUTOR                 |
| TUTORMODULE           |
| TUTORMODULEDET        |
| TUTORMODULEWCHOP      |
| TUTORMODULEWCHOPV1    |
| WebStudents201415     |
+-----------------------+
12 rows in set (0.00 sec)

mysql> 
```

Figure 3: Show tables query



```
mysql> describe STUDENT;
+----------+-------------+------+-----+---------+-------+
| Field    | Type        | Null | Key | Default | Extra |
+----------+-------------+------+-----+---------+-------+
| SID      | varchar(10) | NO   | PRI | NULL    |       |
| SNAME    | varchar(30) | YES  |     | NULL    |       |
| EMAIL    | varchar(30) | YES  |     | NULL    |       |
| Tutor_Id | varchar(10) | YES  | MUL | NULL    |       |
+----------+-------------+------+-----+---------+-------+
4 rows in set (0.00 sec)
```

Figure 4: Describe table query, showing structure of STUDENT table



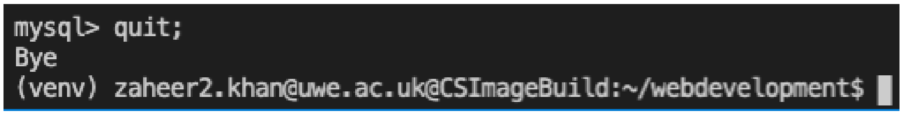
```
mysql> select * from STUDENT;
+------+--------------------------+-------------+----------+
| SID  | SNAME                    | EMAIL       | Tutor_Id |
+------+--------------------------+-------------+----------+
| 1000 | Abdul Basit Chaudhry     | abc@abc.com | 1003     |
| 1001 | Daniel Everret Fernandes | def@def.com | 1000     |
| 1002 | Gigi Hadi Ingram         | ghi@ghi.com | 1001     |
| 1003 | Jacob Knowle Lewis       | jkl@jkl.com | 1002     |
| 1004 | Martin Newton Oolu       | mno@mno.com | 1002     |
| 1005 | Patrick Quinn Rogers     | pqr@pqr.com | 1002     |
| 1006 | Shabaz Tanveer Ucch      | stu@stu.com | 1001     |
| 1007 | Umar Victor Qayyum       | uvq@stu.com | 1001     |
| 1008 | Qais Russell Stuart      | qrs@qrs.com | 1000     |
| 1009 | Rachel Shaw Trump        | rst@rst.com | 1000     |
| 1010 | Tania Uno Victoria       | tuv@tuv.com | 1000     |
| 1011 | Umber Vishal Xavier      | uvx@uvx.com | 1002     |
| 1012 | James Baker              | jb@jb.com   | NULL     |
+------+--------------------------+-------------+----------+
13 rows in set (0.00 sec)

mysql>
```

Figure 5: Fetching all records from the STUDENT table using SELECT query

Don’t worry we’ll learn the semantics of all these queries. At the moment, if you’re able to run the above queries this means your DB environment is successfully set up.

You can exit the MySQL shell using the **`quit`** command (see Figure 6), and you can terminate your SSH session with the remote server using **`exit`**.

Note: MySQL statements must be terminated by a semi colon **;**.



```
mysql> quit;
Bye
(venv) zaheer2.khan@uwe.ac.uk@CSImageBuild:~/webdevelopment$
```

Figure 6: Quitting the MySQL shell

2.2 Using a GUI (Graphical User Interface)

For security, external connections to the CSCTCloud server are restricted and therefore you cannot directly connect a GUI based MySQL client to the MySQL server hosted on CSCTCloud.

To get around this we need to use VS Code to create a connection for us. This requires you to have setup SSH keys for secure access to CSCTCloud, and to have setup VS Code for remote development.

Please refer to the first two guides *Accessing CSCT Cloud using Azure CLI and SSH Keys* and *Setting up remote development for VS Code* for instructions.

2.2.1 Remote server port forwarding

Applications and services are hosted on specific ports on a server machine. Forwarding a server port allows you to access the service or application hosted at that specific port on the remote server as if it was installed on your local machine. You can then use software on your local machine (e.g., a MySQL client, or a web browser) to interact with the service/application.

For example, later in this guide we are going to forward **port 3306**, which is the port the MySQL DB server is hosted at on CSCTCloud. We can then perform MySQL operations through MySQL client software such as VS Code with the MySQL extension, or MySQL Workbench, running on a lab or personal machine.

This process uses an *SSH tunnel*, which is created when you connect to the server using SSH, to securely send and receive data with the ports on the server you have forwarded. You will only be able to access these ports while you are connected to the remote server using VS Code.

Assuming you're already connected to the remote server using VS Code's remote development extension, the following steps will cover how to forward the remote MySQL server port to localhost (your local machine).

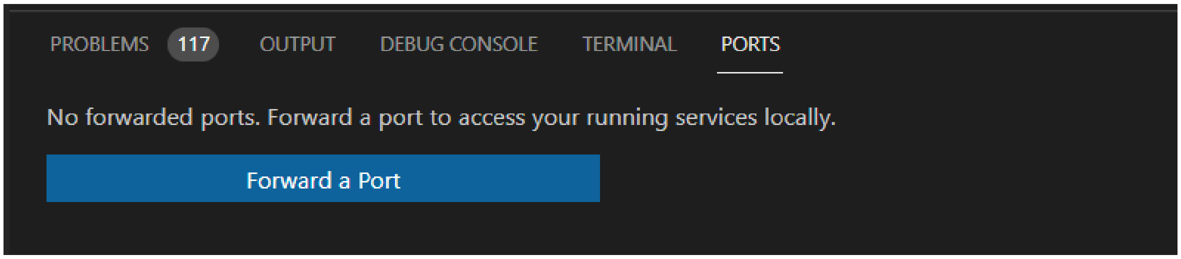
<u>If you're using a UWE lab machine</u>

Make sure you've turned on *Settings Sync* in VS Code on your current machine; this will ensure all the settings and extensions you've previously setup will be ready for you to use.

It will also ensure that any settings and extensions you setup while following this guide will be automatically available for you to use in future practical sessions.

Instructions for turning on *Settings Sync* can be found in the second guide (*Setting up remote development for VS Code*).

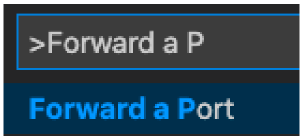
From the panel at the bottom of VS Code, find the *Ports* tab as in Figure 7.



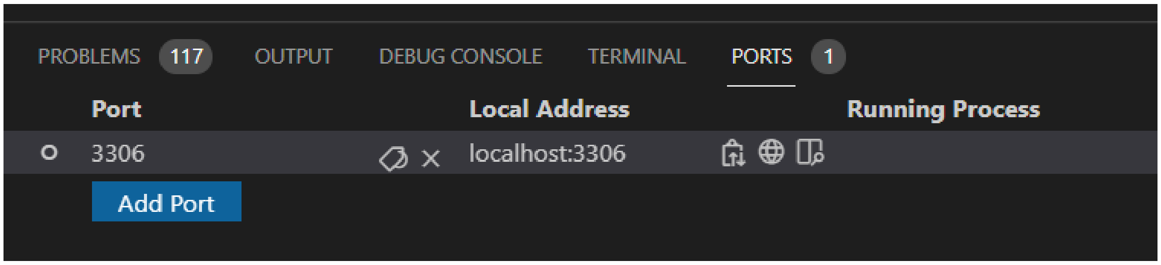
No forwarded ports. Forward a port to access your running services locally.

Figure 7: The Ports tab at the bottom of VS Code

If you can't see the Ports tab, open the Command Palette (`<Ctrl+Shift+P>` or from the View menu), then start typing 'Forward a port' and select the option:



On the *Ports* tab click *Forward a Port*, VS Code will ask you for the port number you want to forward. As the DB server is running on port 3306 on the remote server this is the port we want to use; type this in under *Port* and hit `<Enter>`, this will forward the port to your localhost as shown in Figure 8.



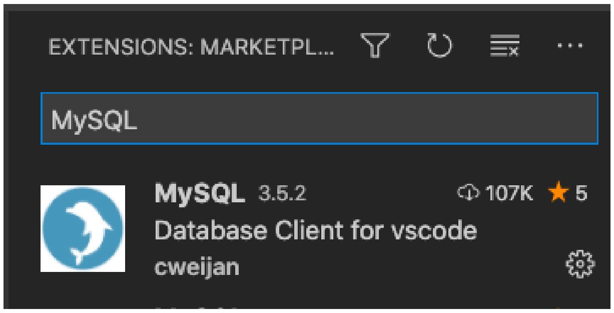
Port	Local Address	Running Process
3306	localhost:3306	

Figure 8: Port forwarding complete

2.2.2 Installing and using the VS Code MySQL extension

There are several free GUI client tools for working with DBs, e.g., MySQL Workbench, or the MySQL extension for VS Code.

Click the *Extensions* icon in the left-hand bar to open the *Extensions* tab, search MySQL and select the MySQL extension for installation (Figure 9).



MySQL

MySQL 3.5.2 107K ★ 5
Database Client for vscode
cweijan

Figure 9: MySQL extension

Once the MySQL extension is installed, you'll see two new icons appear in the left-hand bar:

Database – used to explore SQL databases (e.g., MySQL, PostgreSQL)

NoSQL – used to explore NoSQL databases (e.g., MongoDB)

Click on *Database* and a blank explorer window will appear.

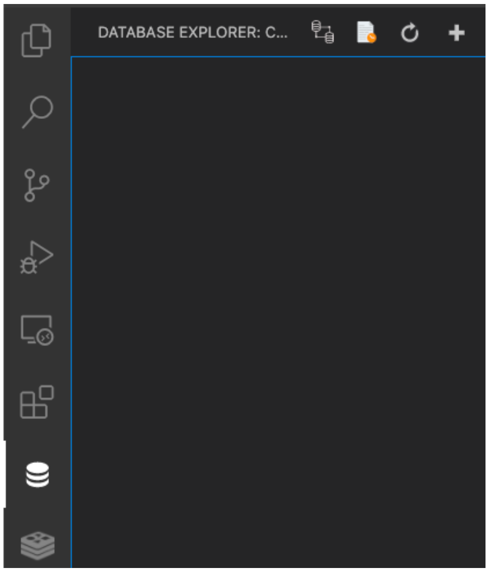
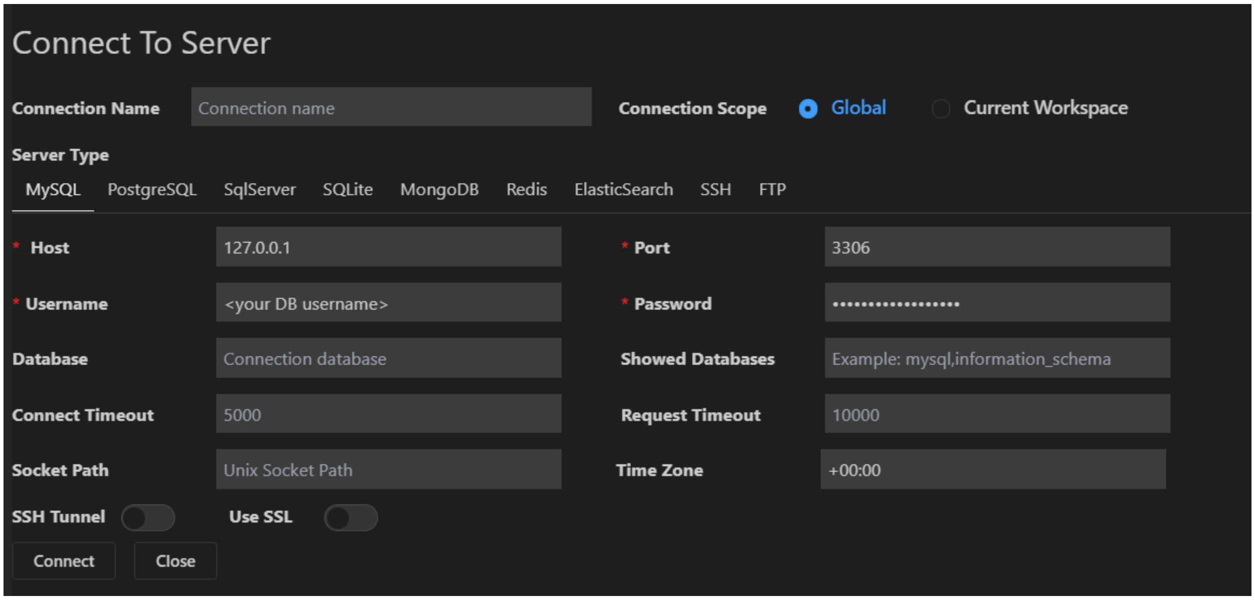


Figure 10: Empty Database Explorer window

Click the *Add Connection* icon and the *Connect To Server* page will appear where connection data (host, port, database username, and password) needs to be added. You can also add the name of the database you want to use in the databases field, but this is optional (see Figure 11). Don't forget to give a suitable name to your connection in the Connection Name field.



Connect To Server

Connection Name	Connection name	Connection Scope	● Global ○ Current Workspace

Server Type

MySQL PostgreSQL SqlServer SQLite MongoDB Redis ElasticSearch SSH FTP

* Host	127.0.0.1	* Port	3306
* Username	<your DB username>	* Password	••••••••••••••••••
Database	Connection database	Showed Databases	Example: mysql,information_schema
Connect Timeout	5000	Request Timeout	10000
Socket Path	Unix Socket Path	Time Zone	+00:00

SSH Tunnel ○ Use SSL ○

Figure 11: Add DB connection parameters

Once you click the *Connect* button, your connection with the DB server should be established and you should be able to see databases for which you have access rights (see Figure 12).

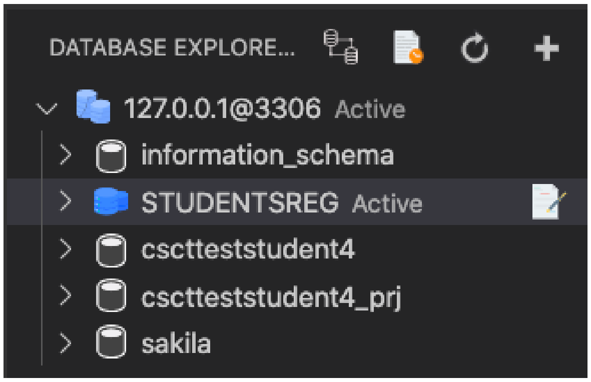
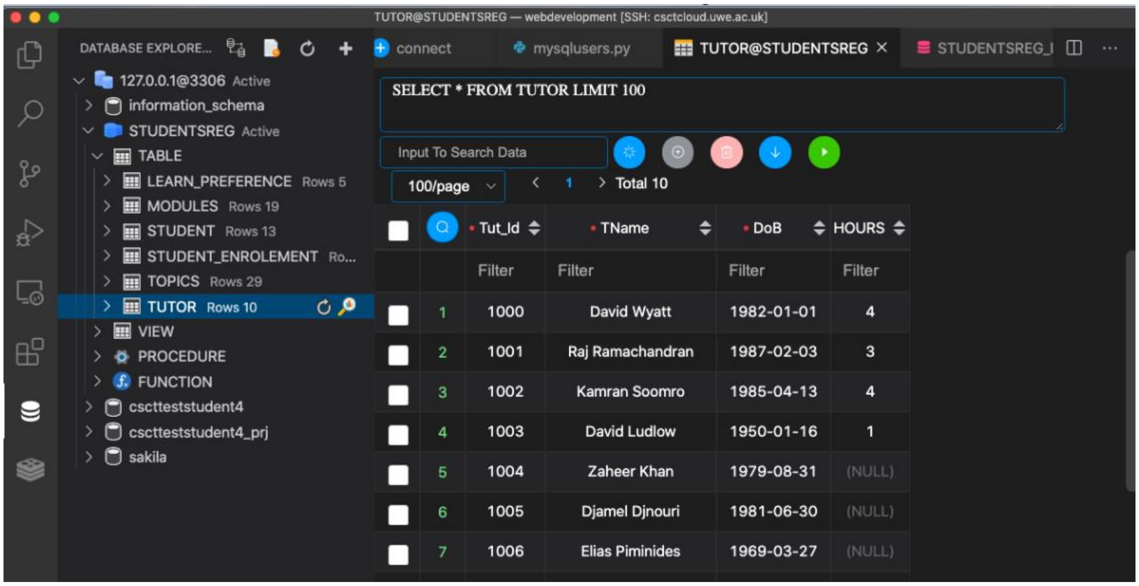


Figure 12: Connection established and DBs are visible with tables

STUDENTSREG and *sakila* DBs are for your learning, and we'll refer to them in our web development and databases lectures and practical sessions. You have restricted privileges on these two databases. Two other databases (named after your database username) are there for you to design your own database tables for your project(s) and practical exercises, and you have ALL privileges on them.

Now if you select a database and a table in it, e.g., the *TUTOR* table of *STUDENTSREG*, it will automatically run the query `SELECT * FROM TUTOR LIMIT 100`, and the result will be shown (see Figure 13).

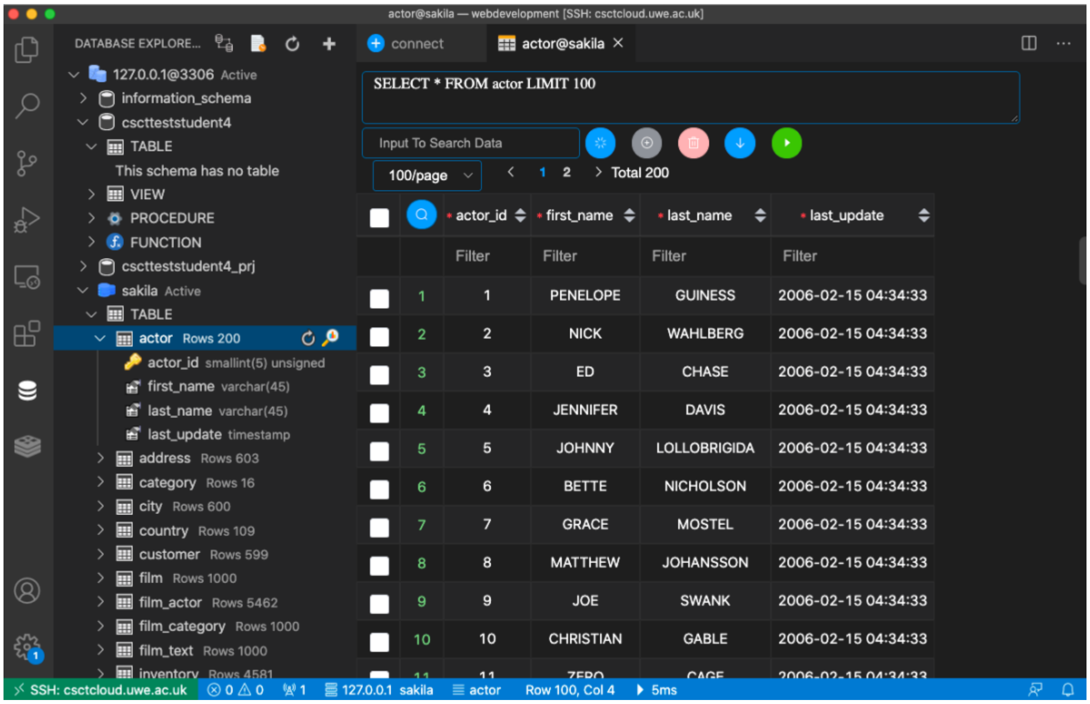


```
SELECT * FROM TUTOR LIMIT 100
```

	Tut_Id	TName	DoB	HOURS
	Filter	Filter	Filter	Filter
1	1000	David Wyatt	1982-01-01	4
2	1001	Raj Ramachandran	1987-02-03	3
3	1002	Kamran Soomro	1985-04-13	4
4	1003	David Ludlow	1950-01-16	1
5	1004	Zaheer Khan	1979-08-31	(NULL)
6	1005	Djamel Djnouri	1981-06-30	(NULL)
7	1006	Elias Piminides	1969-03-27	(NULL)

Figure 13: Selecting a database table

Similarly, you may select another DB and table, e.g., *actor* table from *sakila* database, as shown in Figure 14.



```
SELECT * FROM actor LIMIT 100
```

	actor_id	first_name	last_name	last_update
	Filter	Filter	Filter	Filter
1	1	PENELOPE	GUINESS	2006-02-15 04:34:33
2	2	NICK	WAHLBERG	2006-02-15 04:34:33
3	3	ED	CHASE	2006-02-15 04:34:33
4	4	JENNIFER	DAVIS	2006-02-15 04:34:33
5	5	JOHNNY	LOLLOBRIGIDA	2006-02-15 04:34:33
6	6	BETTE	NICHOLSON	2006-02-15 04:34:33
7	7	GRACE	MOSTEL	2006-02-15 04:34:33
8	8	MATTHEW	JOHANSSON	2006-02-15 04:34:33
9	9	JOE	SWANK	2006-02-15 04:34:33
10	10	CHRISTIAN	GABLE	2006-02-15 04:34:33
11	11	ZERO	CAGE	2006-02-15 04:34:33

Figure 14: Selecting a table in a different database

You can add a new table to a database (where you have the correct privileges to do so) by clicking the + icon next to *Table* (see Figure 15).

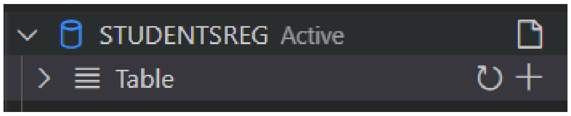


Figure 15: Create table template

You can also write new SQL queries using the Open Query 🗋 icon, e.g., next to the STUDENTSREG database as shown in Figure 16.

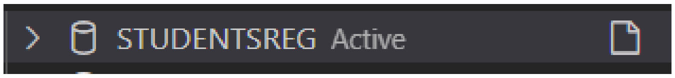
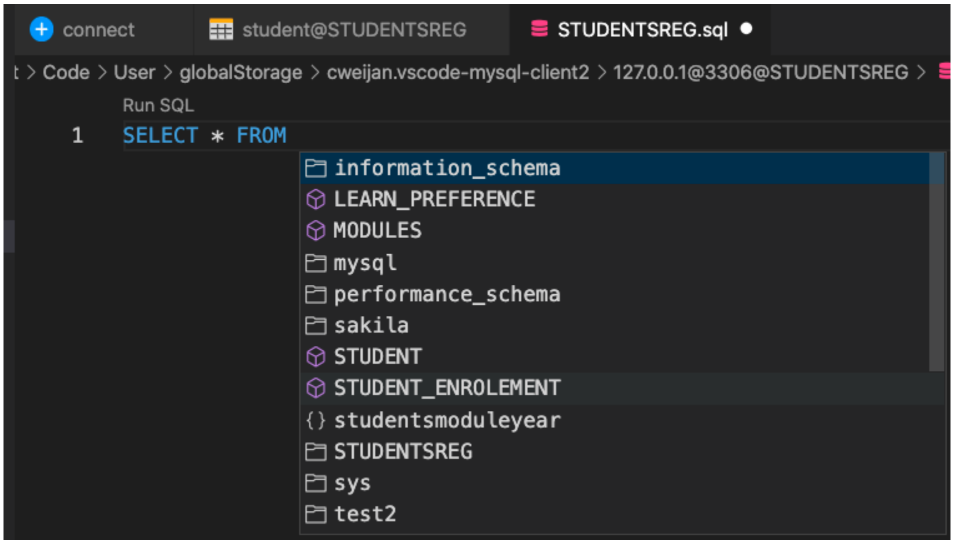


Figure 16: Open query editor for a selected database

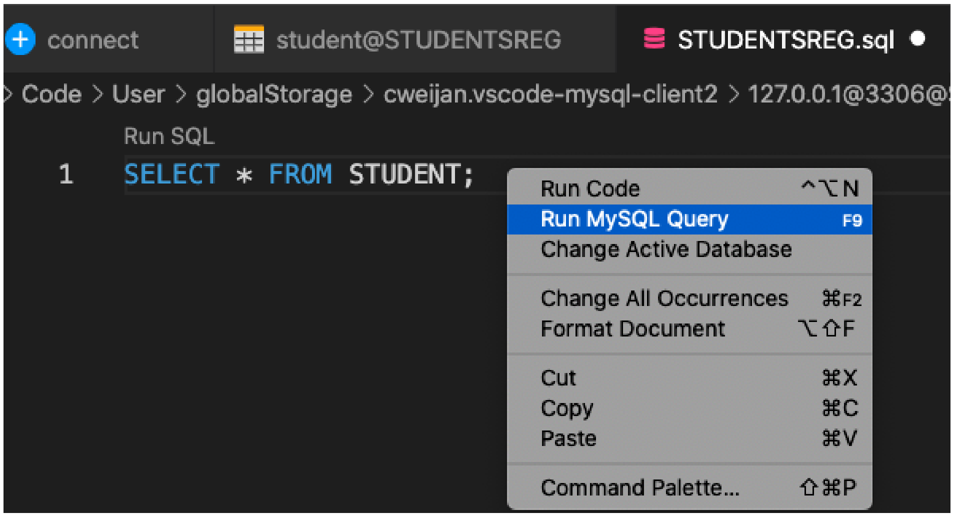
When you're typing your SQL query, VS Code *intellisense* will help you complete your query, as shown in Figure 17. You can open and save queries on your machine by using the standard open and save features in the *File* menu.



```
SELECT * FROM
```

Figure 17: VS Code intellisense helping write a query

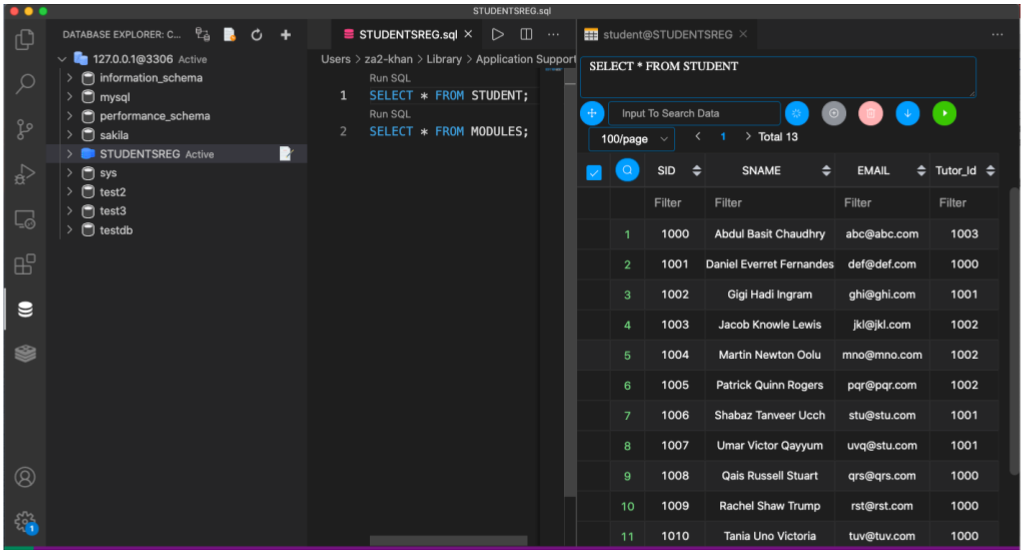
To execute a query, right mouse click on the query line and select *Run MySQL query* (Figure 18).



```
SELECT * FROM STUDENT;
```

Figure 18: Run MySQL query

This will run the query and show the output in a new window, as in Figure 19.



```
SELECT * FROM STUDENT;
SELECT * FROM MODULES;
```

```
SELECT * FROM STUDENT
```

	SID	SNAME	EMAIL	Tutor_Id
	Filter	Filter	Filter	Filter
1	1000	Abdul Basit Chaudhry	abc@abc.com	1003
2	1001	Daniel Everret Fernandes	def@def.com	1000
3	1002	Gigi Hadi Ingram	ghi@ghi.com	1001
4	1003	Jacob Knowle Lewis	jkl@jkl.com	1002
5	1004	Martin Newton Oolu	mno@mno.com	1002
6	1005	Patrick Quinn Rogers	pqr@pqr.com	1002
7	1006	Shabaz Tanveer Ucch	stu@stu.com	1001
8	1007	Umar Victor Qayyum	uvq@stu.com	1001
9	1008	Qais Russell Stuart	qrs@qrs.com	1000
10	1009	Rachel Shaw Trump	rst@rst.com	1000
11	1010	Tania Uno Victoria	tuv@tuv.com	1000

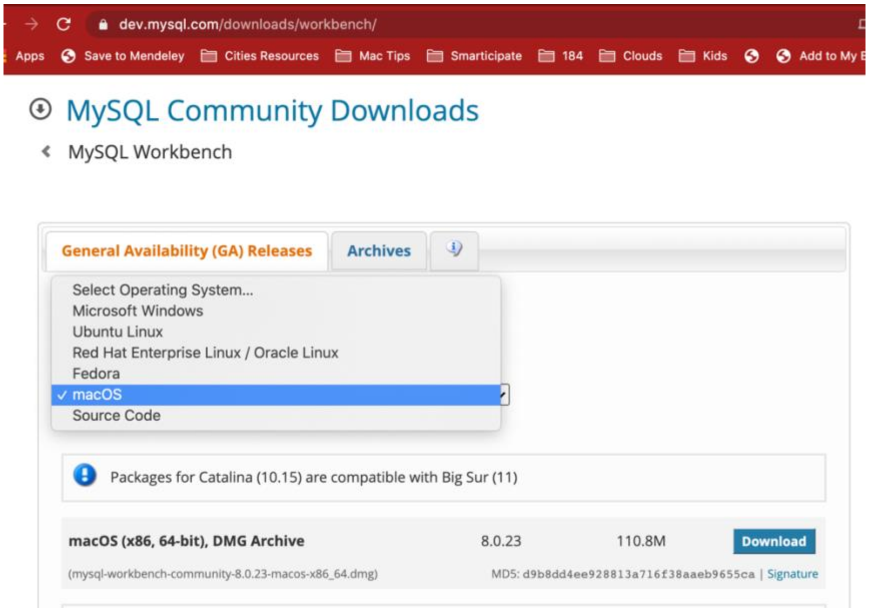
Figure 19: Query output

2.2.3 Installing and using MySQL Workbench

MySQL Workbench is another GUI client software for interacting with MySQL databases. It has several features such as importing and exporting data, query editor, forms, entity relation modeler, forward/reverse engineering etc. You can download and install *MySQL Workbench* from https://dev.mysql.com/downloads/workbench/ – it supports major operating systems as shown in Figure 20.

(If it asks you to *Login* or *Sign Up for an Oracle Web account*, you can select *No thanks, just start my download* at the bottom of the page.)

It's also available through UWE's *appsanywhere* portal: https://appsanywhere.uwe.ac.uk/login



MySQL Community Downloads

MySQL Workbench

Select Operating System...
Microsoft Windows
Ubuntu Linux
Red Hat Enterprise Linux / Oracle Linux
Fedora
✓ macOS
Source Code

Packages for Catalina (10.15) are compatible with Big Sur (11)

macOS (x86, 64-bit), DMG Archive (mysql-workbench-community-8.0.23-macos-x86_64.dmg)	8.0.23	110.8M	Download MD5: d9b8dd4ee928813a716f38aaeb9655ca | Signature

Figure 20: MySQL Workbench download

A detailed manual for *MySQL Workbench* is here: https://dev.mysql.com/doc/workbench/en/. You might find using Workbench much easier, however downloading and installing it is optional if you have already setup the MySQL extension for VS Code.

Assuming you have downloaded and installed Workbench, you can establish a connection with the database server. **You will need to make sure that you have established a remote connection with CSCTCloud using VS Code and have forwarded port 3306 as explained in section 2.2.1.**

When you first start Workbench, you'll need to add a new connection. Select the + icon next to *MySQL Connections* on the welcome screen to do so:

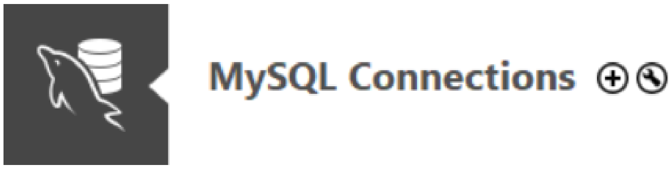
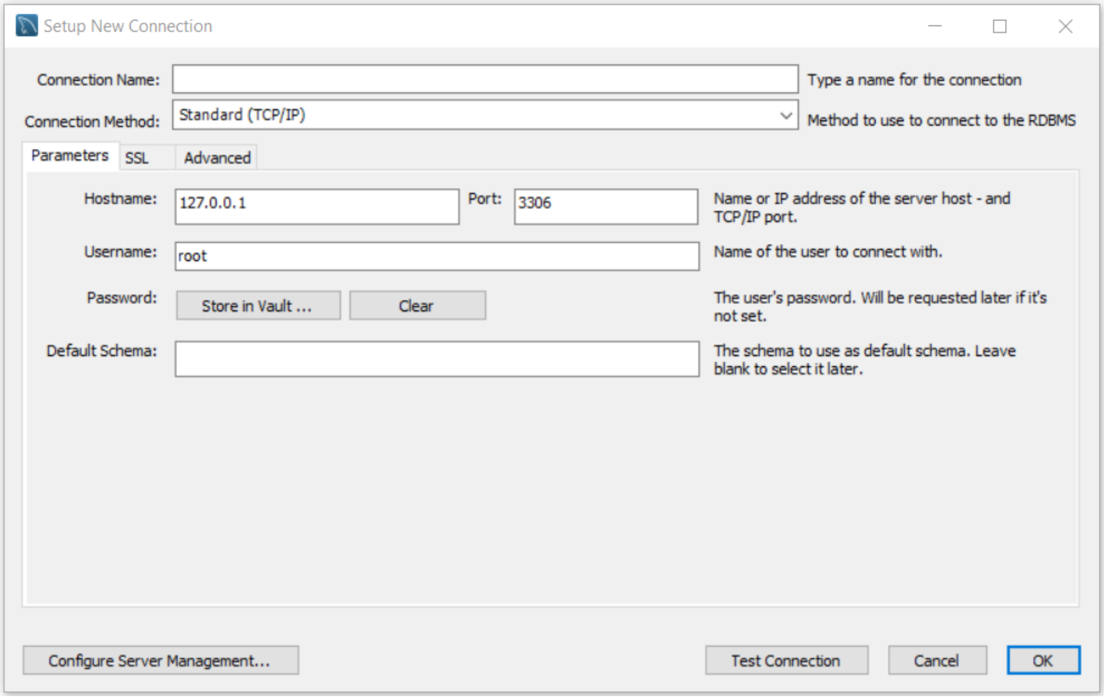


Figure 21: Create new connection in MySQL Workbench

This will open a new window asking for connection parameters, as shown in Figure 22.



Connection Name: Type a name for the connection

Connection Method: Standard (TCP/IP) Method to use to connect to the RDBMS

Hostname: 127.0.0.1 Port: 3306 Name or IP address of the server host - and TCP/IP port.

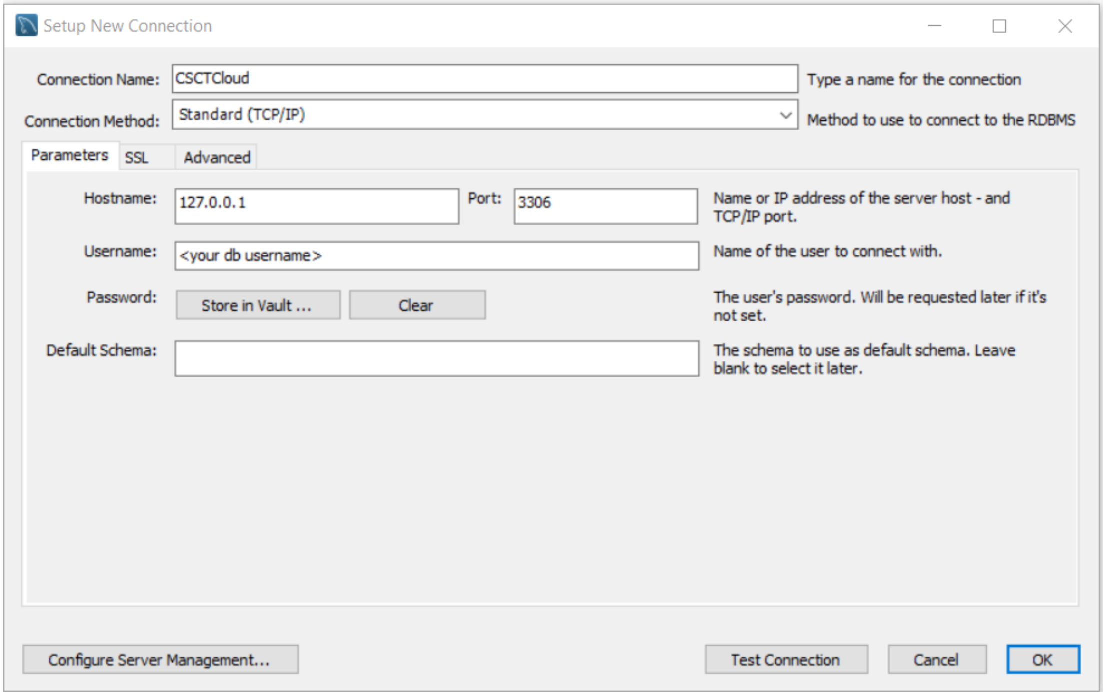
Username: root Name of the user to connect with.

Password: The user's password. Will be requested later if it's not set.

Default Schema: The schema to use as default schema. Leave blank to select it later.

Figure 22: MySQL Workbench new connection window

Fill out your connection details (connection name, hostname, port, username), as in Figure 23Figure 23.



Connection Name: CSCTCloud Type a name for the connection

Connection Method: Standard (TCP/IP) Method to use to connect to the RDBMS

Hostname: 127.0.0.1 Port: 3306 Name or IP address of the server host - and TCP/IP port.

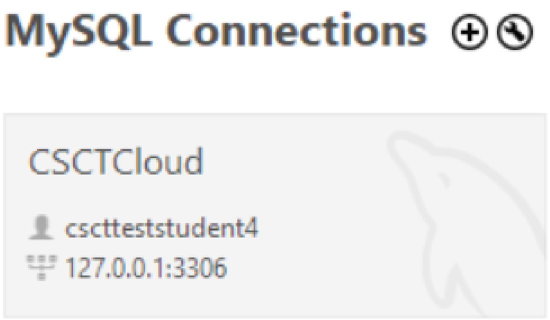
Username: <your db username> Name of the user to connect with.

Password: The user's password. Will be requested later if it's not set.

Default Schema: The schema to use as default schema. Leave blank to select it later.

Figure 23: Connection window with user details

Once you press OK it will add your connection to the list (Figure 24), click on the connection and enter your password to start the connection (Figure 25).

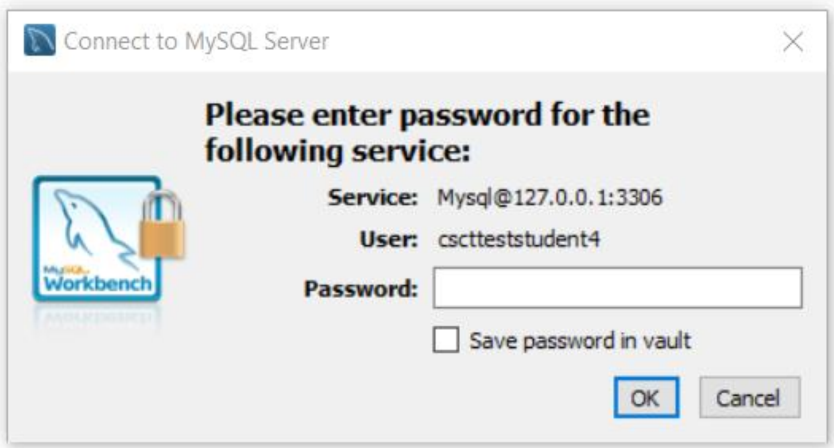


CSCTCloud

csctteststudent4

127.0.0.1:3306

Figure 24: New connection listed in MySQL Workbench



Please enter password for the following service:

Service: Mysql@127.0.0.1:3306

User: csctteststudent4

Password:

□ Save password in vault

Figure 25: MySQL password entry screen

Once connected you should be able to see a screen similar to Figure 26.

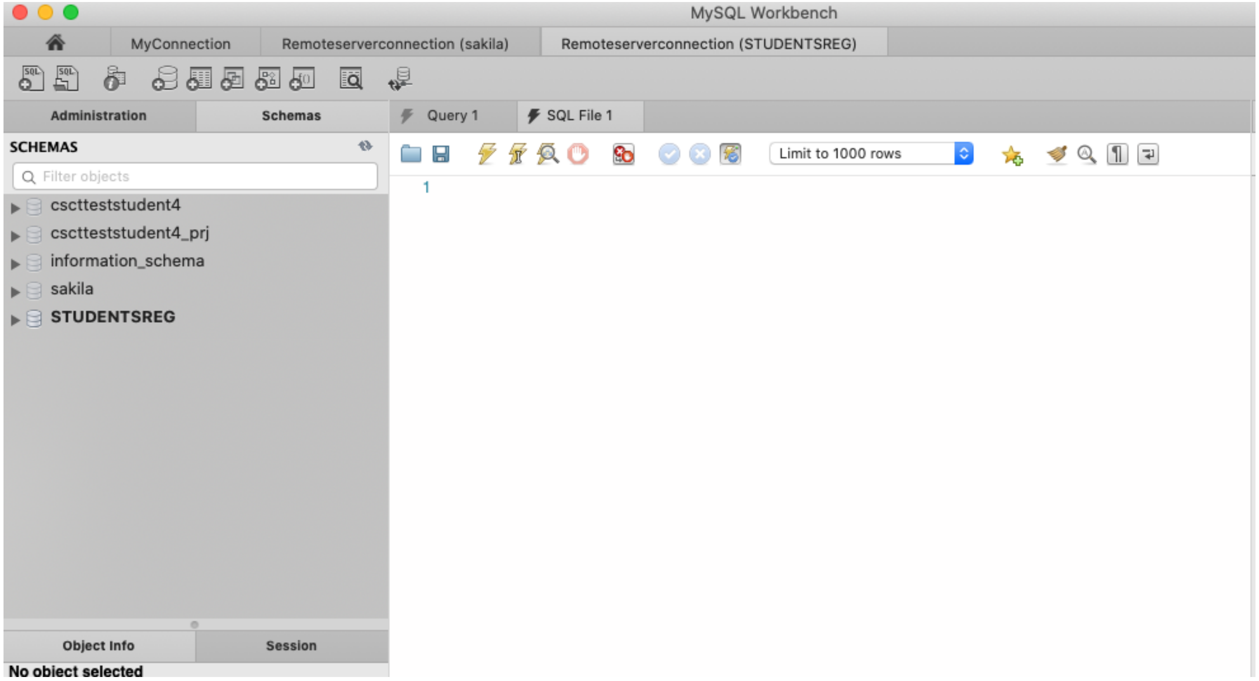


Figure 26: MySQL Workbench workspace

You can see all databases with their table details under the *Schema* panel on the left-hand side:

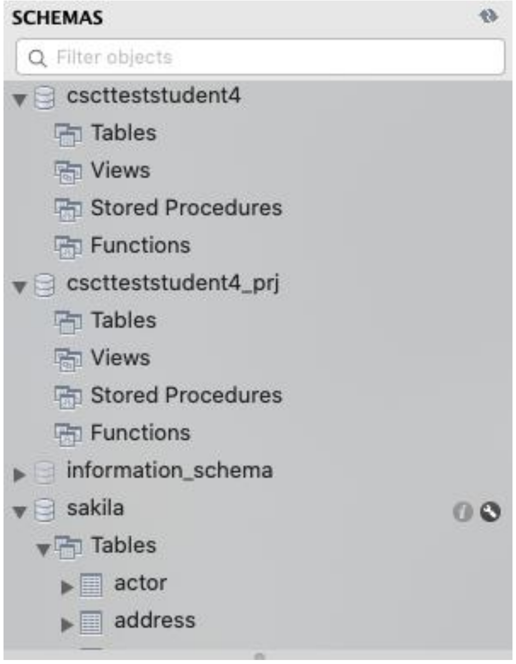
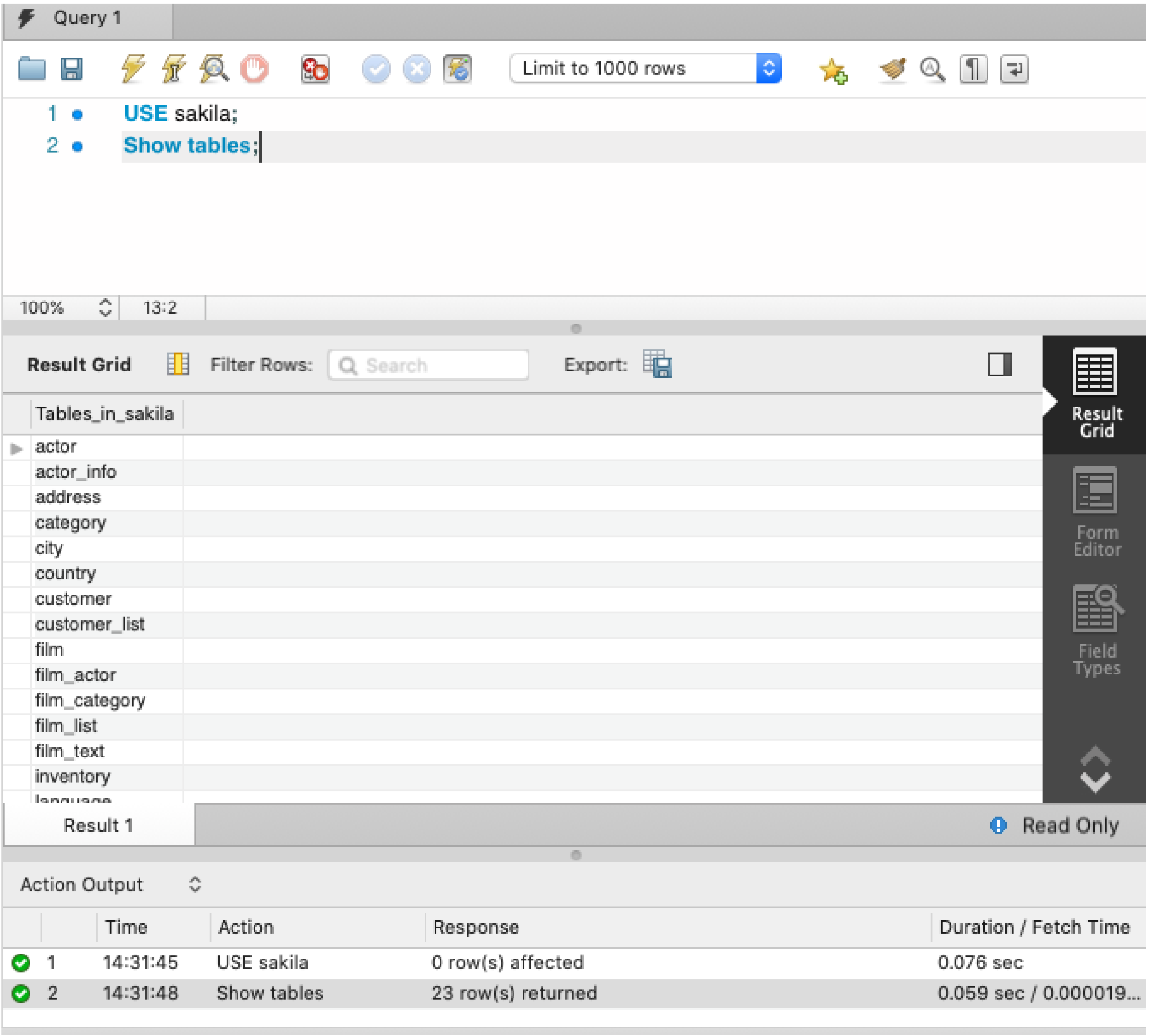


Figure 27: Schema view

You can write and execute queries in the *Query* panel:



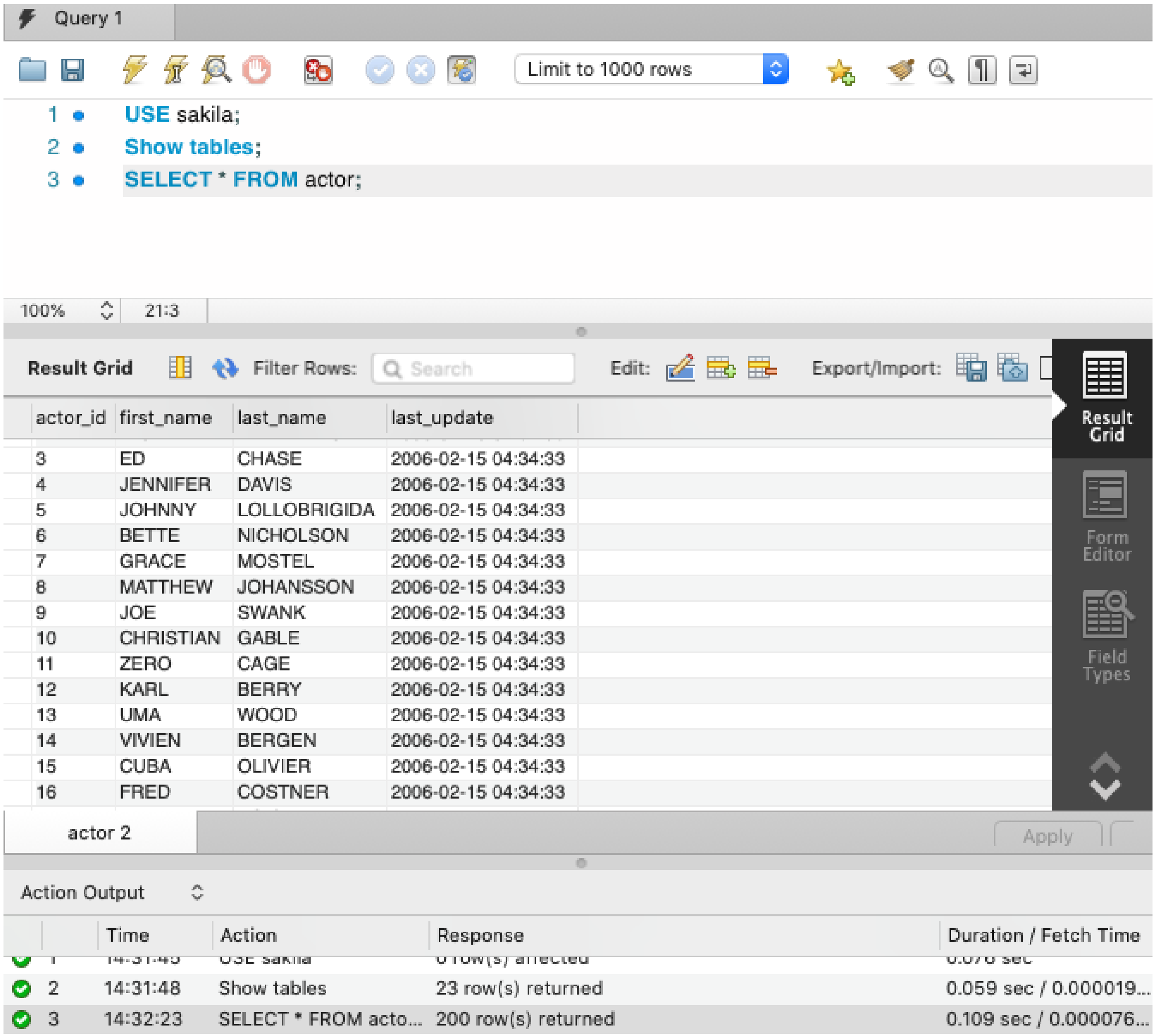
```
USE sakila;
Show tables;
```

Tables_in_sakila
actor
actor_info
address
category
city
country
customer
customer_list
film
film_actor
film_category
film_list
film_text
inventory
language

		Time	Action	Response	Duration / Fetch Time
✓	1	14:31:45	USE sakila	0 row(s) affected	0.076 sec
✓	2	14:31:48	Show tables	23 row(s) returned	0.059 sec / 0.000019...

Figure 28: Writing and executing queries

You can execute all queries entered by pressing the ⚡ icon, or if you want to execute one query you can place the cursor on that query line and press the ⚡ icon. Figure 29 shows a single query execution.



```
1 • USE sakila;
2 • Show tables;
3 • SELECT * FROM actor;
```

actor_id	first_name	last_name	last_update
3	ED	CHASE	2006-02-15 04:34:33
4	JENNIFER	DAVIS	2006-02-15 04:34:33
5	JOHNNY	LOLLOBRIGIDA	2006-02-15 04:34:33
6	BETTE	NICHOLSON	2006-02-15 04:34:33
7	GRACE	MOSTEL	2006-02-15 04:34:33
8	MATTHEW	JOHANSSON	2006-02-15 04:34:33
9	JOE	SWANK	2006-02-15 04:34:33
10	CHRISTIAN	GABLE	2006-02-15 04:34:33
11	ZERO	CAGE	2006-02-15 04:34:33
12	KARL	BERRY	2006-02-15 04:34:33
13	UMA	WOOD	2006-02-15 04:34:33
14	VIVIEN	BERGEN	2006-02-15 04:34:33
15	CUBA	OLIVIER	2006-02-15 04:34:33
16	FRED	COSTNER	2006-02-15 04:34:33

		Time	Action	Response	Duration / Fetch Time
✓	1	14:31:45	USE sakila	0 row(s) affected	0.070 sec
✓	2	14:31:48	Show tables	23 row(s) returned	0.059 sec / 0.000019...
✓	3	14:32:23	SELECT * FROM acto...	200 row(s) returned	0.109 sec / 0.000076...

Figure 29: Single query execution

You can get back to the connections screen (Figure 24) by pressing the home icon 🏠 from the top left corner.

2.3 Running DB queries using Python

You can also interact with the DB server using many different programming languages, e.g., Python scripts. This is something that we'll learn in the next few weeks.

3. Your DB server user account

You need a database user account to access the database server installed on CSCTCloud. You can derive the username and password for your user account based on a set of rules detailed below.

Your account should have access to two default schemas/databases, where you can create your tables and records for projects as well as practical exercises. These databases are named after your database account username:

- `<your DB username>`
- `<your DB username>_prj`

3.1 Your DB server username

Your database server username can be derived from your UWE email address:

1. Remove the domain portion of your email address (e.g., *@live.uwe.ac.uk* or *@uwe.ac.uk*) to get your email ID
2. Now remove all special characters ('.' and '-') from your email ID
3. The resulting text is your username—**note this down**

For example:

UWE email address	**DB username**
`aben2.jassan@uwe.ac.uk`	`aben2jassan`
`anton.jack-hammer@live.uwe.ac.uk`	`antonjackhammer`

3.2 Your initial DB server password

Your initial database server password can be derived from the DB server username you found above:

1. Capitalise the first and last letters of your DB username
2. Append the total number of characters in your DB username
3. Append the special characters `+$++`
4. The resulting text is your password—**change this to a new secure password using the instructions below in section 3.3.**

For example:

DB username	**Capitalise first and last letters…**	**Append total number of characters…**	**Append special characters…**
`aben2jassen`	`Aben2jasseN`	`Aben2jasseN11`	`Aben2jasseN11+$++`
`antonjackhammer`	`AntonjackhammeR`	`AntonjackhammeR15`	`AntonjackhammeR15+$++`

Bringing both examples together:

UWE email address	**DB username**	**Initial DB password**
`aben2.jassan@uwe.ac.uk`	`aben2jassan`	`Aben2jasseN11+$++`
`anton.jack-hammer@live.uwe.ac.uk`	`antonjackhammer`	`AntonjackhammeR15+$++`

3.3 Changing your DB server password

Once you’ve logged into the DB server for the first time you should change your password.

Otherwise, other CSCTCloud users will be able to derive your password using the rules above and login to the DB server as you.

You have been given the DB server privilege required to change your own DB user account password. You can change your password using the following SQL command:

```
ALTER USER <username> IDENTIFIED BY ‘<new password>’;
```

For example:

```
ALTER USER aben2jassen IDENTIFIED BY ‘SecretNewPassword2021£’;
```

Your new password should:

- Have at least 8 characters
- Have a mix of uppercase and lowercase letters
- Have at least 1 number
- Have at least 1 special character