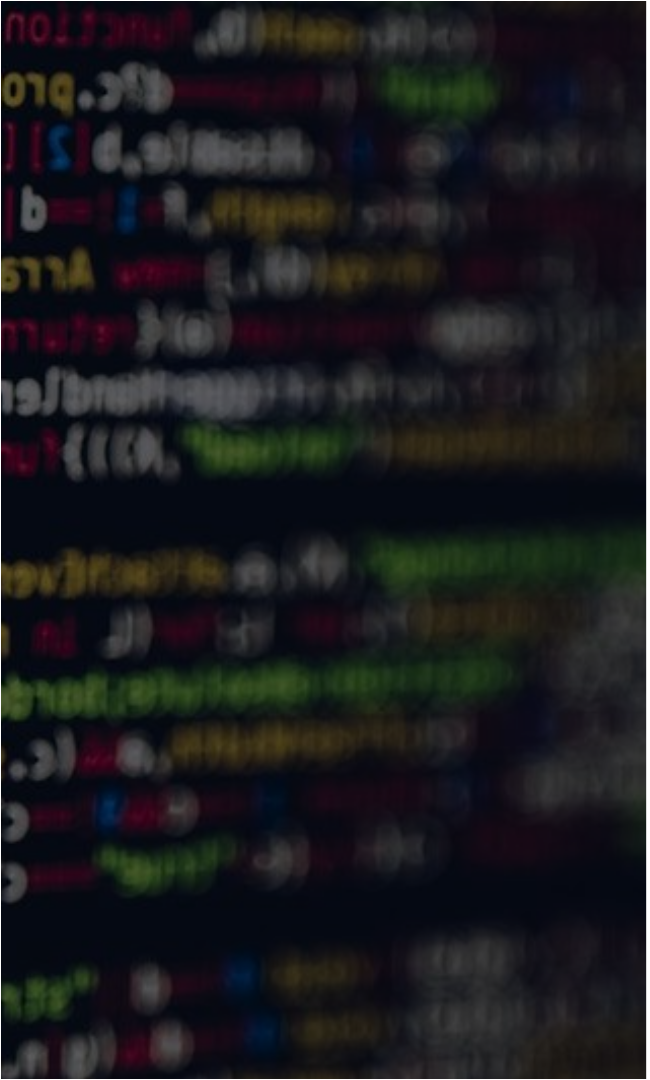
EXPLORE | DIGITAL SKILLS

SQL for Data Science
Creating a Relational Database



Installing MySQL Workbench

Connecting to MySQL Server

MySQL Workbench Overview

Table Relationships

Creating a Relational Database

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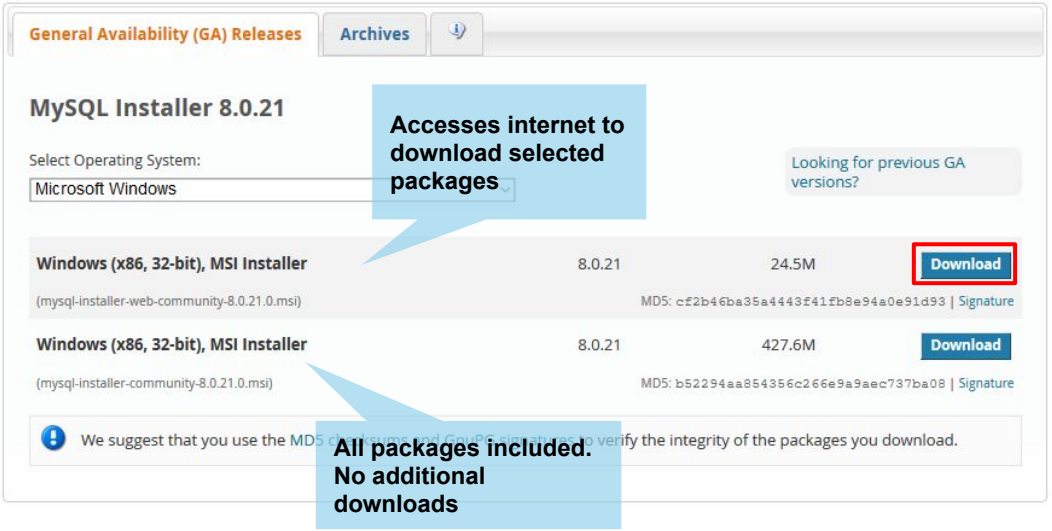
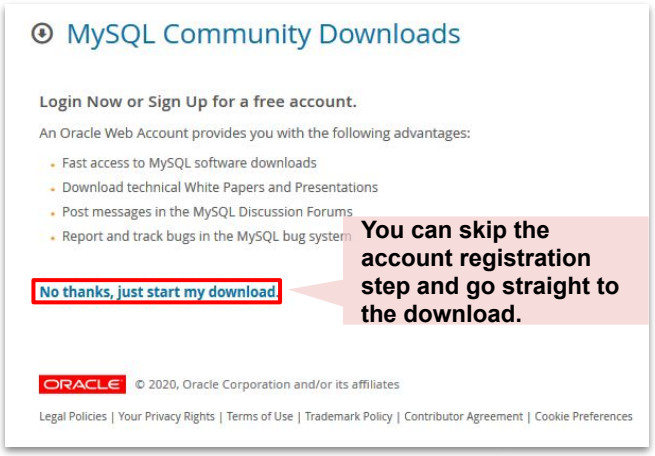
Installing MySQL workbench - Windows

Navigate to https://dev.mysql.com/downloads/installer/ and download the MySQL installer.



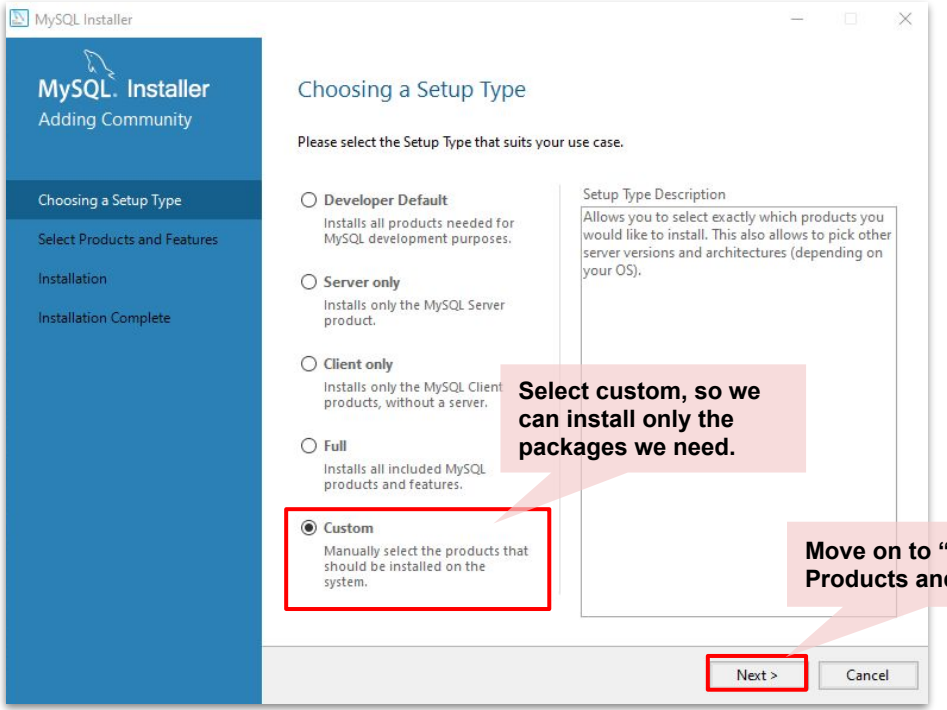


If you are not using Windows, navigate here and choose the appropriate version for your operating system.
Installation instructions for Mac users can be found here on the MySQL setup guide.

EXPLORE DIGITAL SKILLS

Installing MySQL workbench

Run the installer and follow the prompts until you get to the “Choosing a setup Type” screen:



Select custom, so we can install only the packages we need.

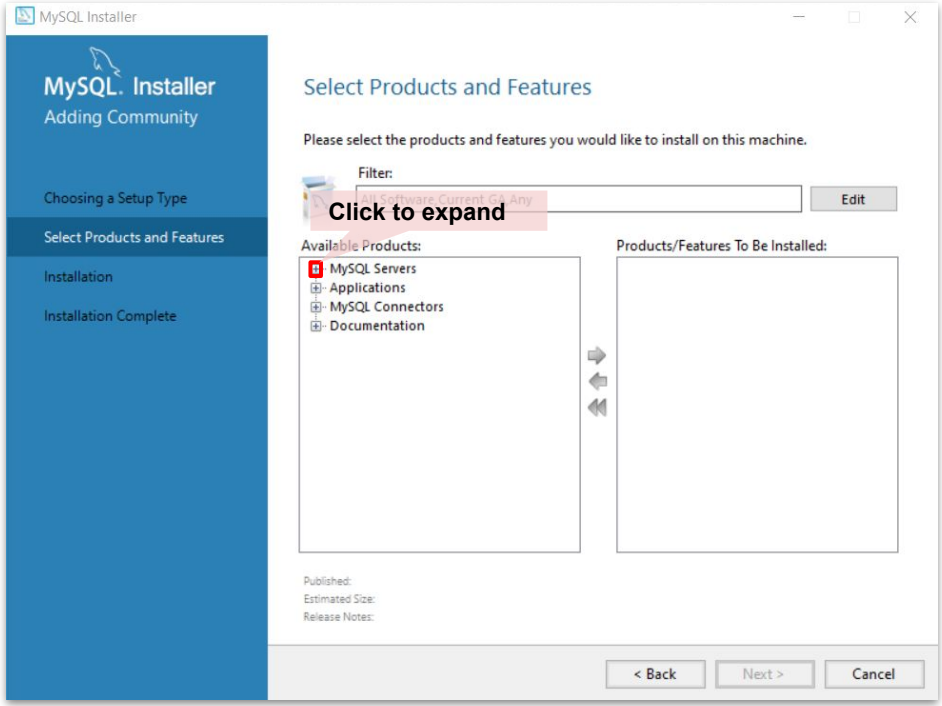
Move on to “Select Products and Features”

If you are prompted for permissions, click “**yes**” to allow.

EXPLORE DIGITAL SKILLS

Installing MySQL workbench

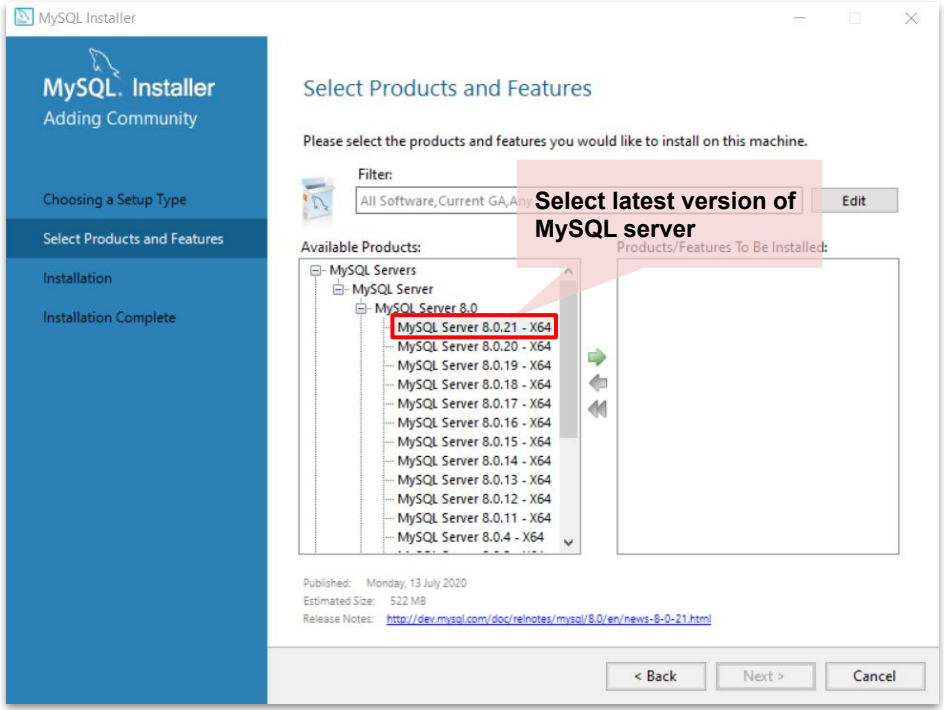
Select a MySQL server version and corresponding MySQL Workbench to install:



EXPLORE DIGITAL SKILLS

Installing MySQL workbench

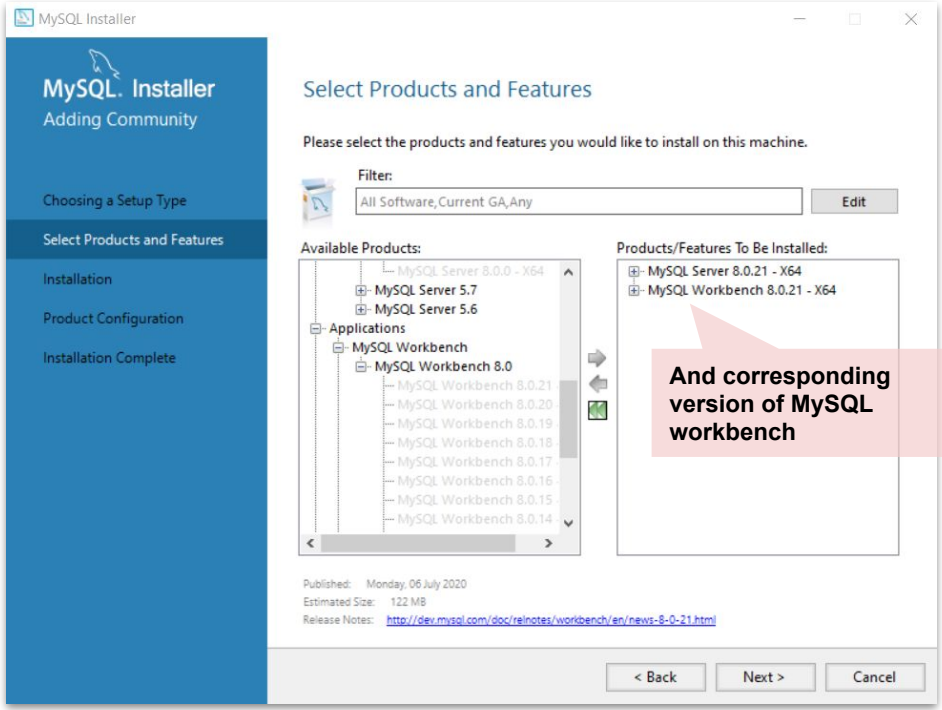
Select a MySQL server version and corresponding MySQL Workbench to install:



EXPLORE DIGITAL SKILLS

Installing MySQL workbench

Select a MySQL server version and corresponding MySQL Workbench to install:



And corresponding version of MySQL workbench

Depending on your level of comfort with SQL, it may also be useful to install **samples and examples** under the Documentation tab.

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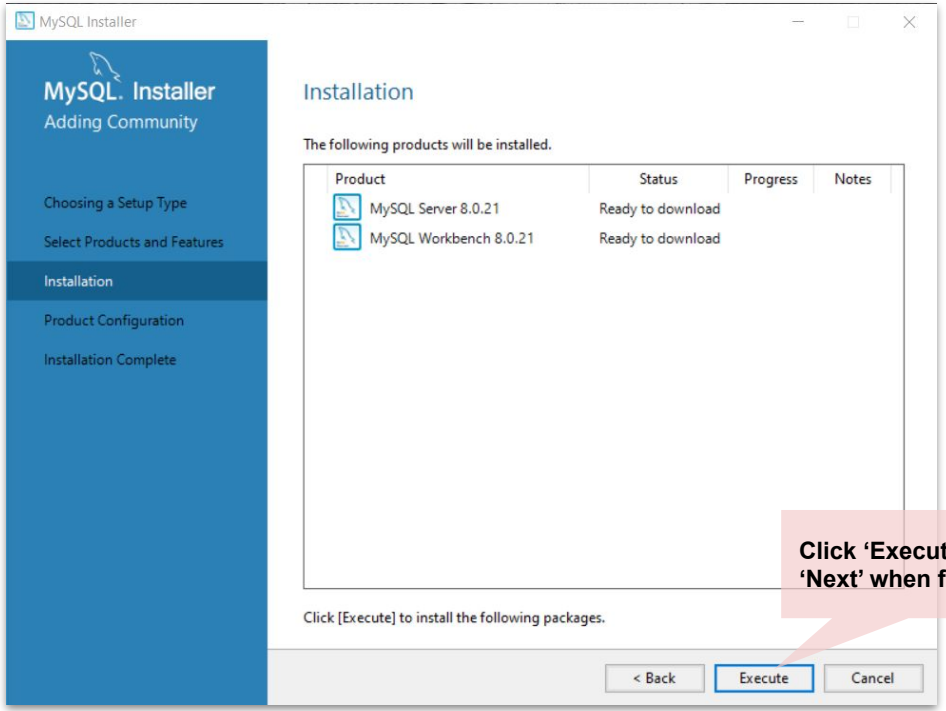
Installing MySQL workbench

Install MySQL server and Workbench:



Depending on your level of comfort with SQL, it may also be useful to install **samples and examples** under the Documentation tab.

Click 'Execute' and 'Next' when finished

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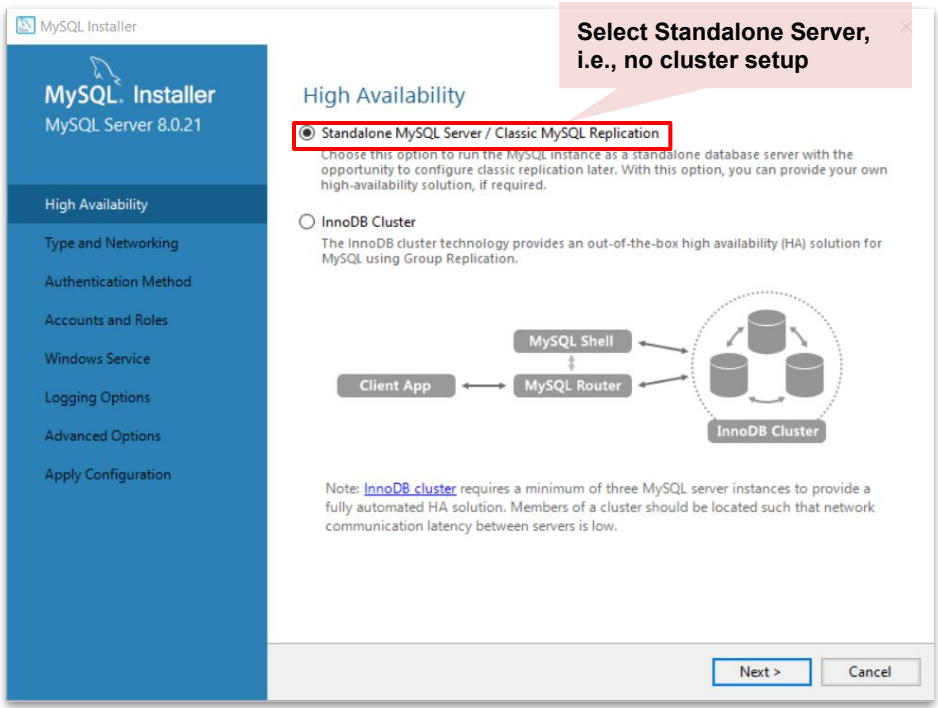
Installing MySQL workbench

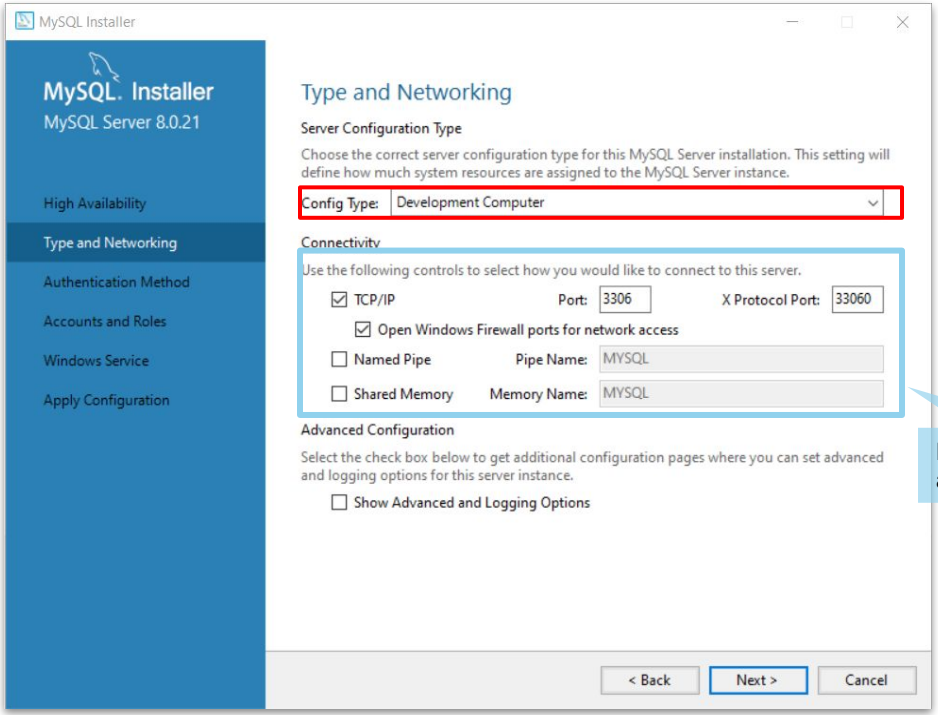
Configure MySQL Server:



EXPLORE DIGITAL SKILLS

Installing MySQL workbench

Configure MySQL Server:



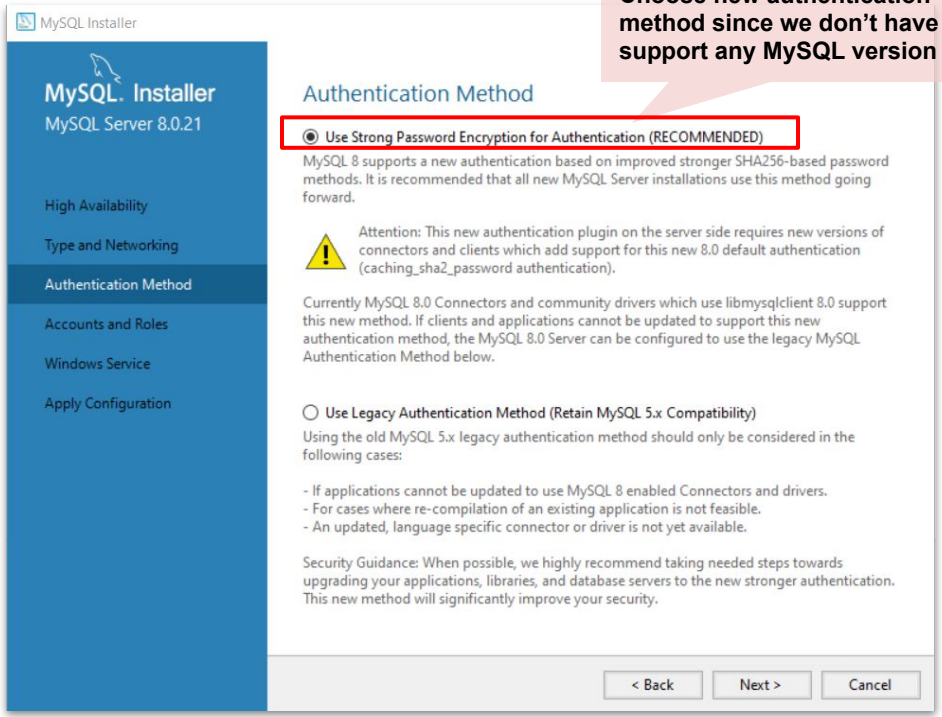
Choosing **Development Computer** means that we choose MySQL Server for an individual computer. This version of MySQL will also use the least amount of memory (i.e. RAM) as possible when it runs.

Leave everything here as is.

EXPLORE DIGITAL SKILLS

Installing MySQL workbench

Configure MySQL Server:

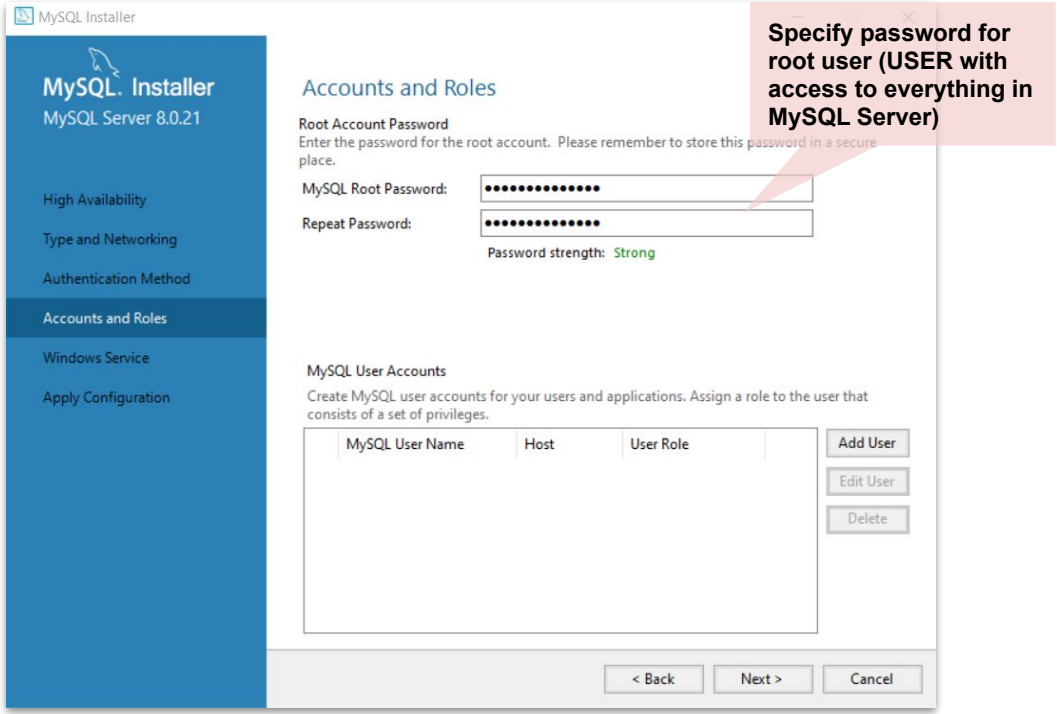


Choose new authentication method since we don't have to support any MySQL version 5.x

EXPLORE DIGITAL SKILLS

Installing MySQL workbench

Configure MySQL Server:

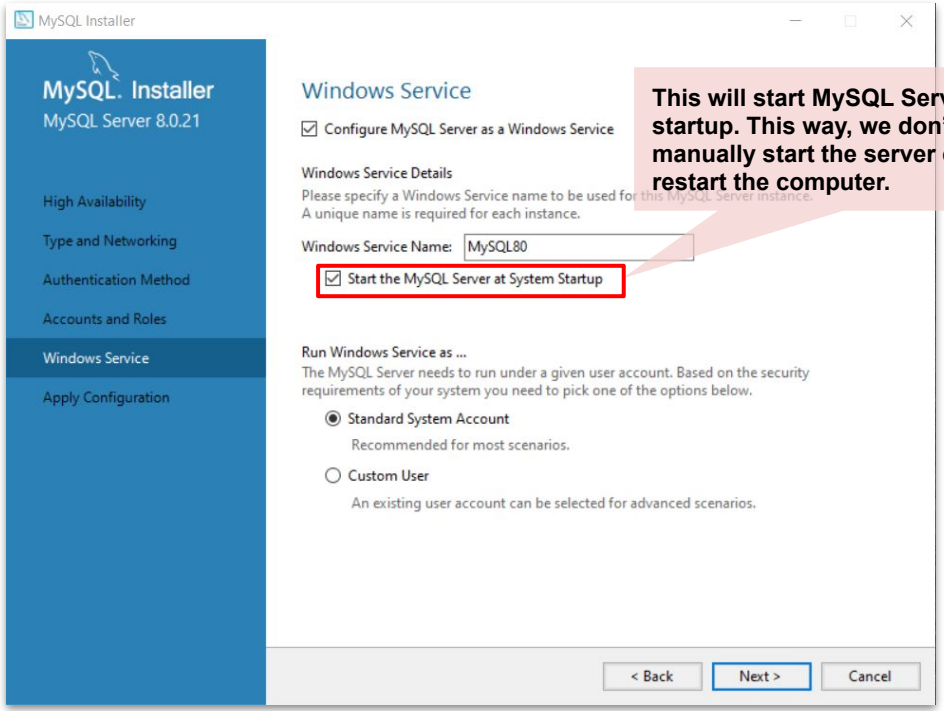


Specify password for root user (USER with access to everything in MySQL Server)

EXPLORE DIGITAL SKILLS

Installing MySQL workbench

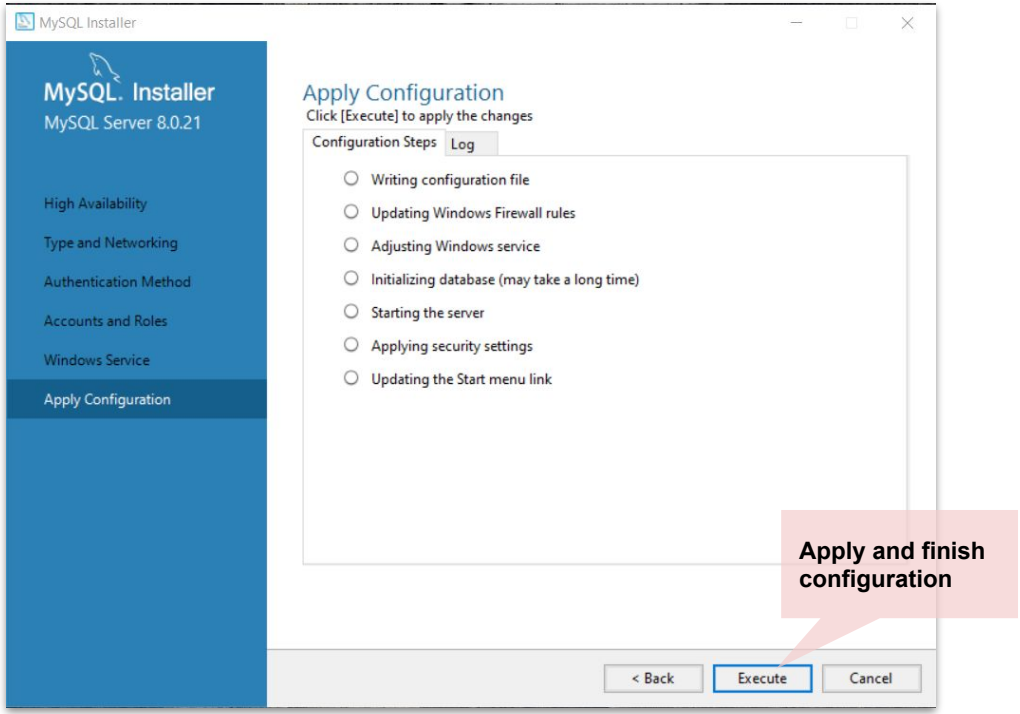
Configure MySQL Server:



This will start MySQL Server at system startup. This way, we don't have to manually start the server each time we restart the computer.

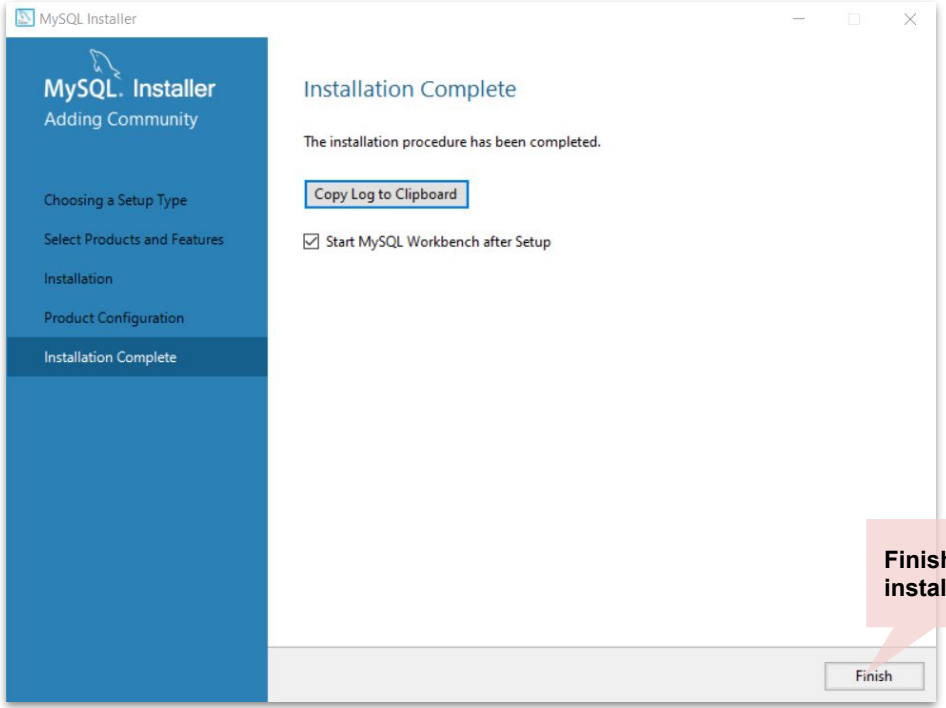
Installing MySQL workbench

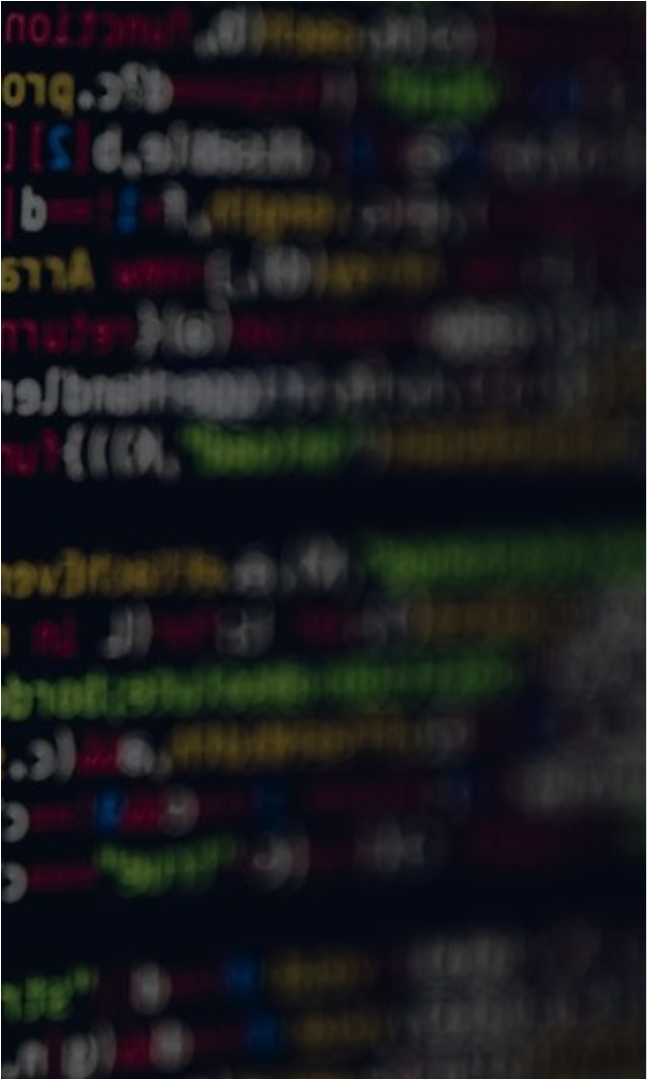
Apply configuration:



Installing MySQL workbench

Finish installation:





Installing MySQL Workbench

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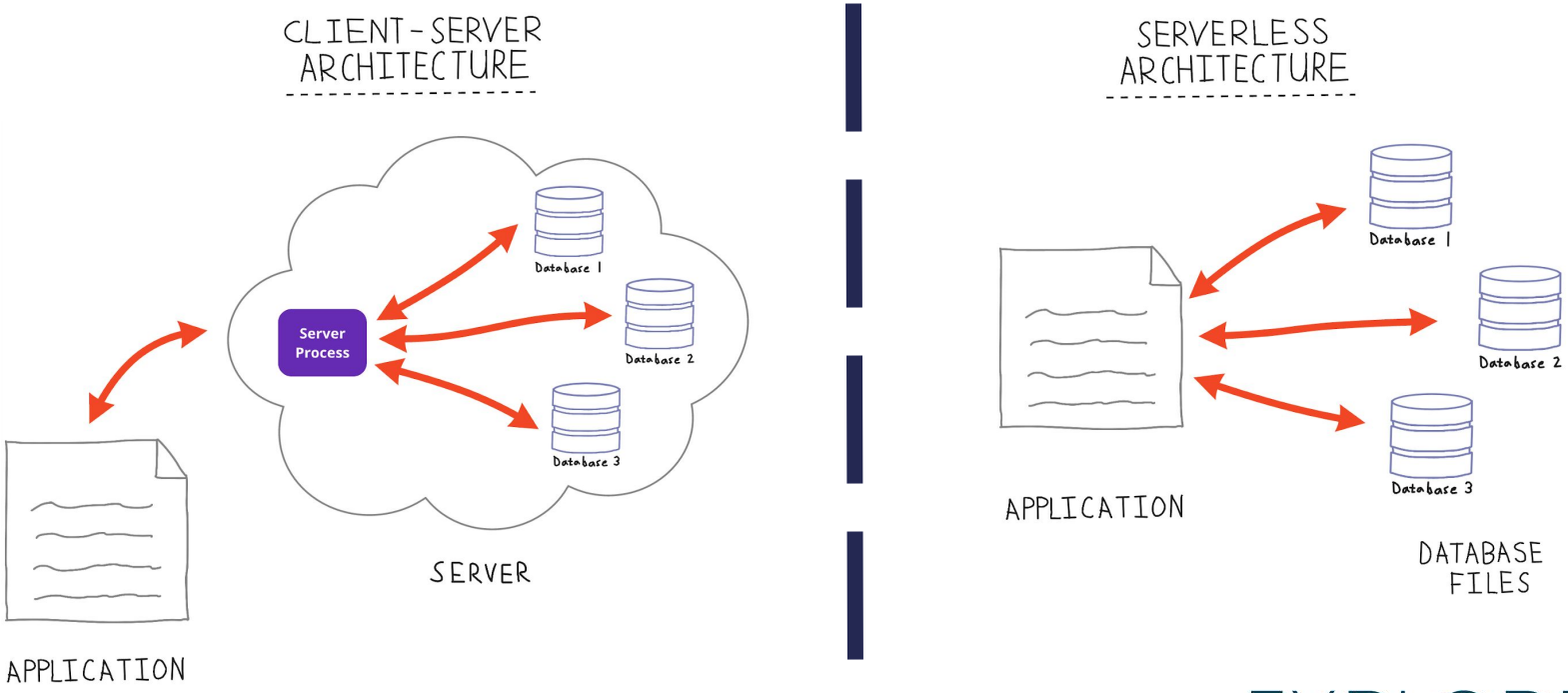
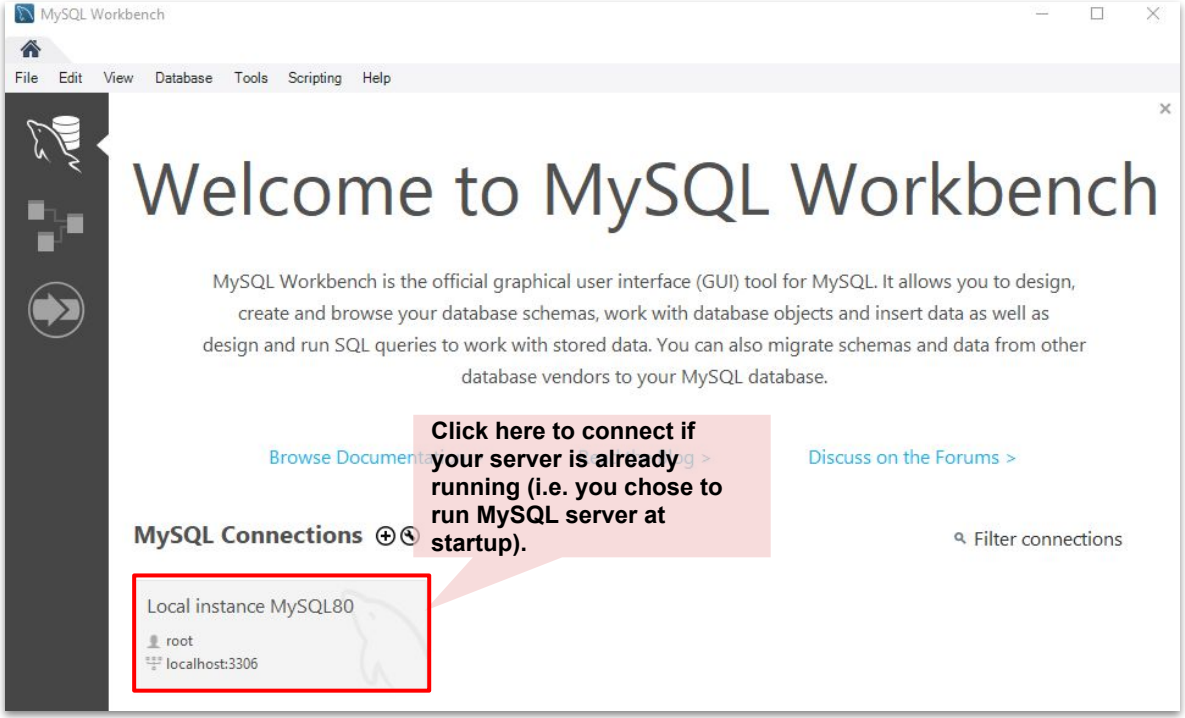
Connecting to MySQL Server

MySQL follows a **client-server** paradigm, i.e., we interact with databases that are located within a server through a client application.



Connecting to MySQL Server

To use our client application (i.e. MySQL workbench), we first have to establish a connection to the server (i.e. MySQL server).



From this point onwards in the train, the MySQL Workbench will have a consistent interface regardless of the home operating system.

We show screenshots from Windows, but you should be able to follow along from any OS.

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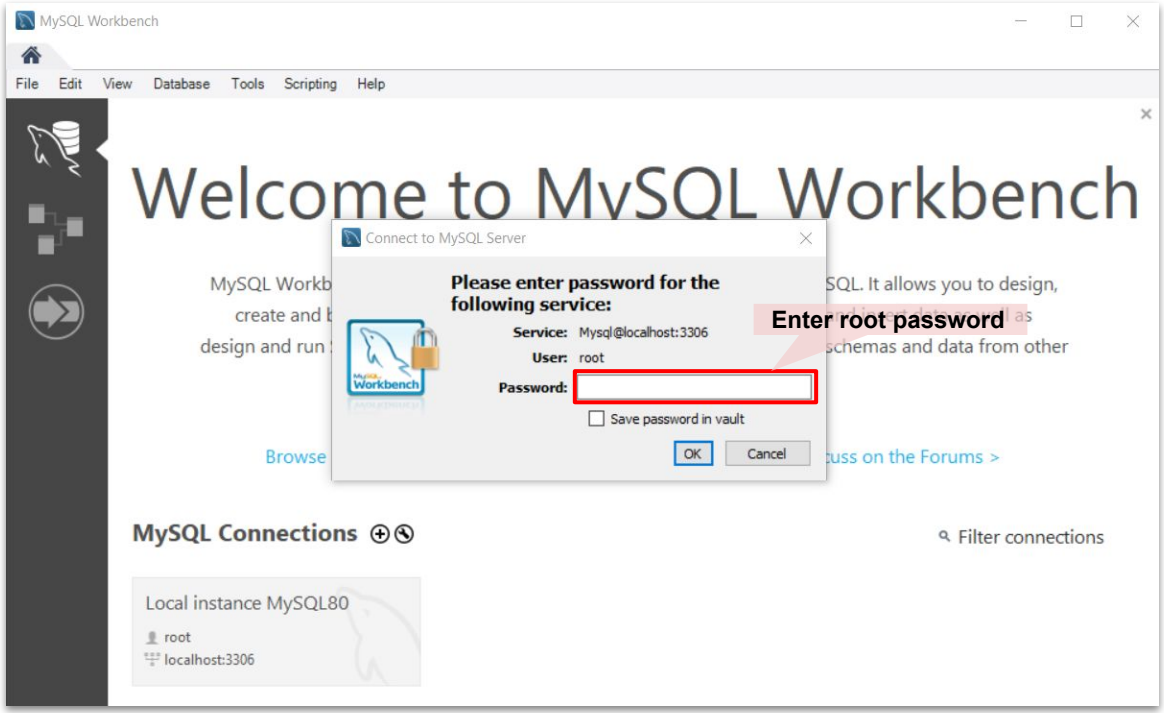
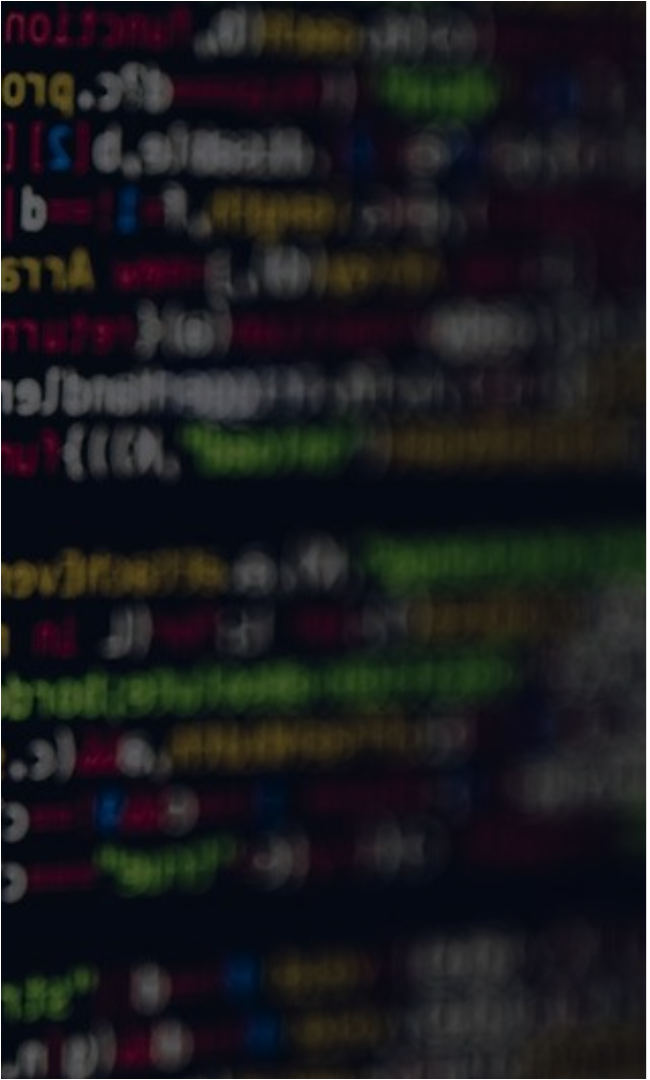
Connecting to MySQL Server

To use our client application (i.e. MySQL workbench), we first have to establish a connection to the server (i.e. MySQL server).





Installing MySQL Workbench

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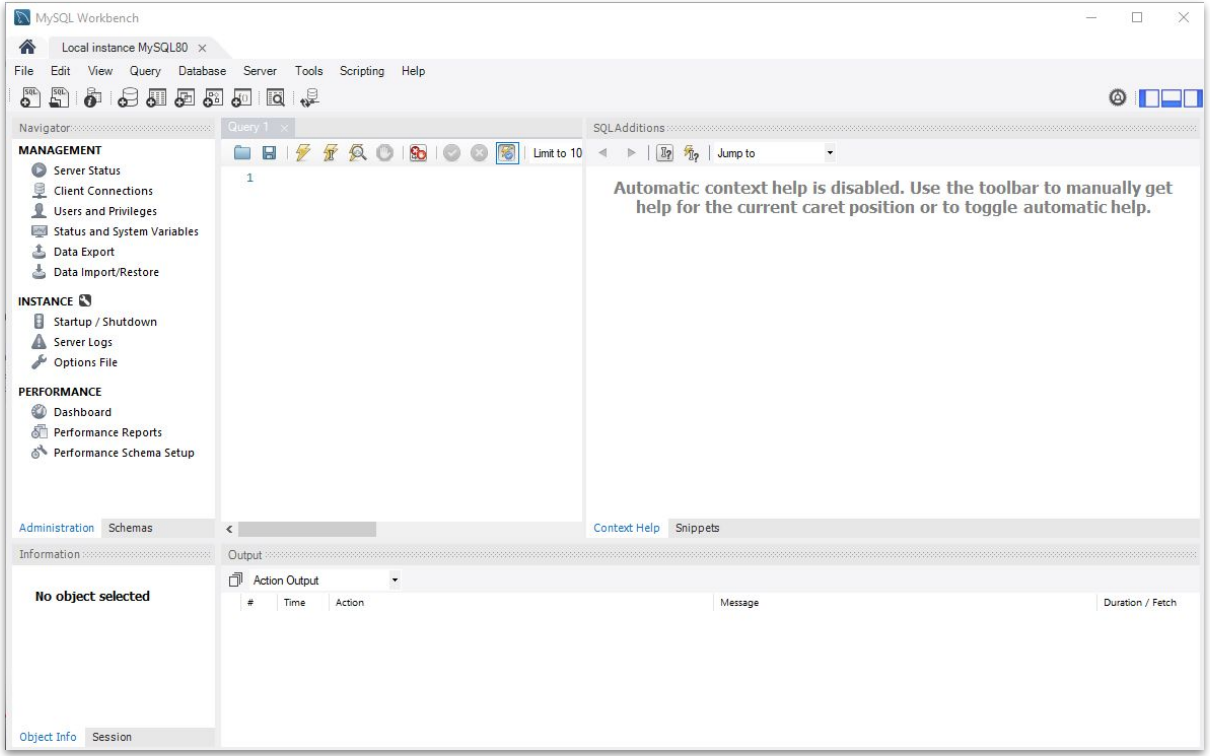
MySQL Workbench Overview

After successfully connecting, MySQL workbench will open on the following home screen:



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MySQL Workbench Overview

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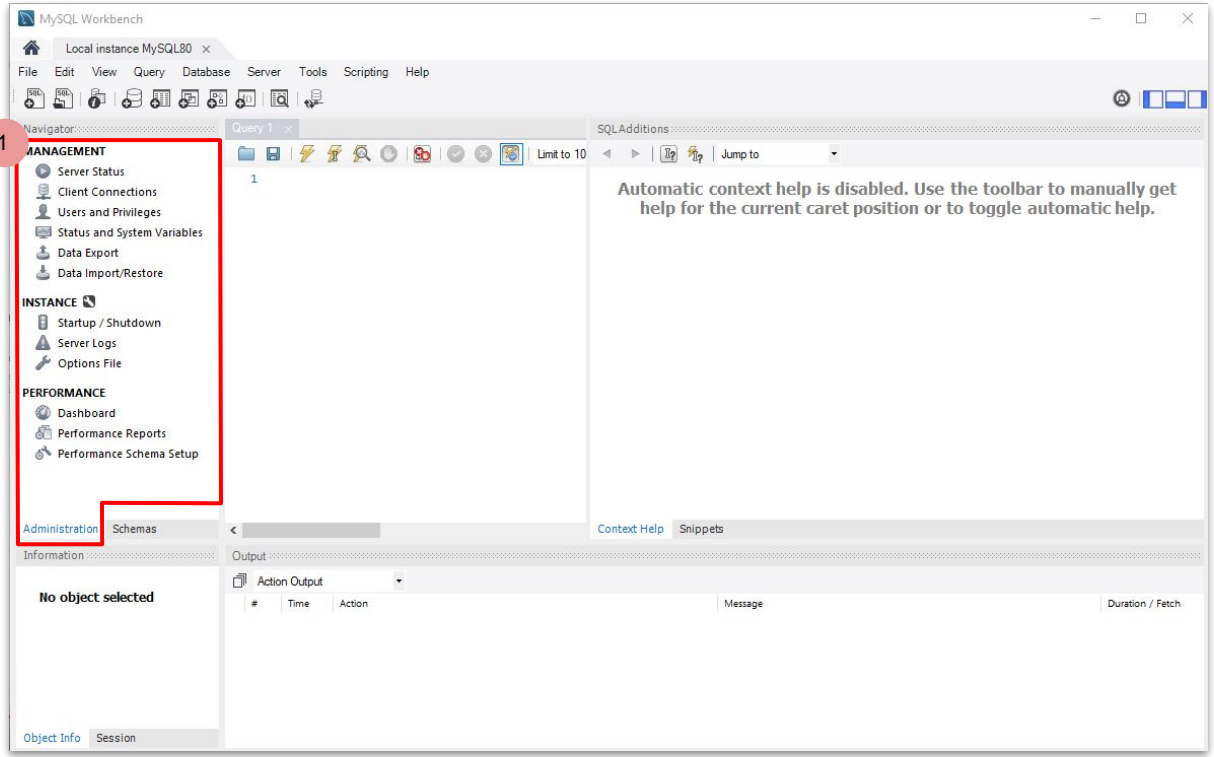

1. **Administration tab** - server configuration, user administration, and database health monitoring.

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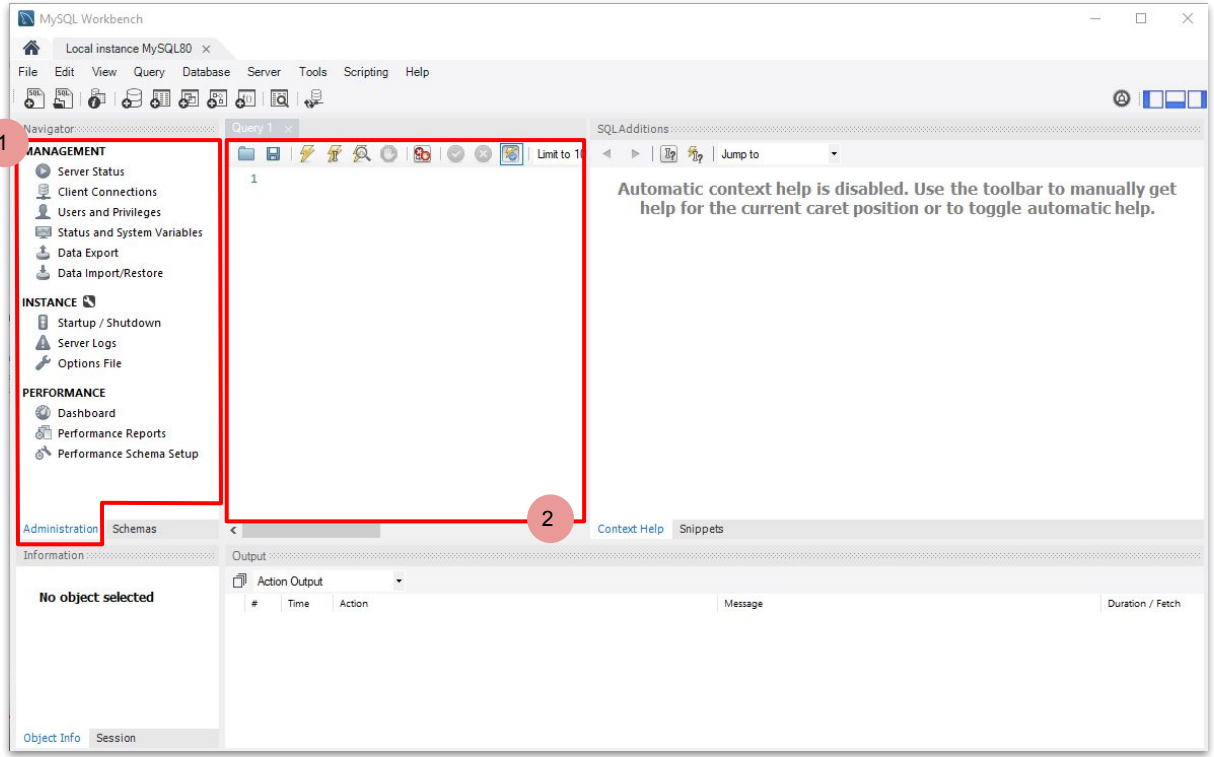
MySQL Workbench Overview

After a successfully connecting, MySQL workbench will open on the following home screen:

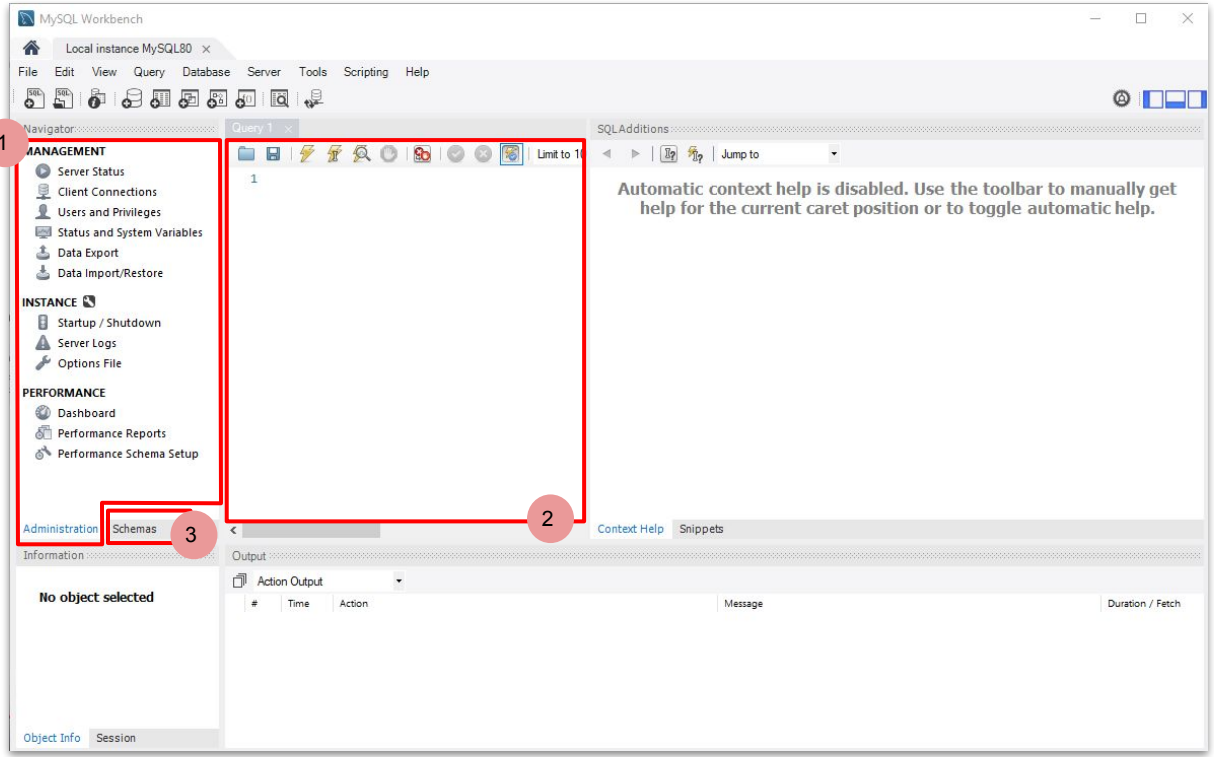


1. **Administration tab** - server configuration, user administration, and database health monitoring.
2. **SQL query pane** - Write and execute SQL queries

EXPLORE DIGITAL SKILLS

MySQL Workbench Overview

After a successfully connecting, MySQL workbench will open on the following home screen:



1. **Administration tab** - server configuration, user administration, and database health monitoring.
2. **SQL query pane** - Write and execute SQL queries
3. **Schemas tab** - View existing databases

EXPLORE DIGITAL SKILLS

MySQL Workbench Overview

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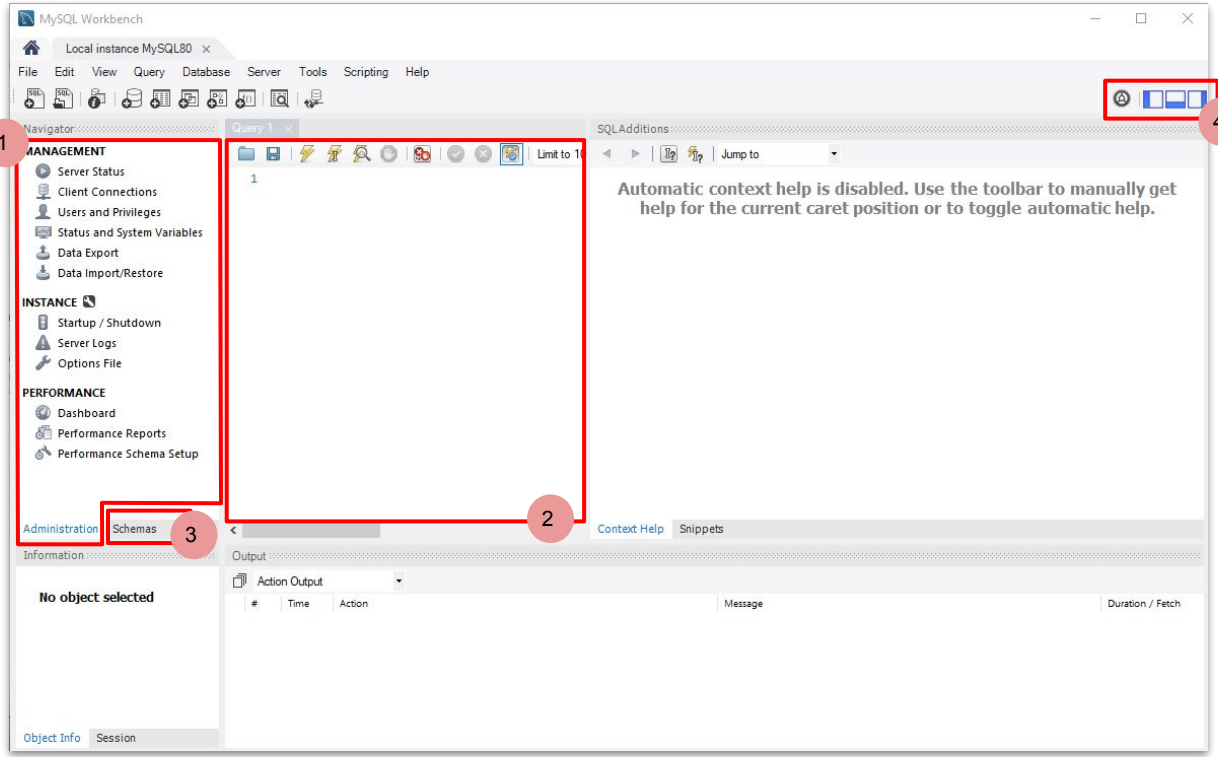
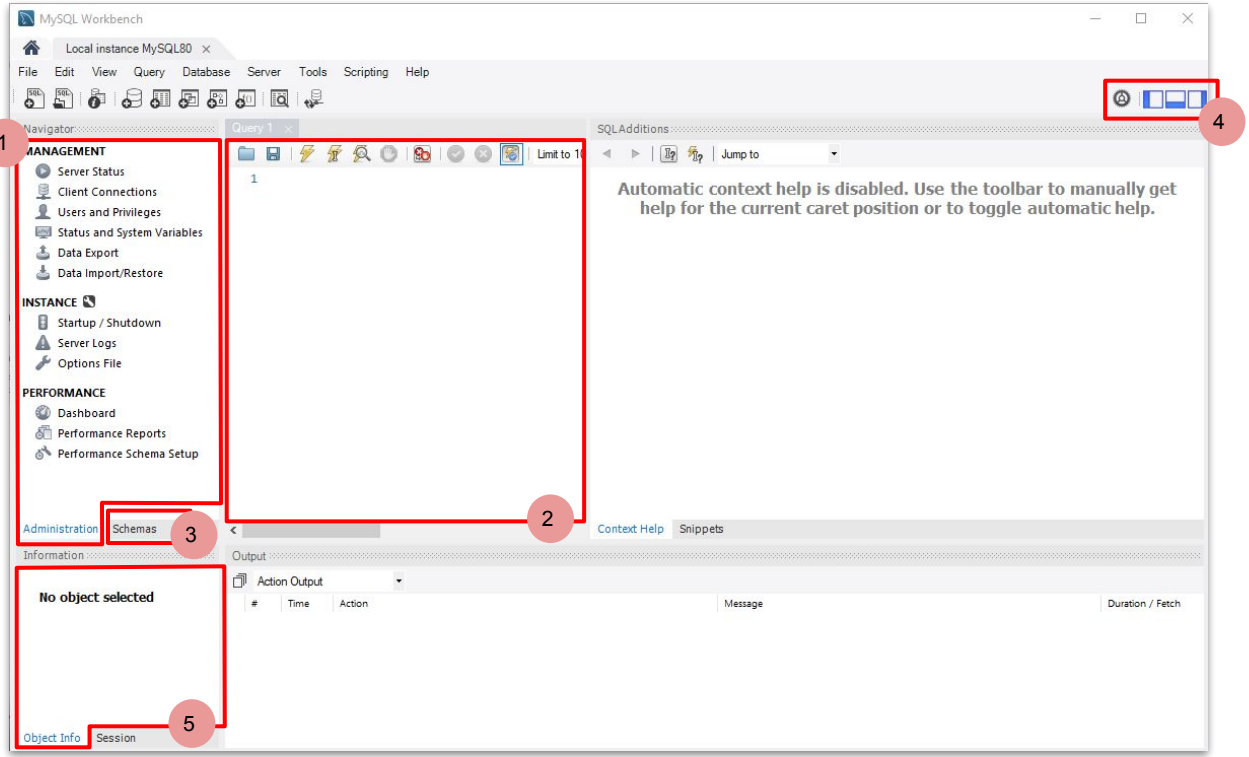


1. **Administration tab** - server configuration, user administration, and database health monitoring.
2. **SQL query pane** - Write and execute SQL queries
3. **Schemas tab** - View existing databases
4. **Layout buttons** - Toggle MySQL workbench layout

EXPLORE DIGITAL SKILLS

MySQL Workbench Overview

After a successfully connecting, MySQL workbench will open on the following home screen:



1. **Administration tab** - server configuration, user administration, and database health monitoring.
2. **SQL query pane** - Write and execute SQL queries
3. **Schemas tab** - View existing databases
4. **Layout buttons** - Toggle MySQL workbench layout
5. **Active object view** - view active schema (i.e. database).

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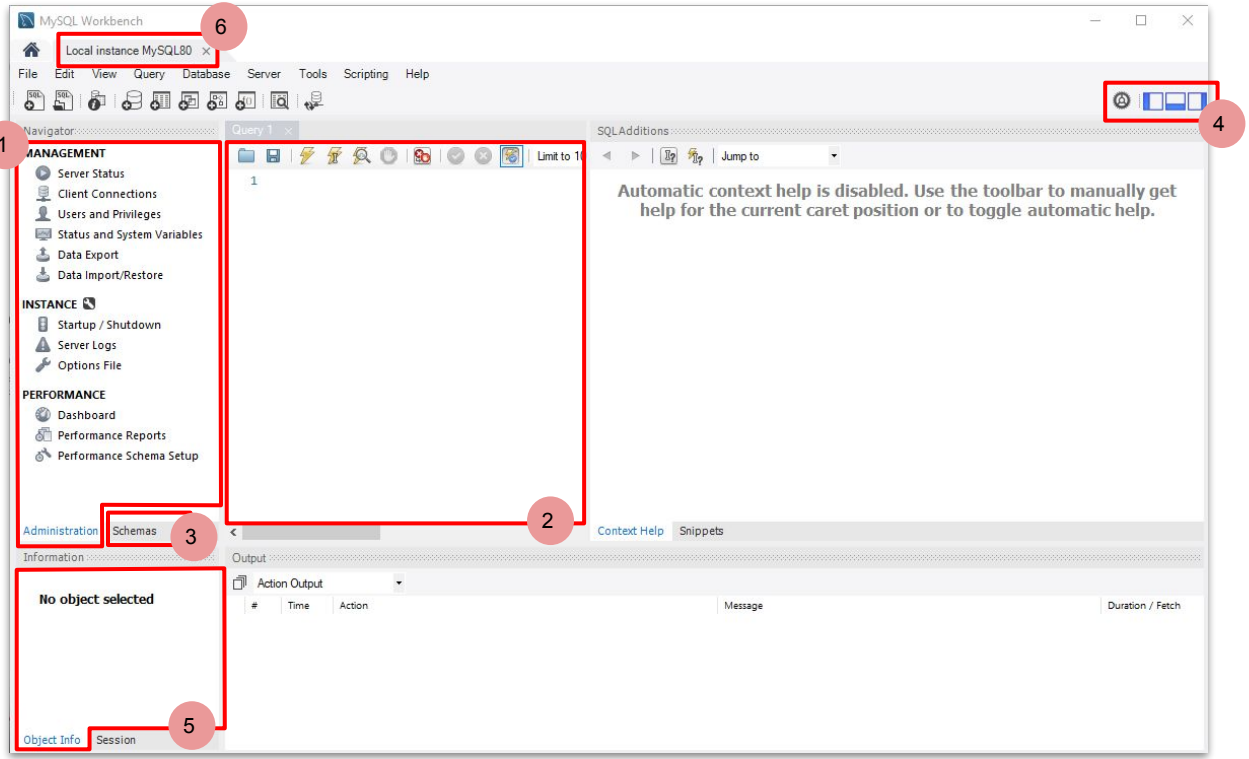
MySQL Workbench Overview

After a successfully connecting, MySQL workbench will open on the following home screen:



1. **Administration tab** - server configuration, user administration, and database health monitoring.
2. **SQL query pane** - Write and execute SQL queries
3. **Schemas tab** - View existing databases
4. **Layout buttons** - Toggle MySQL workbench layout
5. **Active object view** - view active schema (i.e. database).
6. **Active MySQL server connection**

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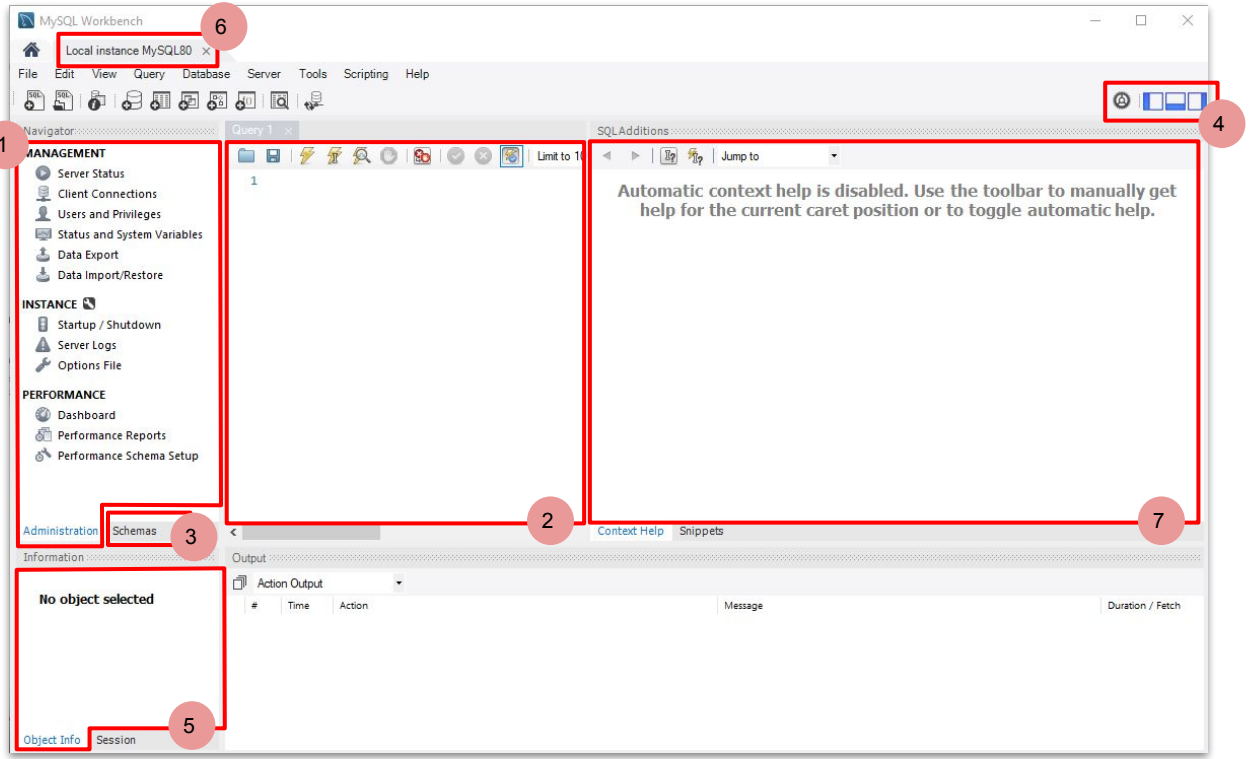
MySQL Workbench Overview

After a successfully connecting, MySQL workbench will open on the following home screen:



1. **Administration tab** - server configuration, user administration, and database health monitoring.
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3. **Schemas tab** - View existing databases
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5. **Active object view** - view active schema (i.e. database).
6. **Active MySQL server connection**
7. **Additions pane** - for containing SQL statements or snippets

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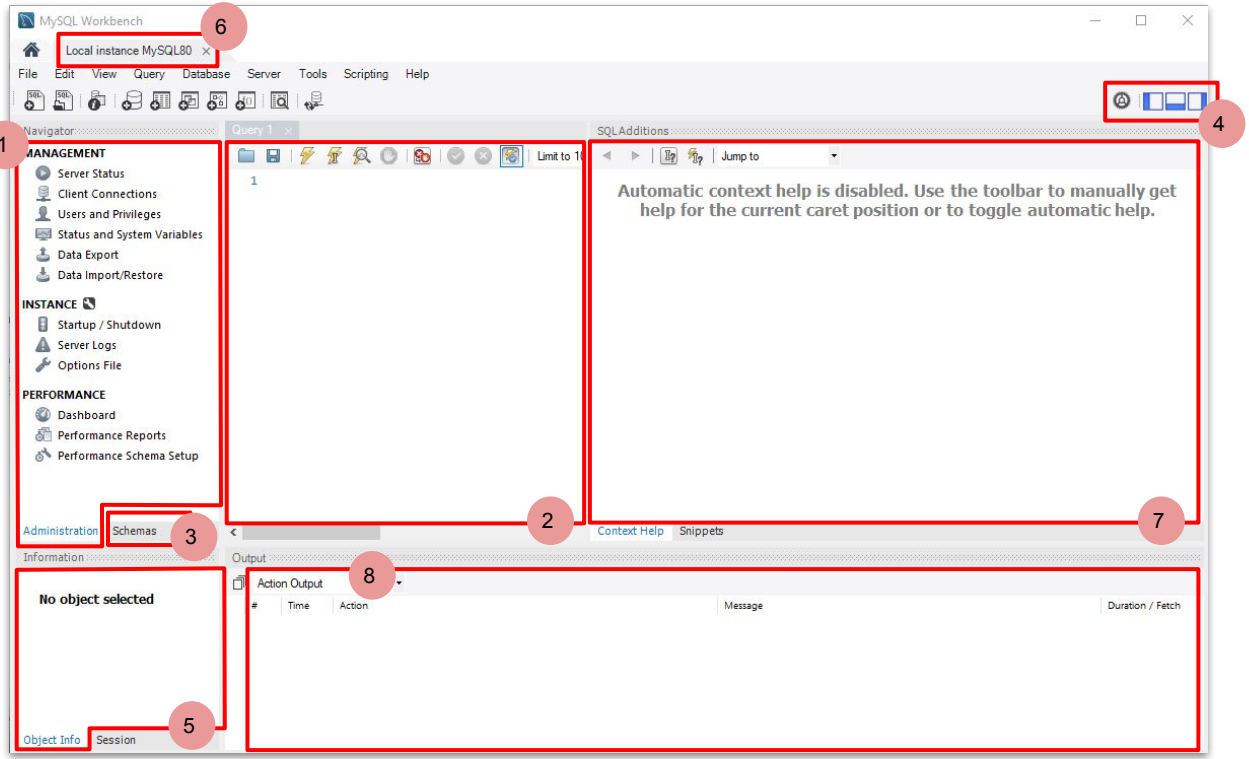
MySQL Workbench Overview

After a successfully connecting, MySQL workbench will open on the following home screen:



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3. **Schemas tab** - View existing databases
4. **Layout buttons** - Toggle MySQL workbench layout
5. **Active object view** - view active schema (i.e. database).
6. **Active MySQL server connection**
7. **Additions pane** - for containing SQL statements or snippets
8. **Output pane**

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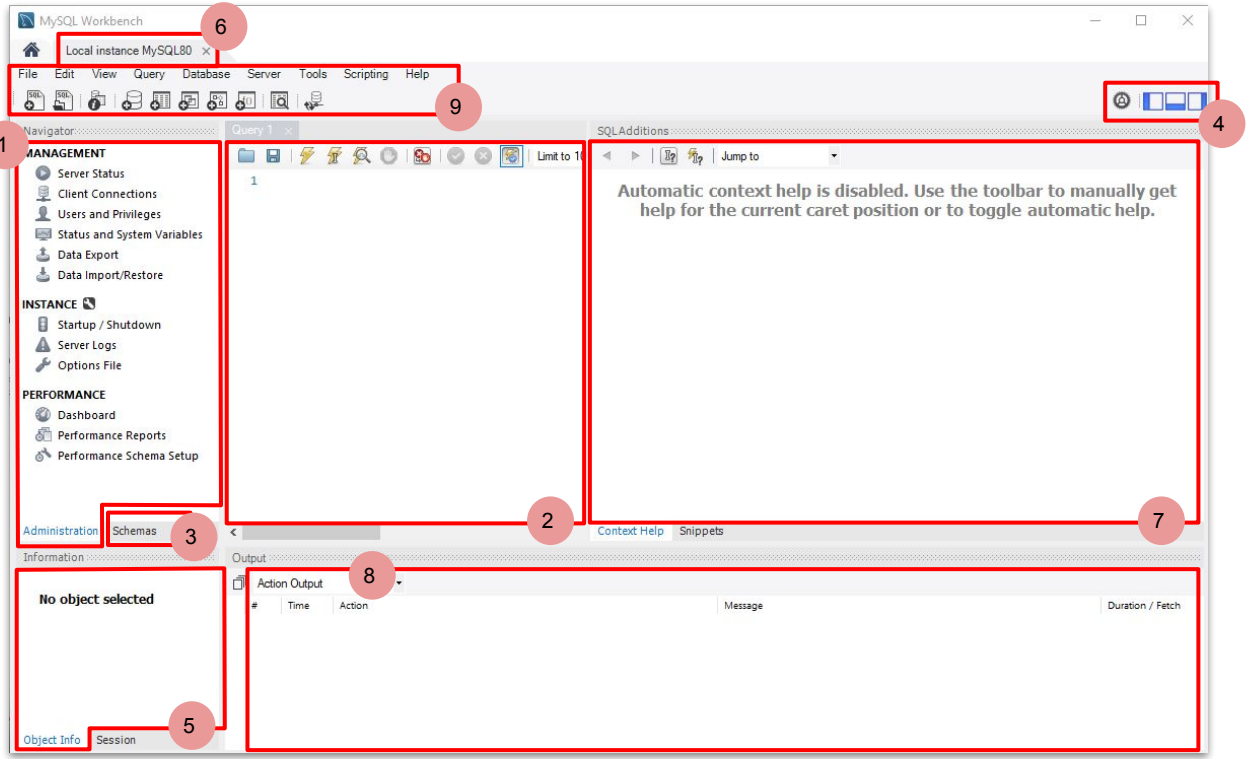
MySQL Workbench Overview

After a successfully connecting, MySQL workbench will open on the following home screen:



1. **Administration tab** - server configuration, user administration, and database health monitoring.
2. **SQL query pane** - Write and execute SQL queries
3. **Schemas tab** - View existing databases
4. **Layout buttons** - Toggle MySQL workbench layout
5. **Active object view** - view active schema (i.e. database).
6. **Active MySQL server connection**
7. **Additions pane** - for containing SQL statements or snippets
8. **Output pane**
9. **Ribbon**:

- Create or open SQL script file

- Create new database in active server connection

- Create new table in active database

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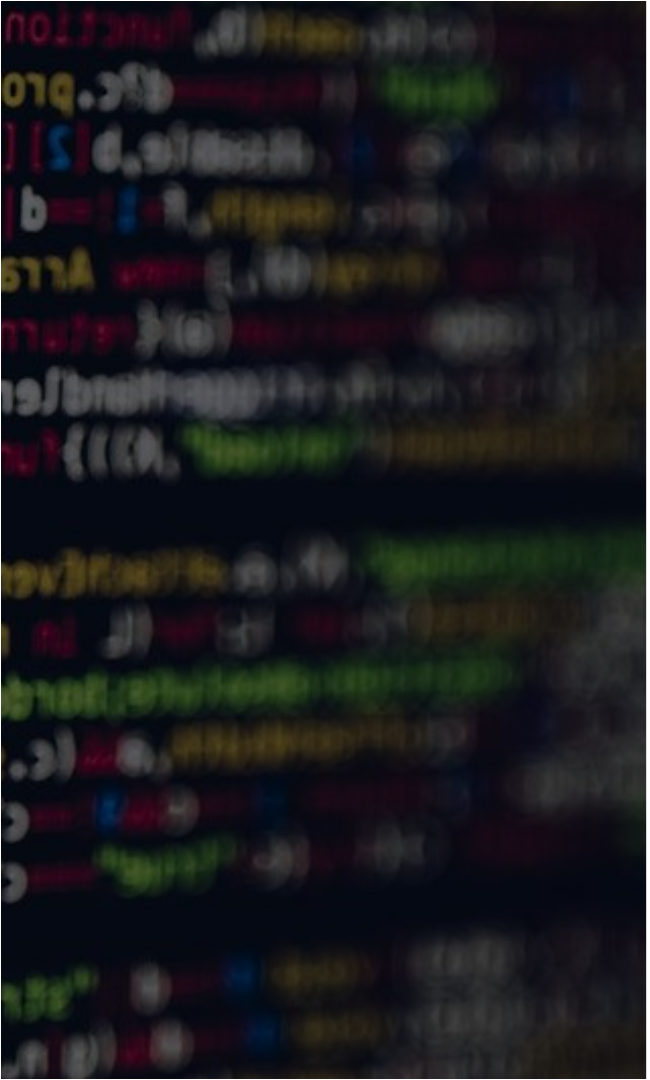

Installing MySQL Workbench

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MySQL Workbench Overview

Table Relationships

Creating a Relational Database

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Table Relationships

Relational databases are collections of tables that are connected together. Each table represents an entity that has a collection of attributes (i.e. table columns). Tables in a database are connected to each other by means of relationships which are specified according to how different entities interact with each other. There are 4 main types of table relationships:

Relationship	ER diagram Symbol	Description
One to One		An instance in one table relates to a single instance in another table, e.g. a customer in the customers table can only have one address in the address in the addresses table.
One to Many or Many to One		An instance in one table can correspond to multiple instances in another table, e.g. each customer from the customers table can have multiple invoices from the invoices table. For the “Many to One” relationship, the reverse is true.
Many to Many		Multiple instances of one table can correspond to multiple instances of another table, e.g. one invoice can contain multiple items and each item can be in multiple invoices.
Self Referencing Relationship	* depends on nature of relationship	An instance in one table can correspond to another instance in the same table, i.e. through a different attribute.

Table Relationships

In order to connect a table to one or more tables in the database, we need to specify table relationships using key columns. Two tables are regarded as connected if one or both of the tables contain information that is related to one or more of the other tables columns. This way, information about an instance of an entity can be distributed across multiple tables in the database. There are two main types of key columns :

Primary keys

This is an attribute (i.e. column) that can be used to uniquely identify any row in the table. By definition, primary key columns cannot have duplicate or missing entries. As such, we usually auto-generate primary key values using special columns, e.g. INT AUTO_INCREMENT, that generate a value each time we add a row to the table.

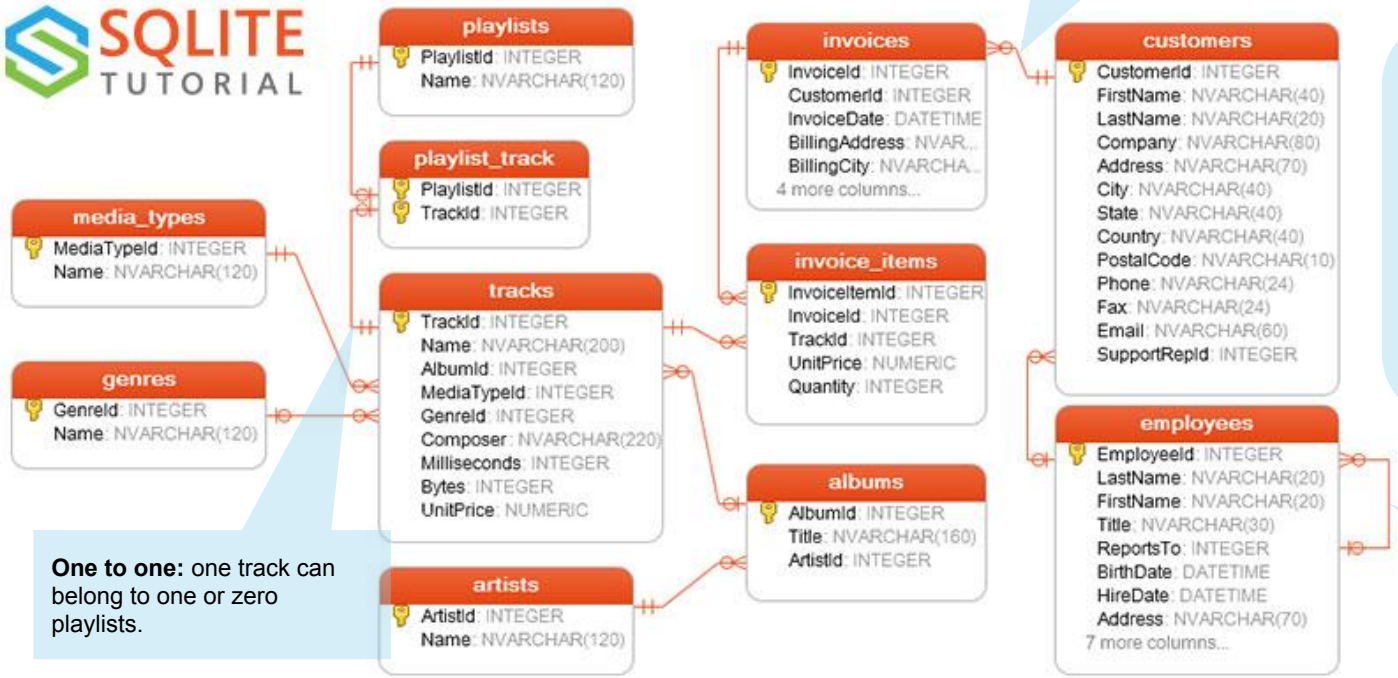
Foreign keys

This is an attribute (or set of attributes) in a table whose value corresponds to a primary key in another table. Unlike primary keys, foreign keys can have duplicate entries. However, foreign keys columns must still obey the constraint that each entry in the column has to correspond to some value in primary key column of the connected table.

Table Relationships

Chinook ER relationship examples:

Primary key columns in the database are are indicated with the key icons



One to Many: One and only one customer can have zero or many invoices.

One to one: one track can belong to one or zero playlists.

Self reference (many to one): Multiple employees can report to the same manager.

More relationships

- Zero or many
- Zero or one
- One and only one

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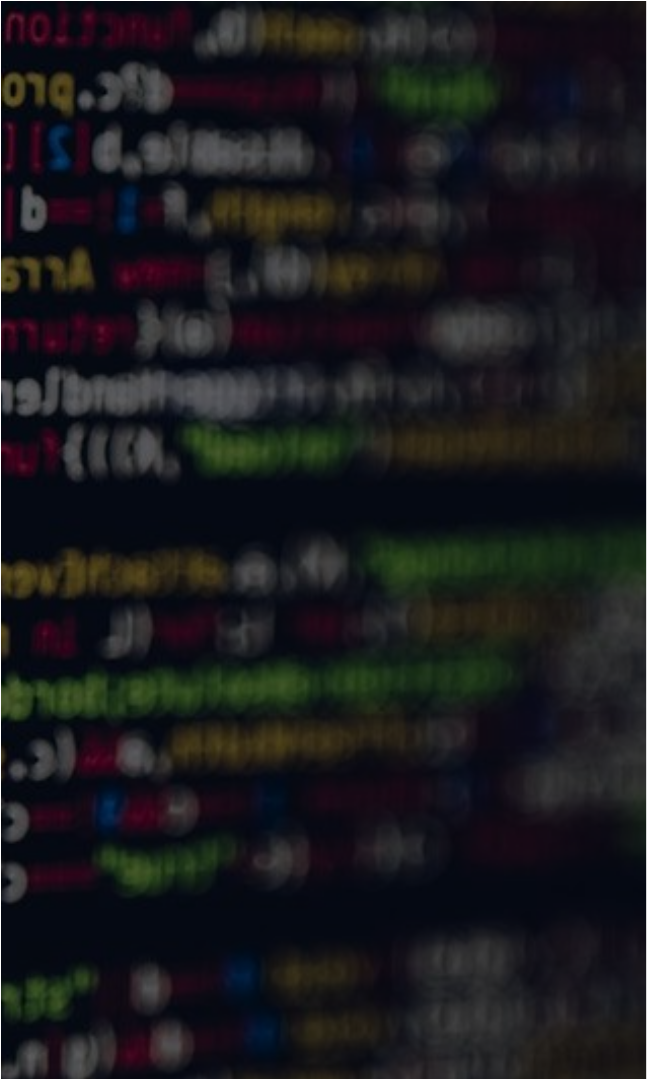

Installing MySQL Workbench

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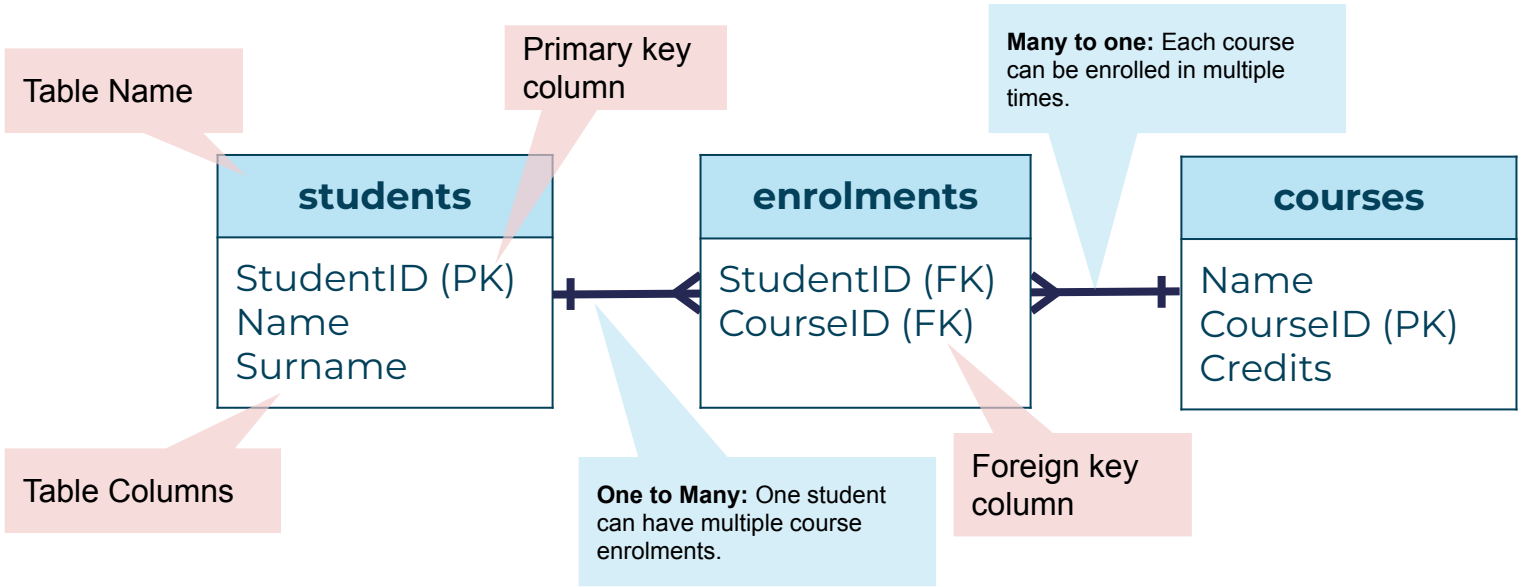
Table Relationships

Creating a Relational Database

EXPLORE DIGITAL SKILLS

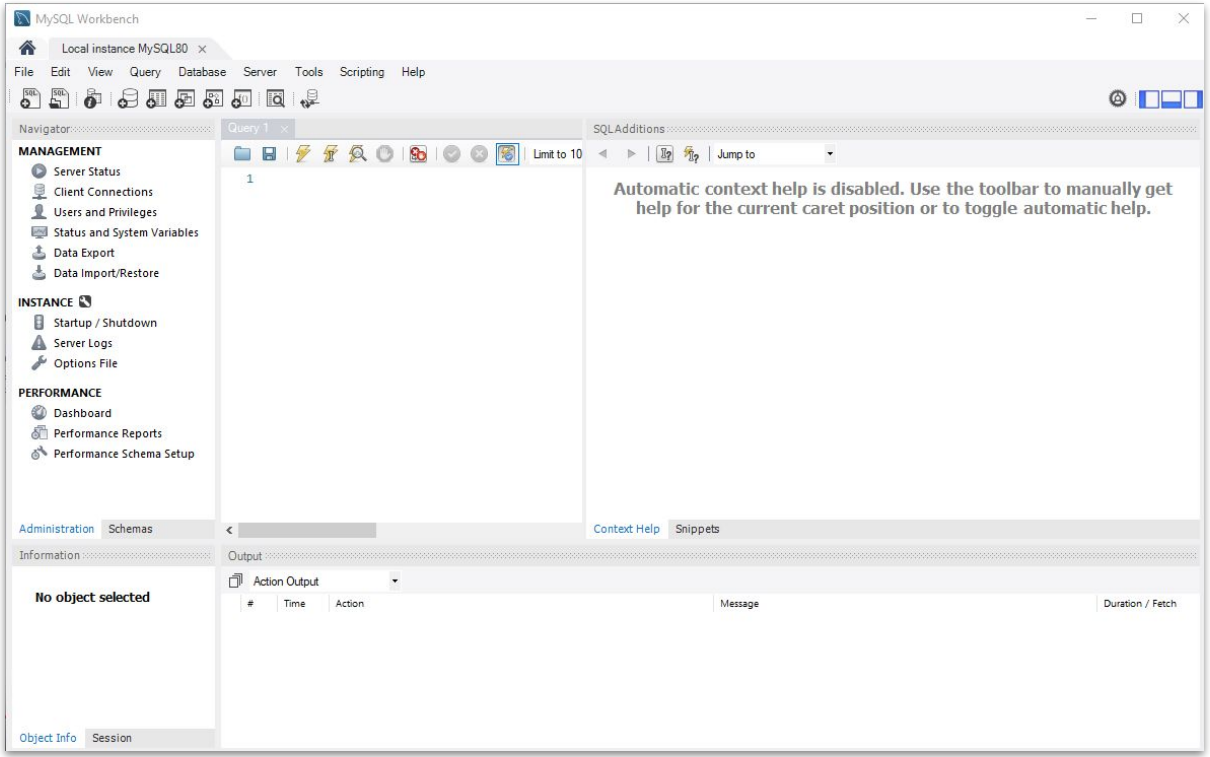
Creating a Relational Database

Now that we understand table relationships, let's create our own database. We will use MySQL workbench to create a college database structured according to the following ER diagram:



Creating a Relational Database

In this section, we cover how to create the database using the MySQL workbench interface:



Creating a Schema

1. Open MySQL workbench and connect to MySQL server as shown earlier in this train.

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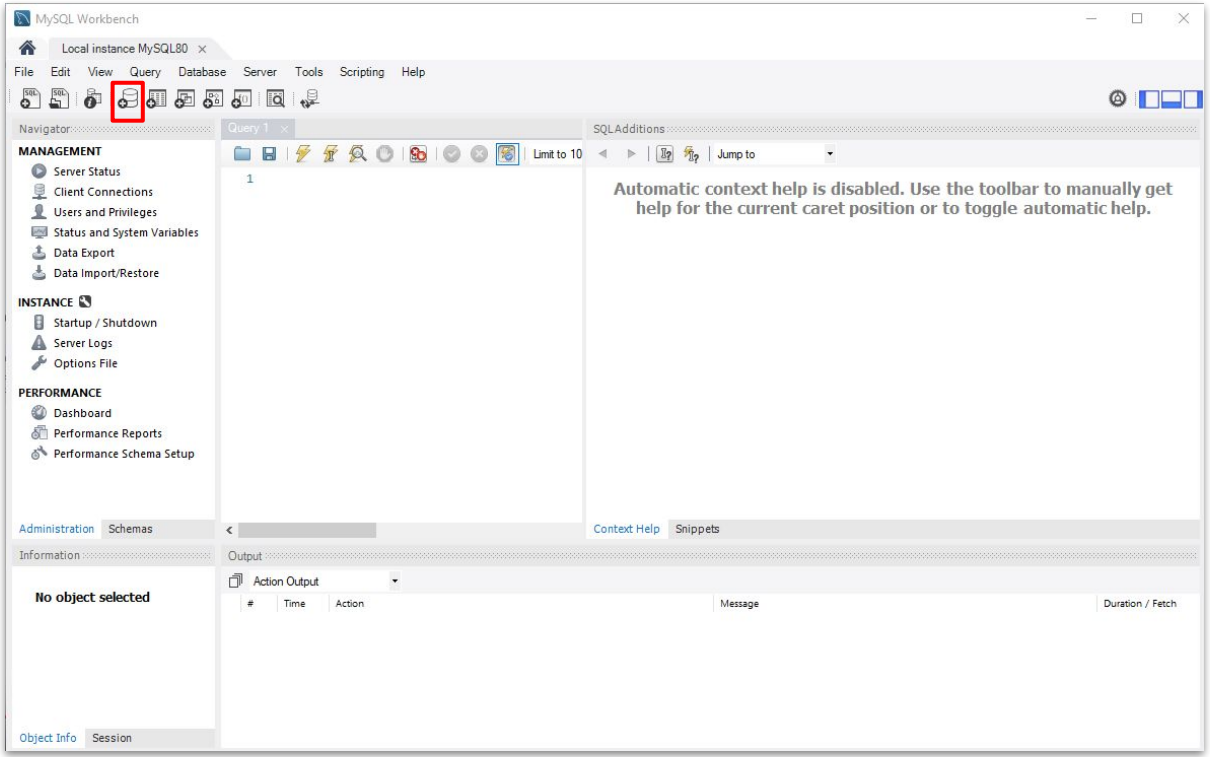
Creating a Relational Database

In this section, we cover how to create the database using the MySQL workbench interface:



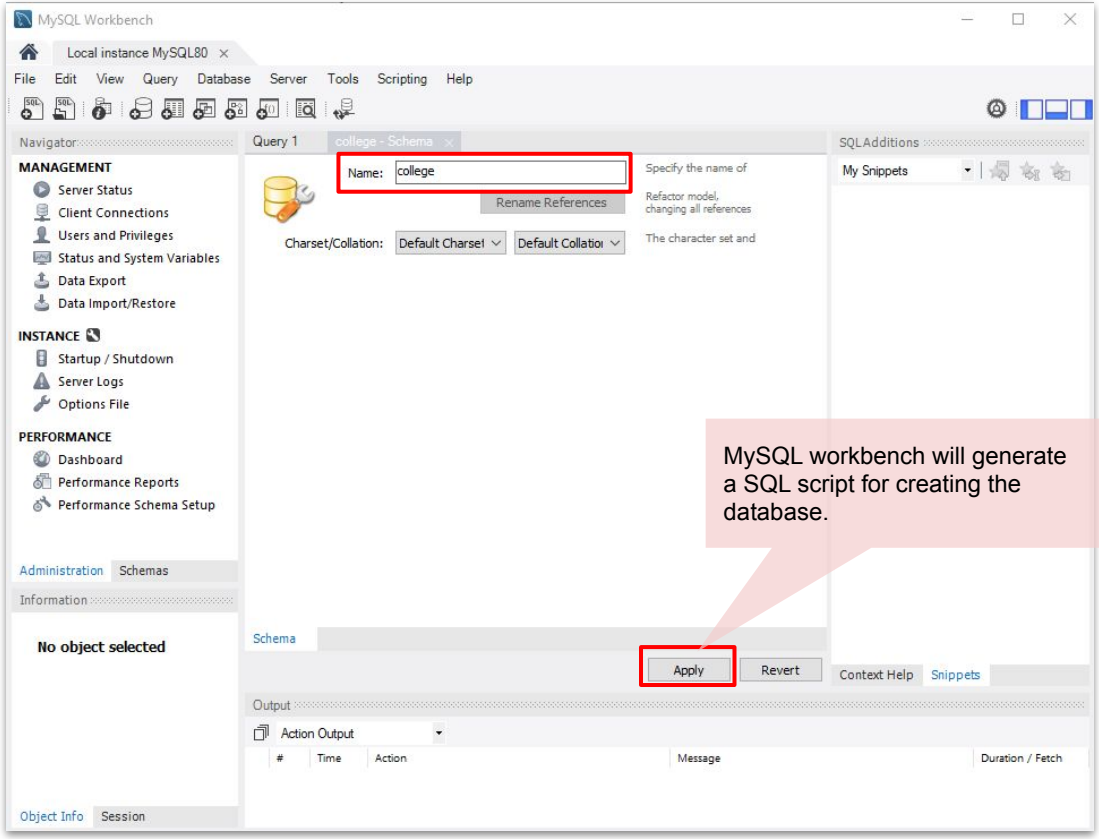
Creating a Schema

1. Open MySQL workbench and connect to MySQL server as shown earlier in this train.
2. Click the create schema button  , to create the database.

EXPLORE DIGITAL SKILLS

Creating a Relational Database

In this section, we cover how to create the database using the MySQL workbench interface:



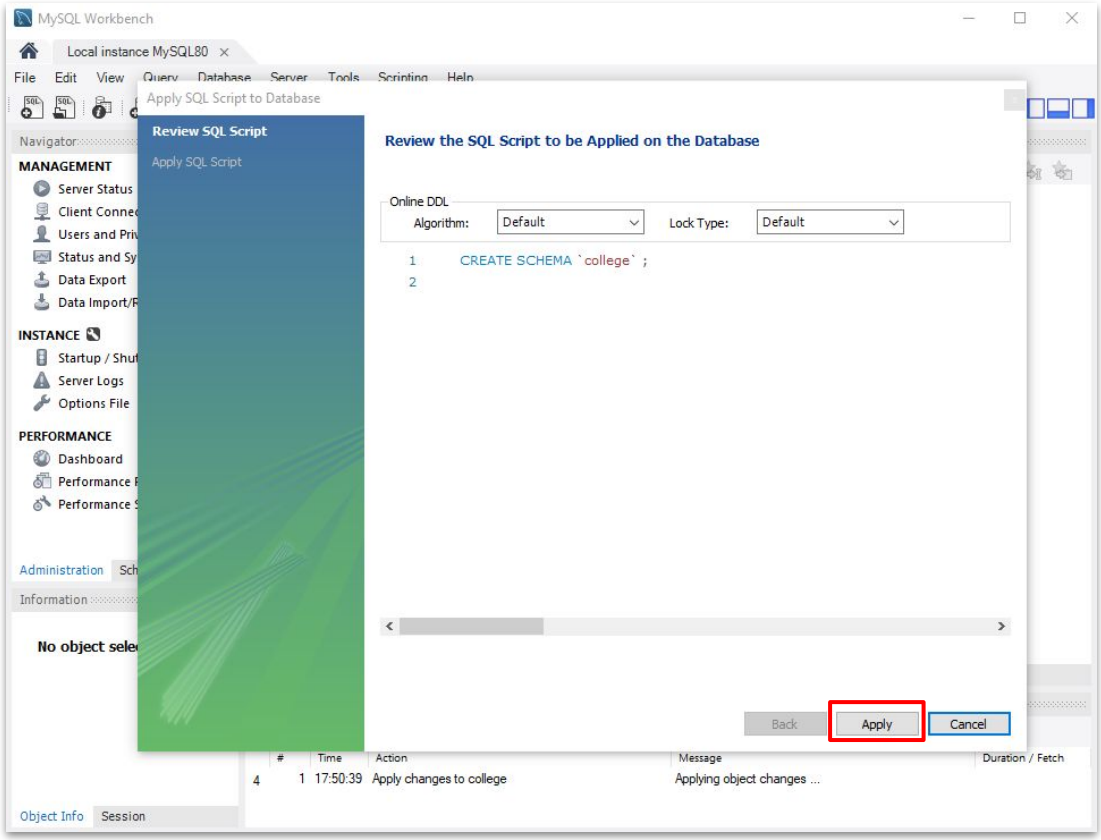
Creating a Schema

1. Open MySQL workbench and connect to MySQL server as shown earlier in this train.
2. Click the create schema button  , to create the database.
3. Specify a name for the database in the wizard and click apply.

EXPLORE DIGITAL SKILLS

Creating a Relational Database

In this section, we cover how to create the database using the MySQL workbench interface:



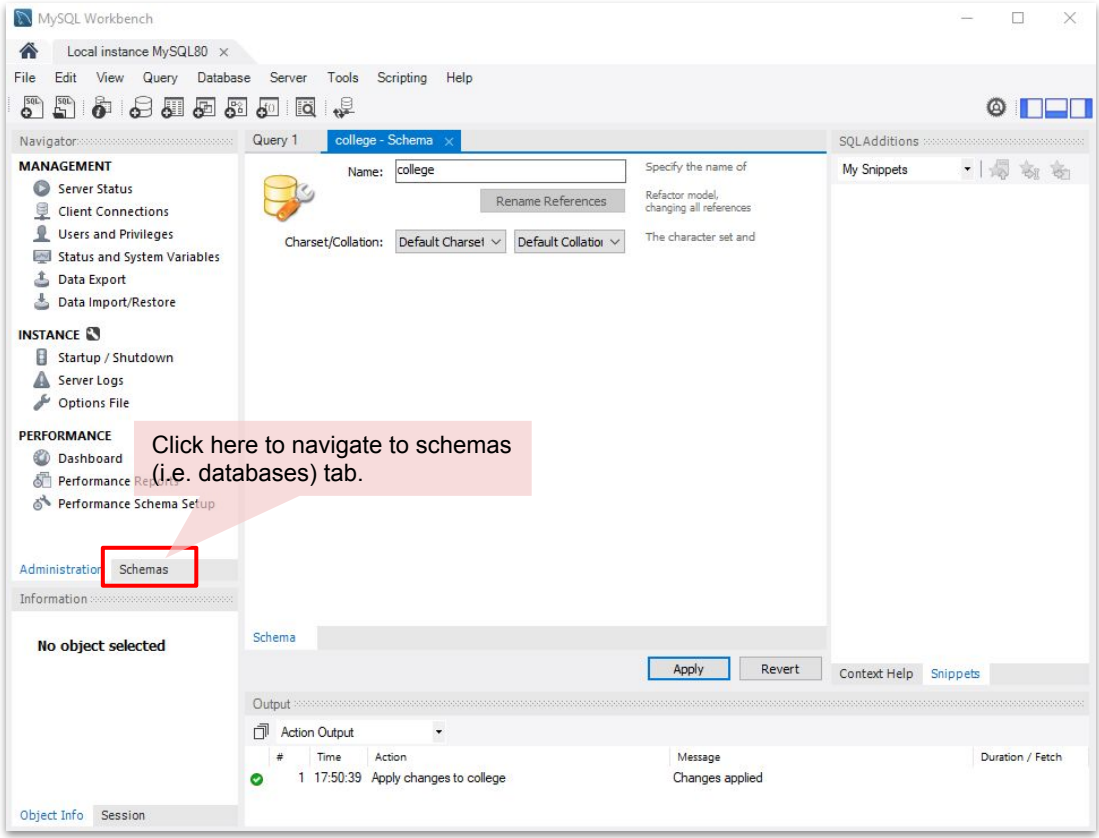
Creating a Schema

1. Open MySQL workbench and connect to MySQL server as shown earlier in this train.
2. Click the create schema button , to create the database.
3. Specify a name for the database in the wizard and click apply.
4. Click apply and then finish.

EXPLORE DIGITAL SKILLS

Creating a Relational Database

After creating the database, we need to set it as active. To do this, double click it's name in the the schemas tab.



EXPLORE DIGITAL SKILLS

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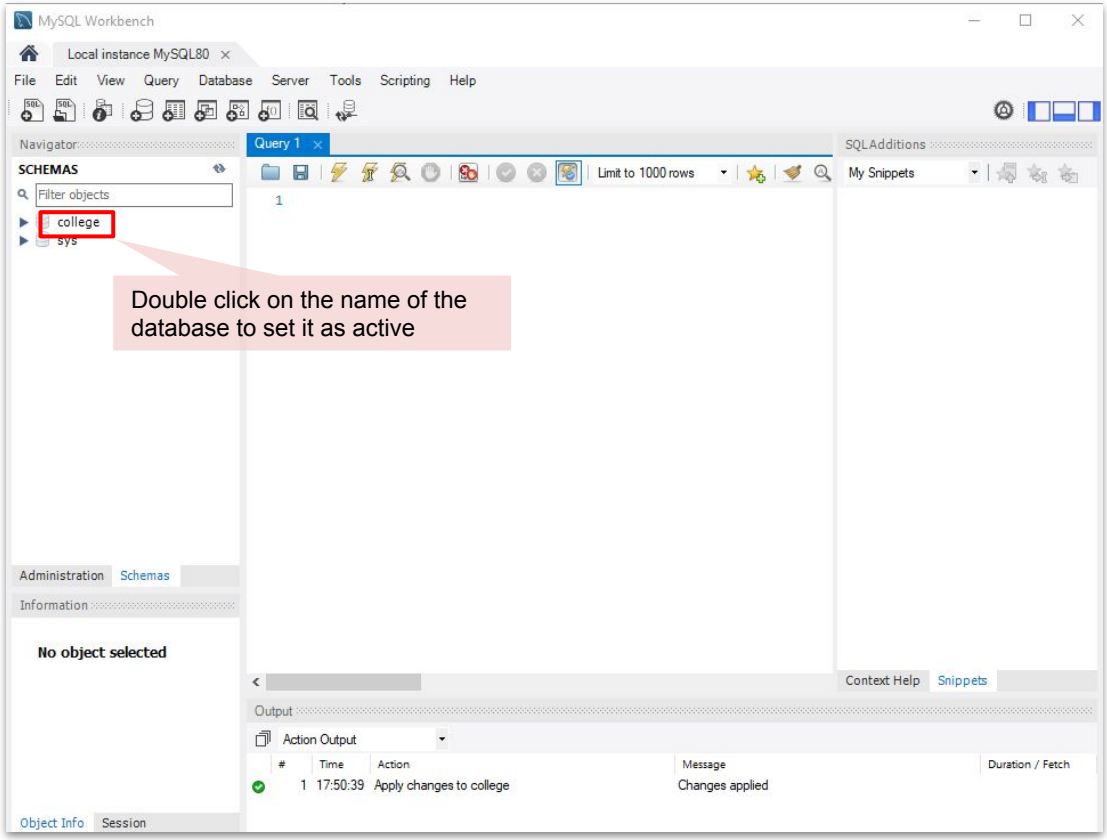

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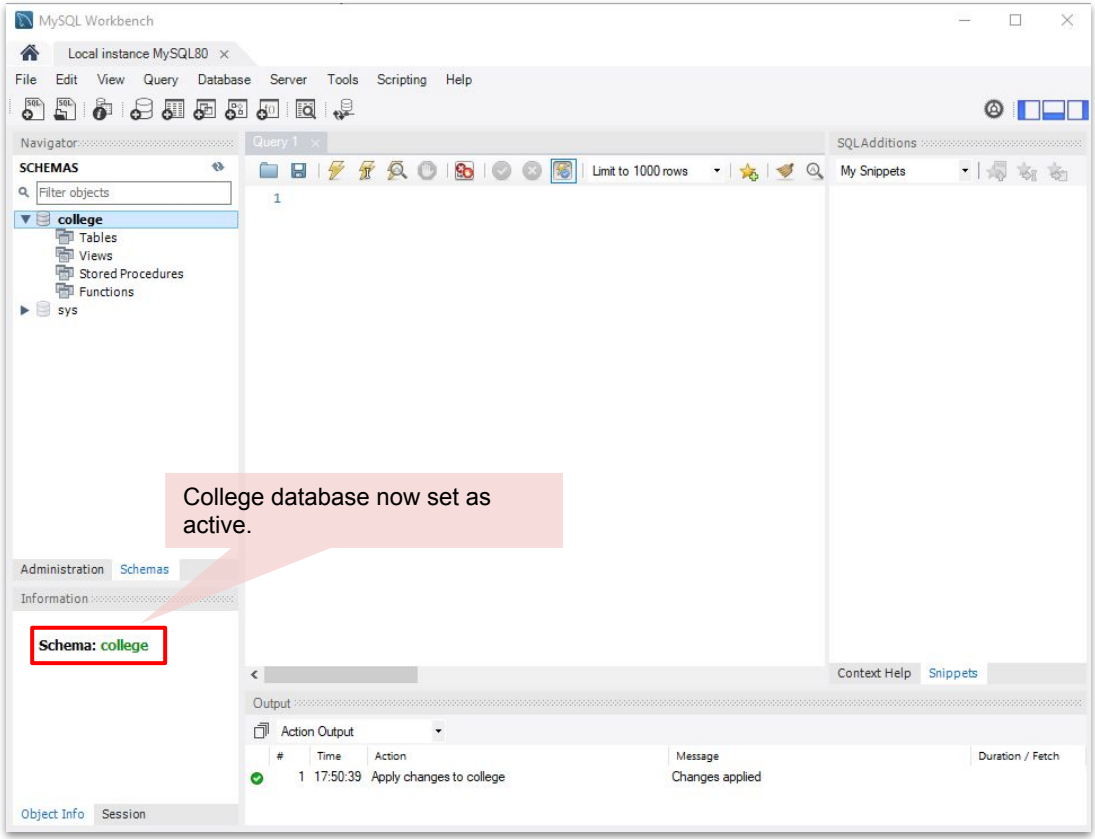
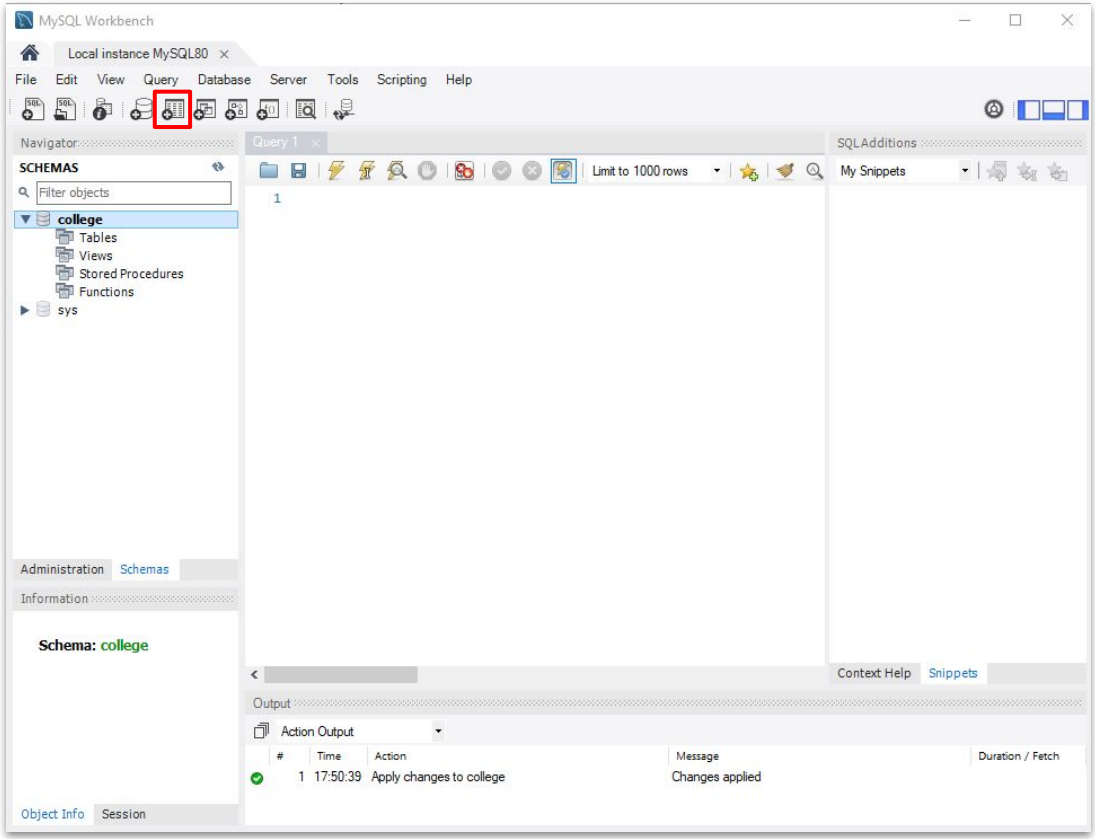


EXPLORE DIGITAL SKILLS

Creating a Relational Database

Next, we create tables under the active database:



Creating a Table

1. Click on the create new table button , to create a new table in the college database.
2. Set the table name, add columns, their datatypes, and constraints (i.e. set PK columns to Non-Null and Auto-Increment).

EXPLORE | DIGITAL SKILLS

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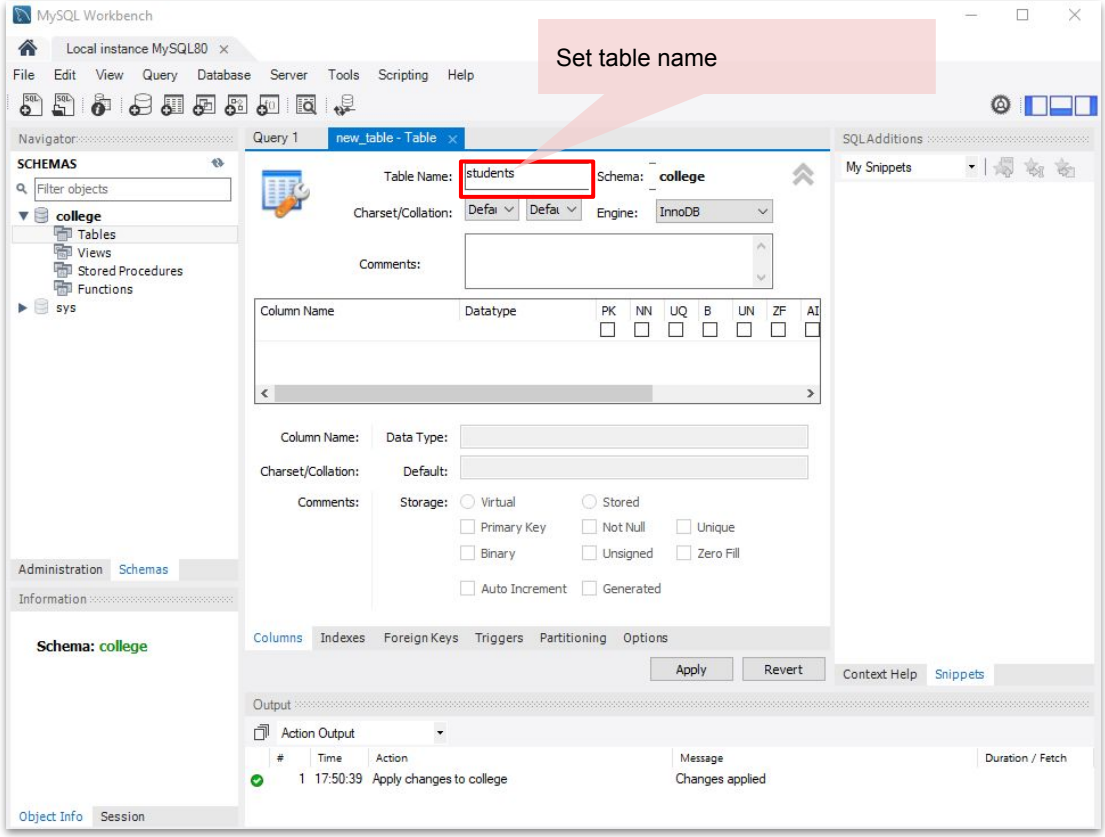

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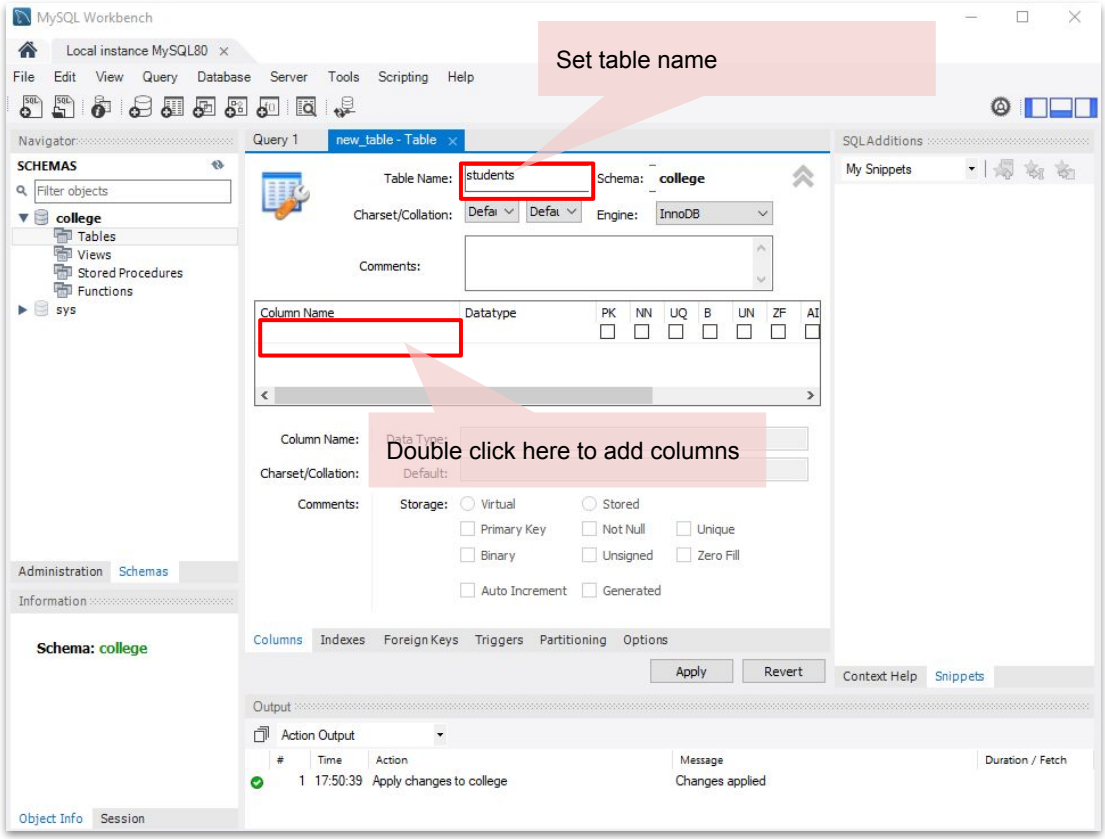

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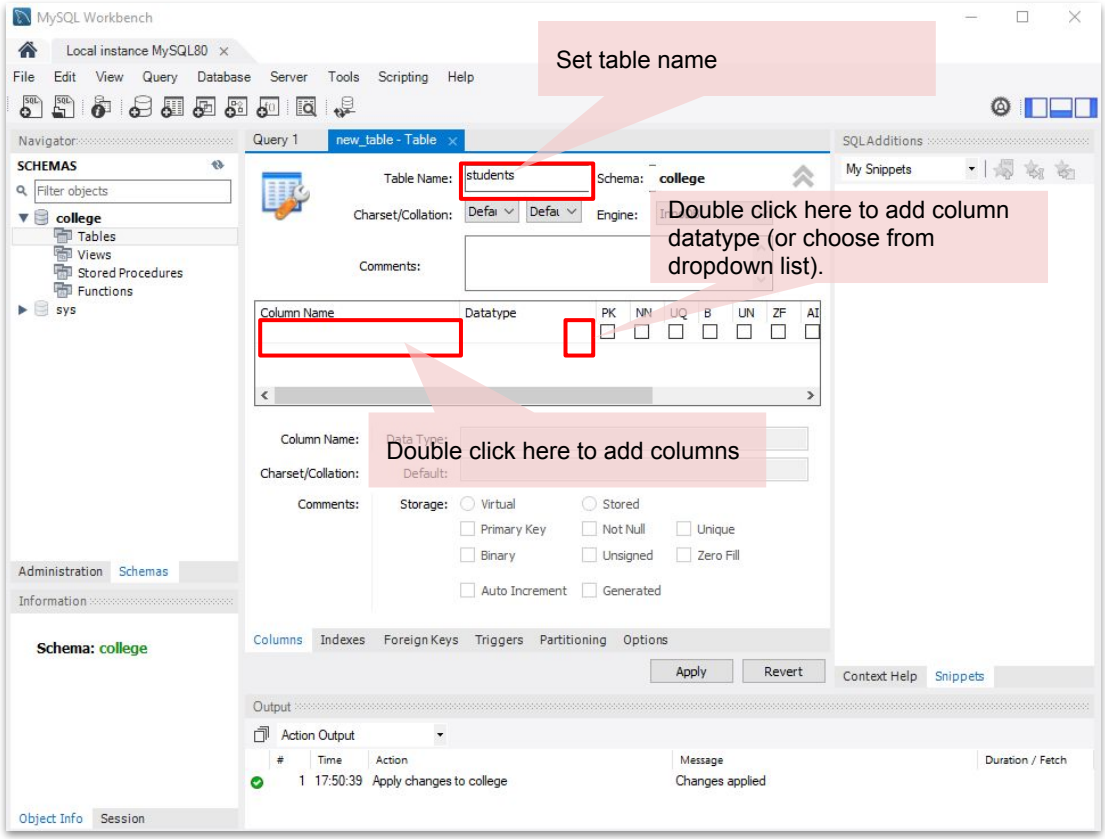

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EXPLORE DIGITAL SKILLS

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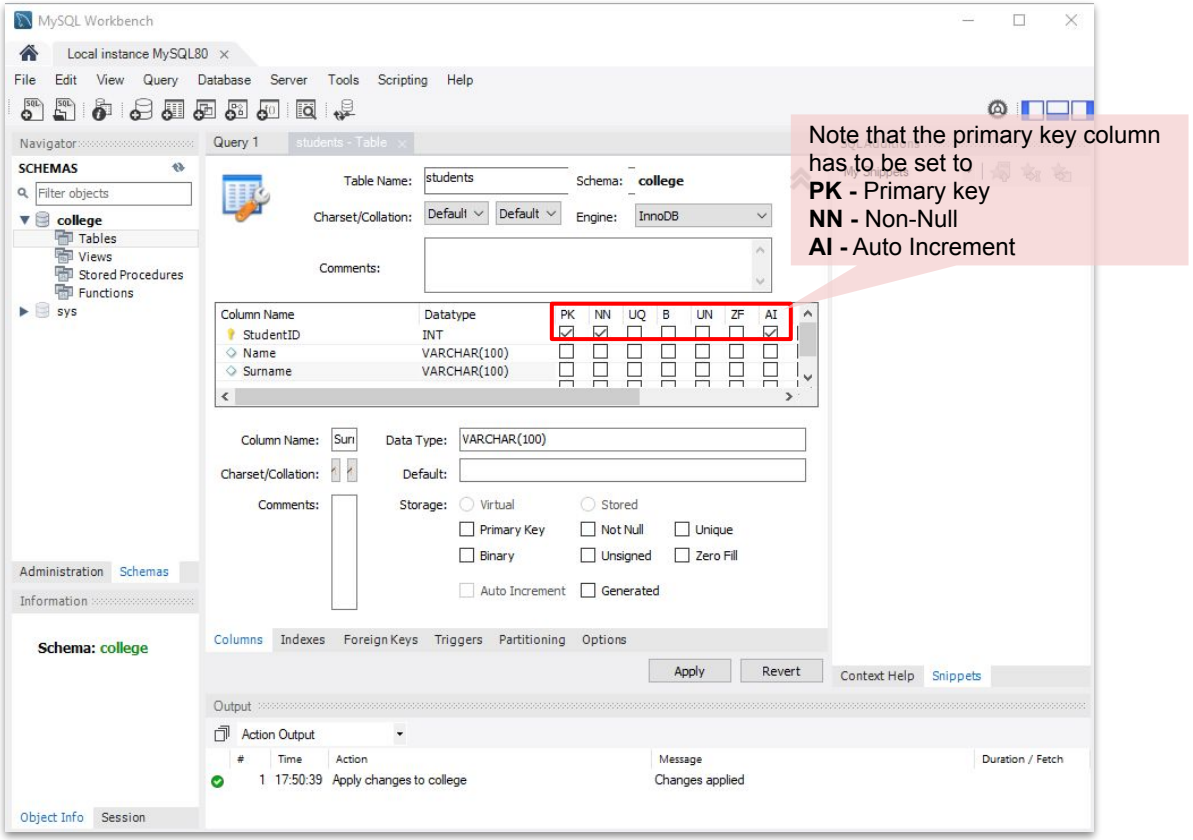

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EXPLORE DIGITAL SKILLS

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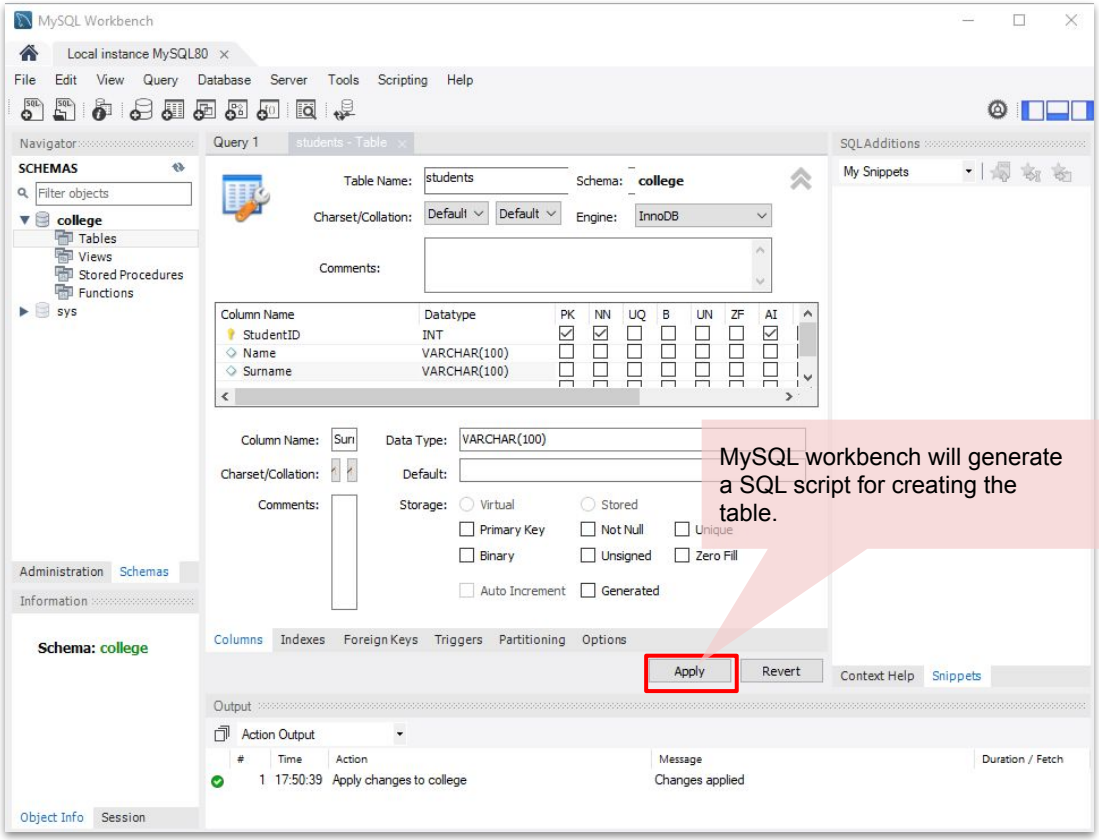


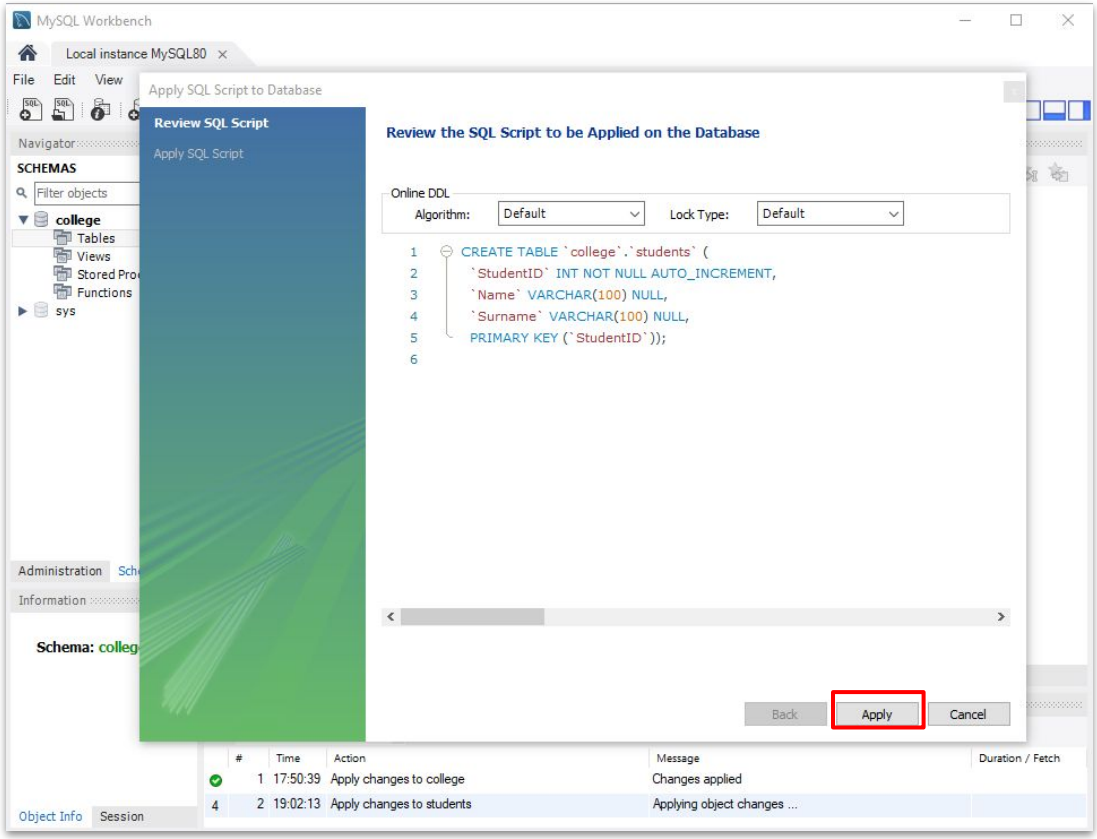
Creating a Table

1. Click on the create new table button , to create a new table in the college database.
2. Set the table name, add columns, their datatypes, and constraints (i.e. set PK columns to Non-Null and Auto-Increment).
3. Click apply, then apply again on the wizard, and finish.

EXPLORE DIGITAL SKILLS

Creating a Relational Database

Next, we create tables under the active database:



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EXPLORE | DIGITAL SKILLS

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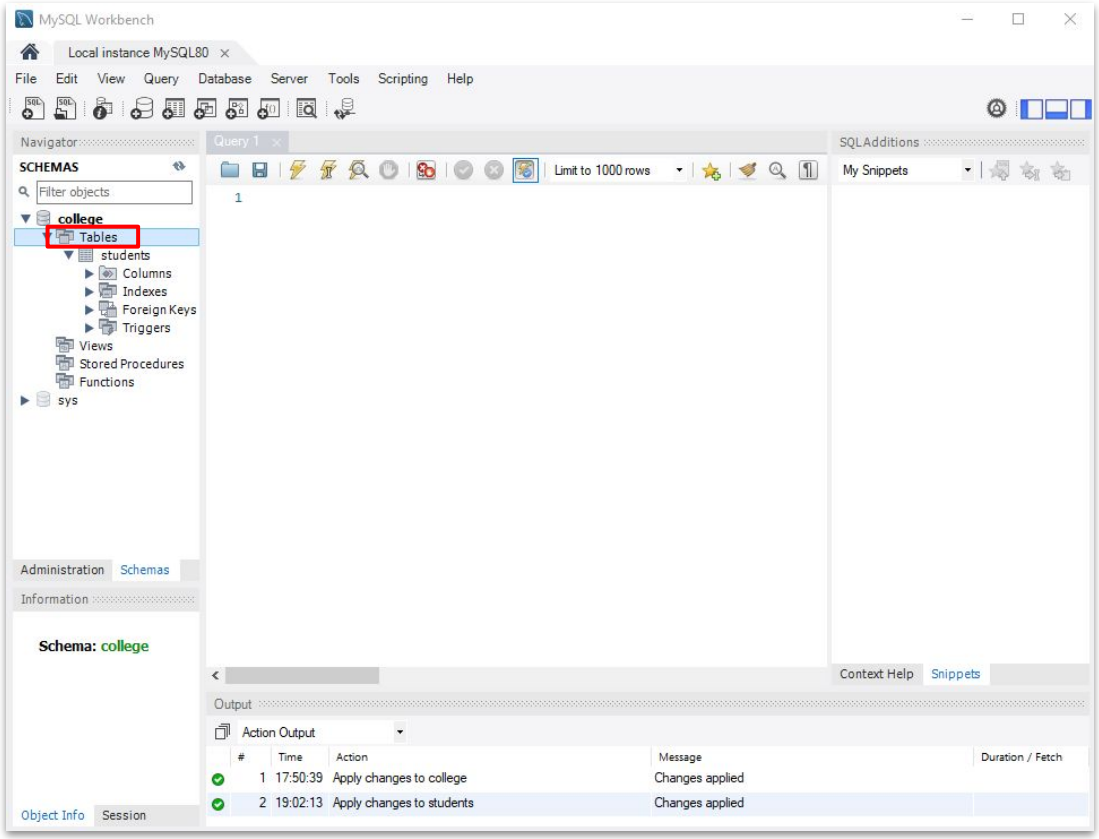

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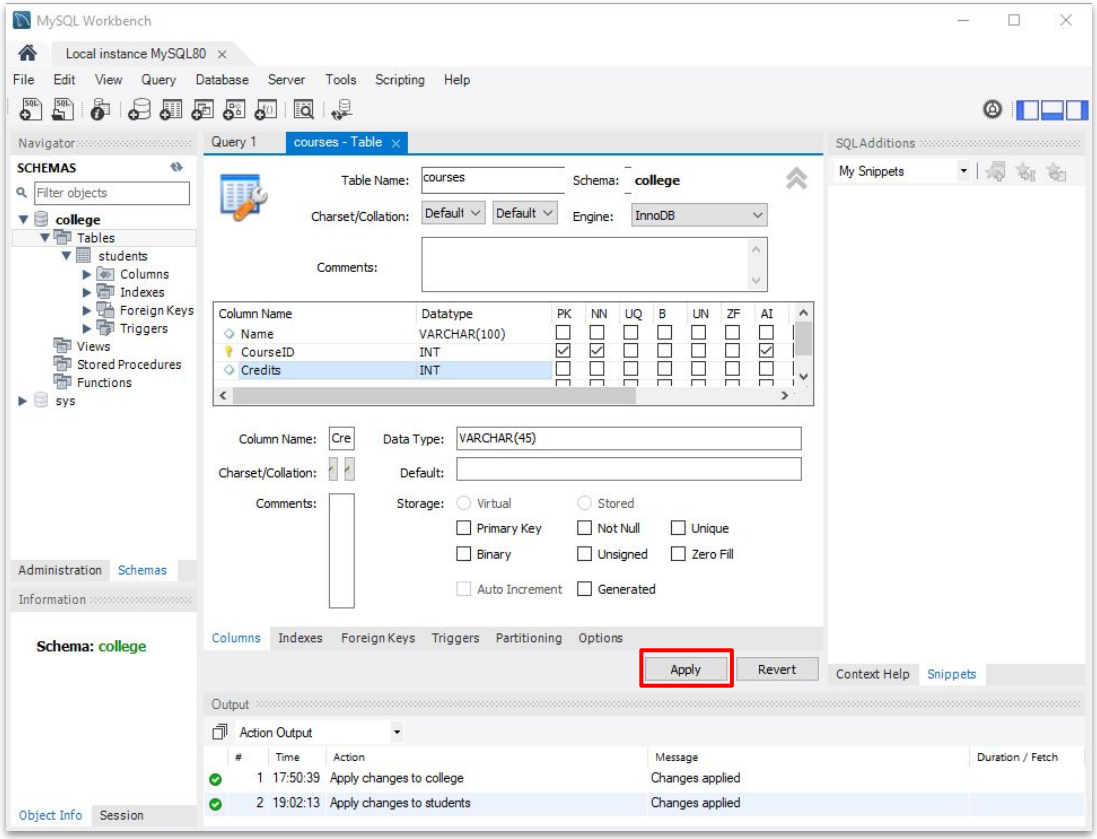
2. Set the table name, add columns, their datatypes, and constraints (i.e. set PK columns to Non-Null and Auto-Increment).
3. Click apply, then apply again on the wizard, and finish.
4. The new table can be viewed by clicking on the tables tab under the database name.

EXPLORE DIGITAL SKILLS

Creating a Relational Database

Repeat the process to create other tables, let's do the **courses** table next:



Creating a Table

1. Click on the create new table button , to create a new table in the college database.
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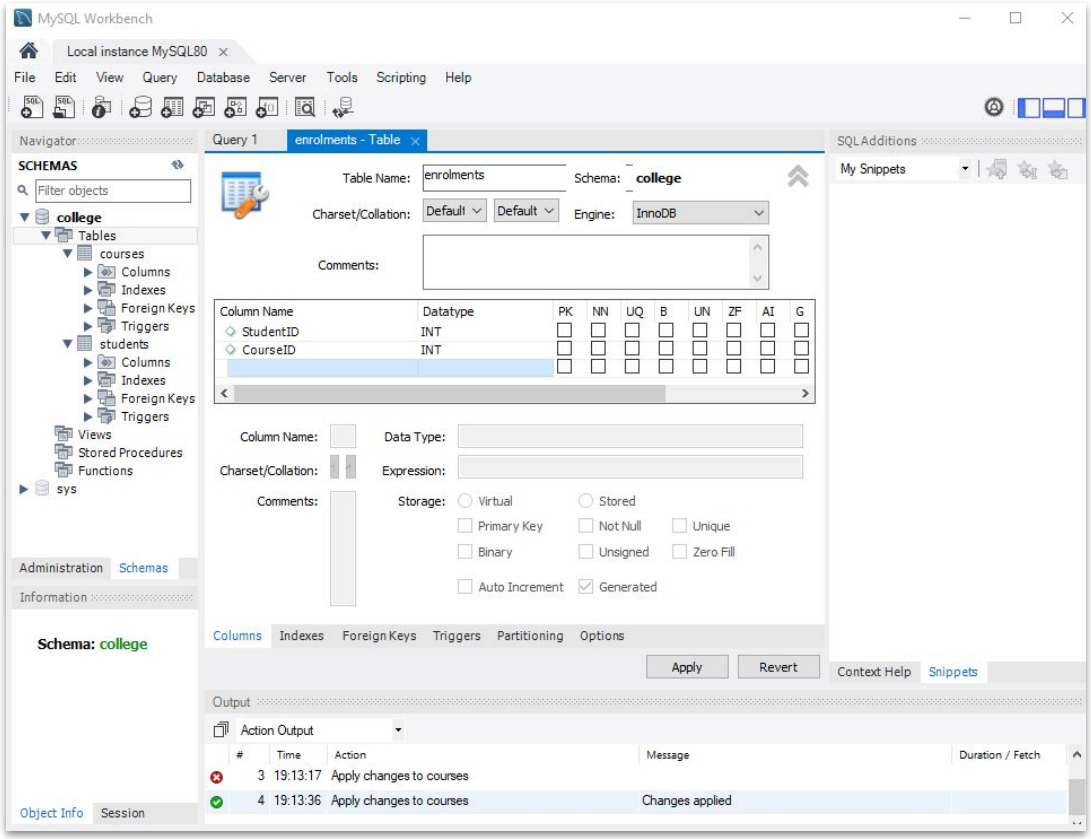
EXPLORE DIGITAL SKILLS

Creating a Relational Database

Next, the **enrolments** table, the only difference here is that this table has foreign key columns:



Foreign Key columns

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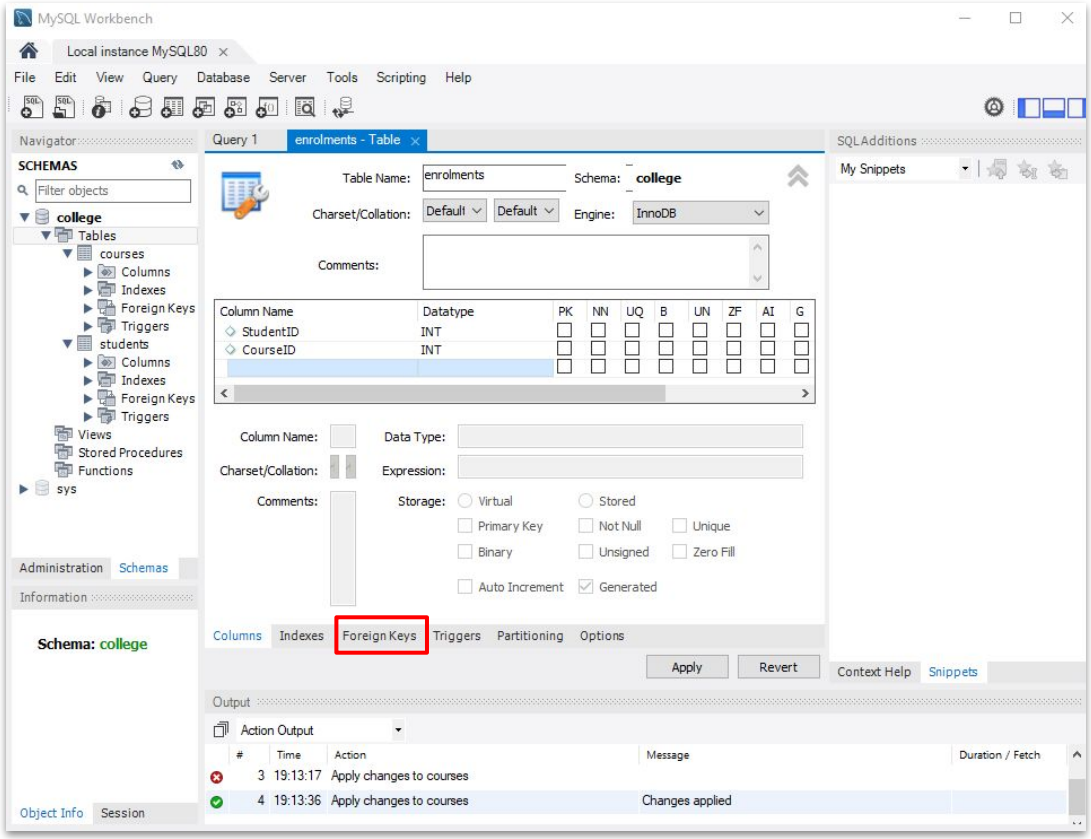

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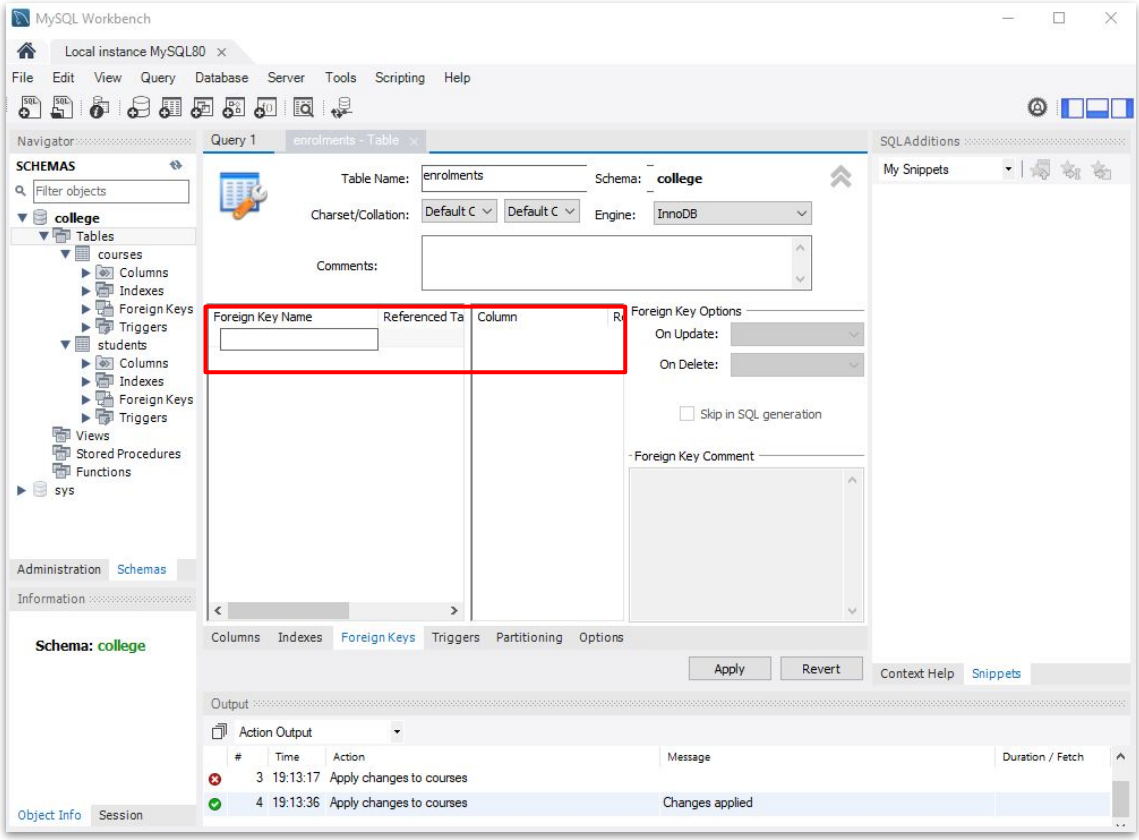

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4. Set Foreign key column name, the table it references, and the referenced table column.

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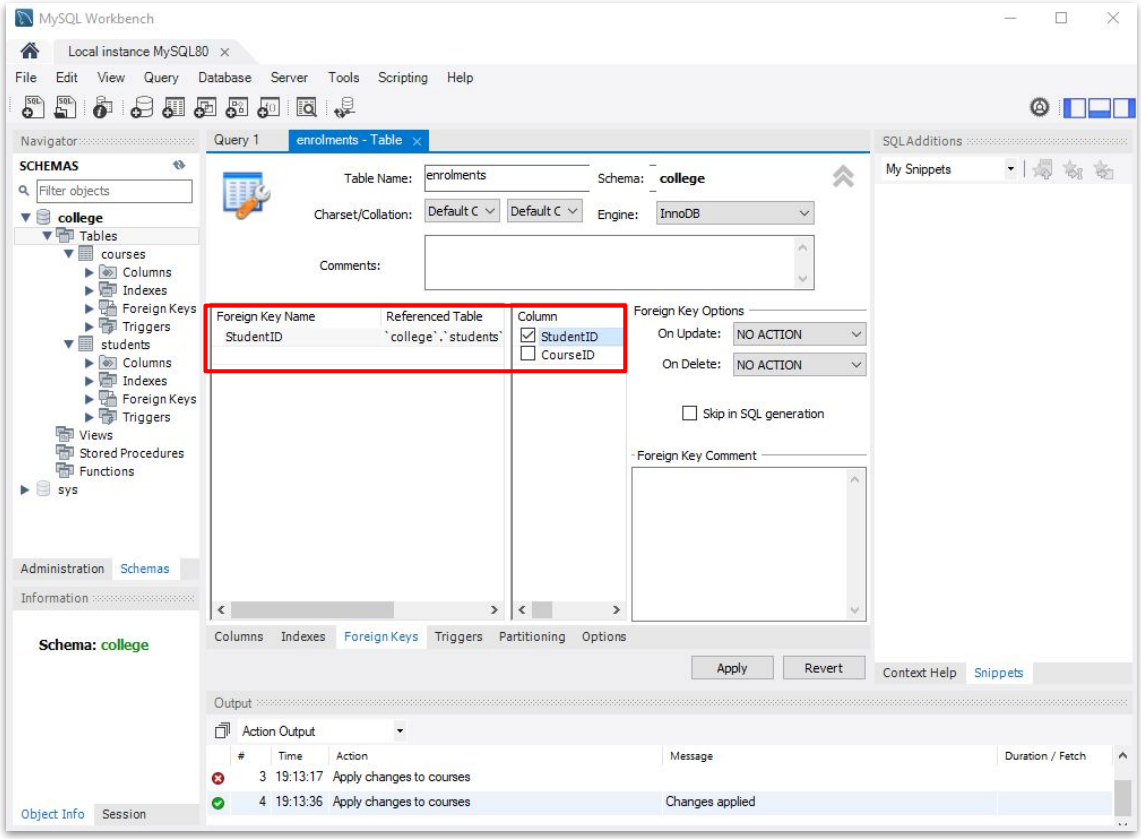

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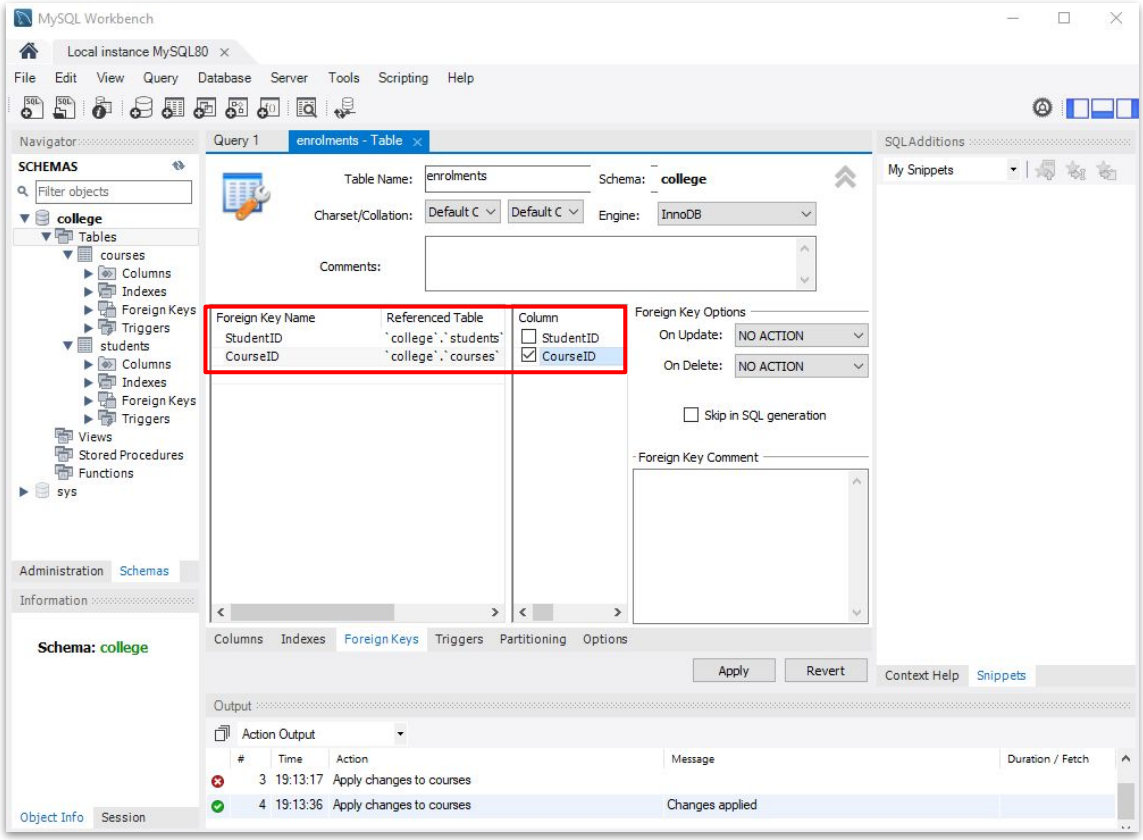

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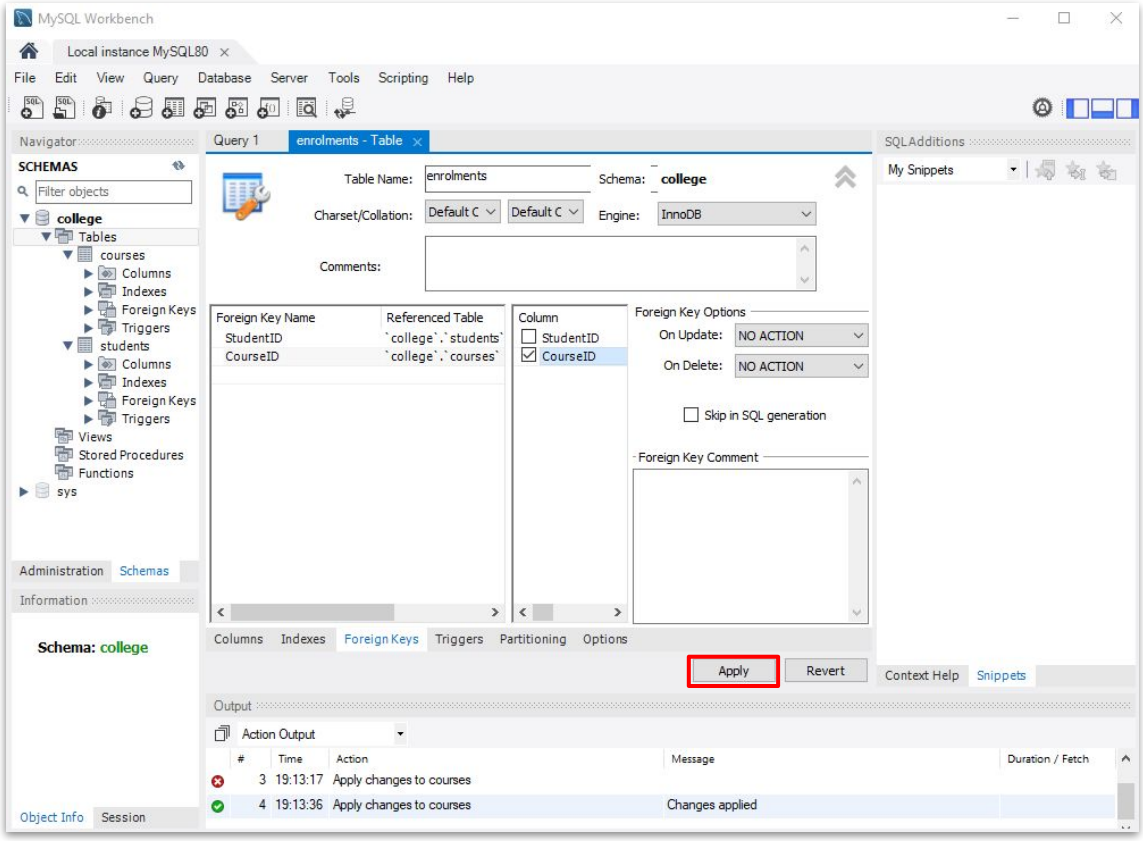

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5. Click apply, then apply again on the wizard, and finish.

EXPLORE DIGITAL SKILLS

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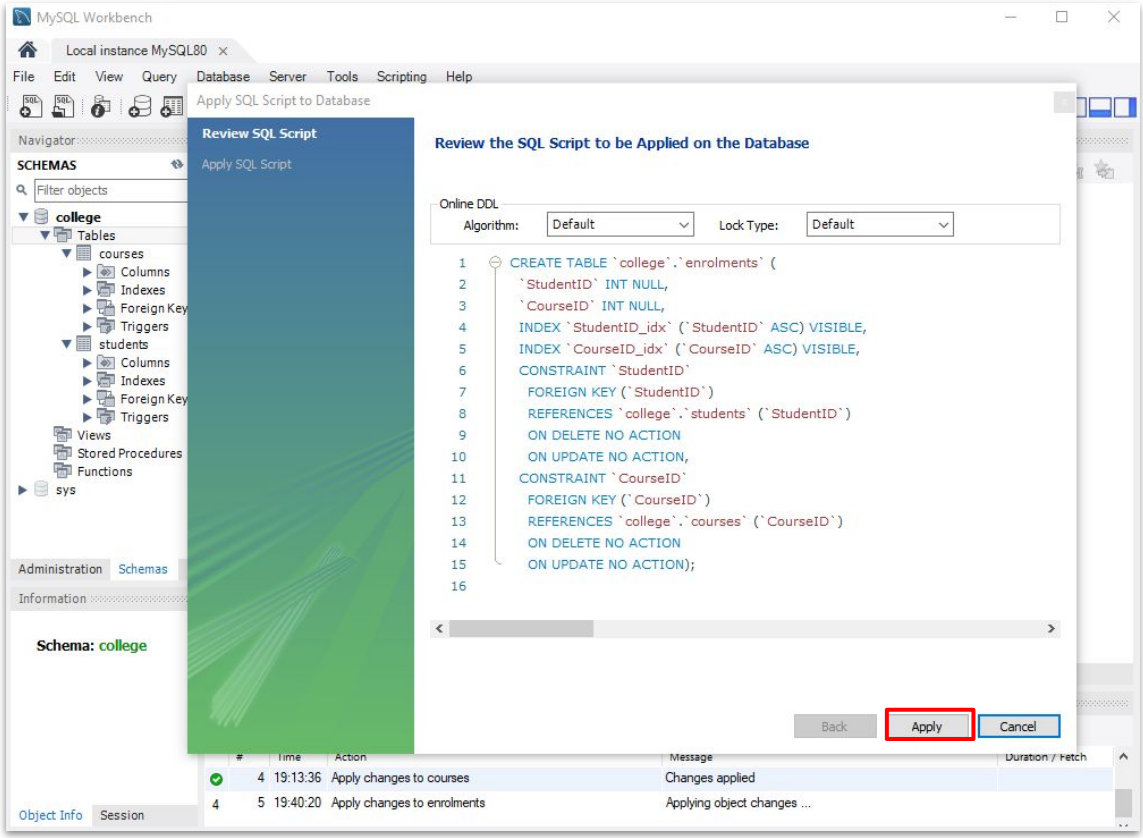

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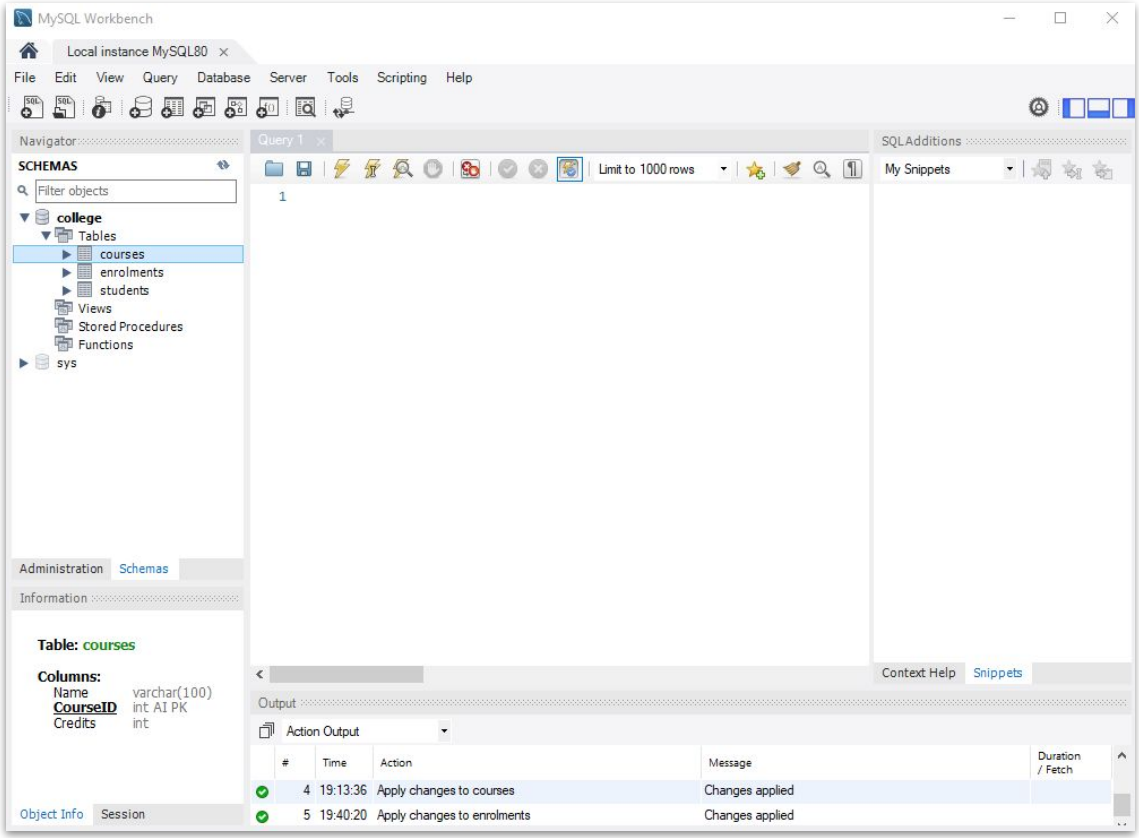
EXPLORE DIGITAL SKILLS

Creating a Relational Database

At this we have successfully created our database, the last step here, is to **add data**:



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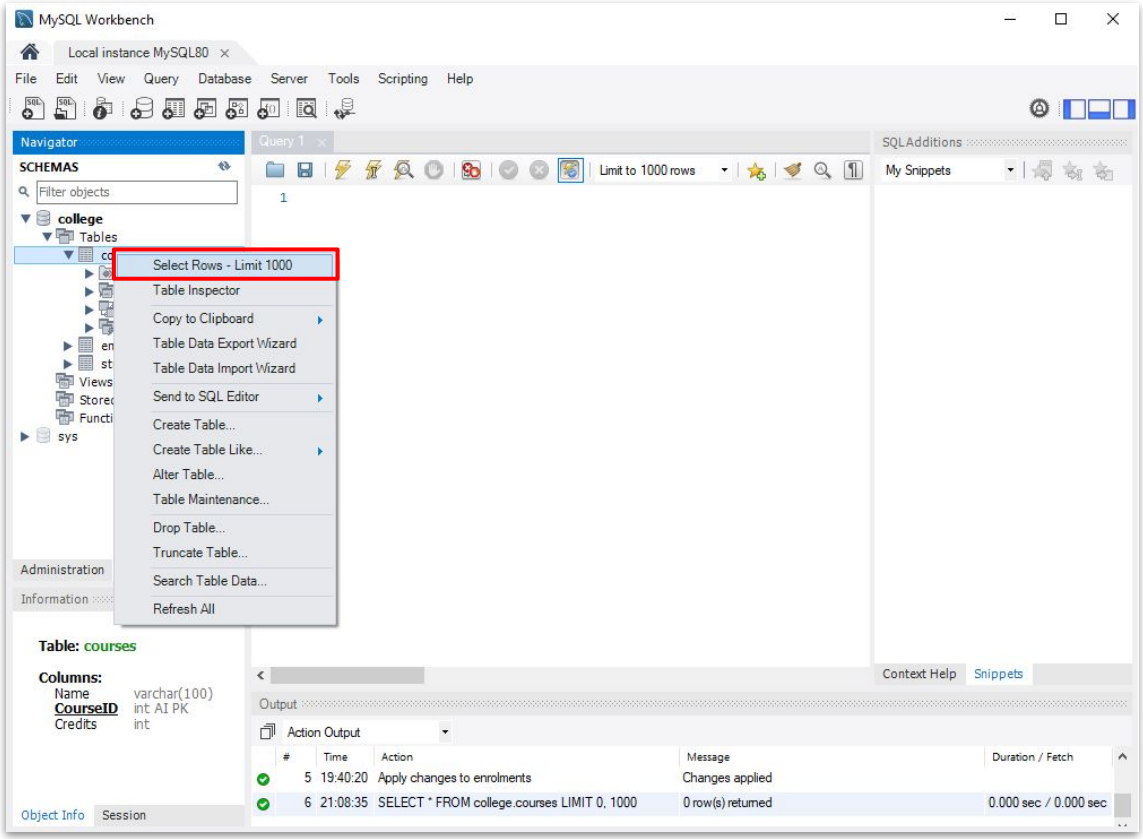

Adding data to tables

1. Right click on the table name and click **select rows**.

EXPLORE DIGITAL SKILLS

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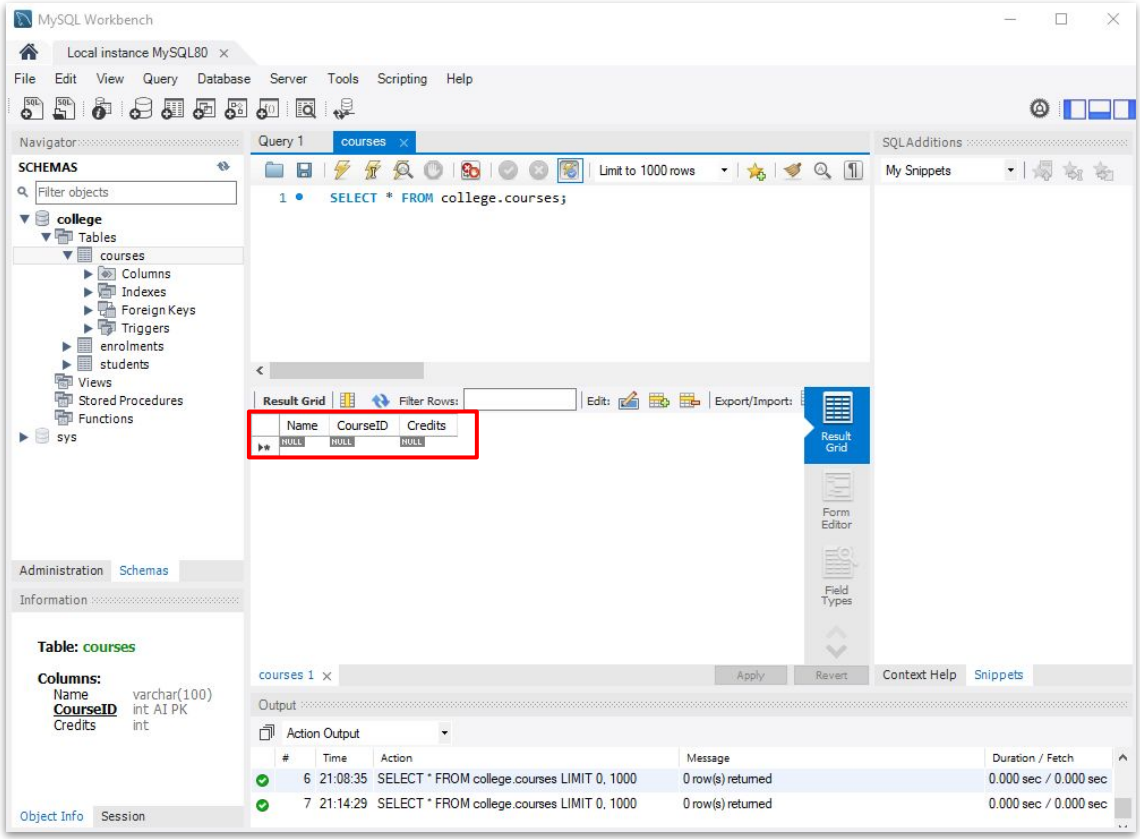

Adding data to tables

1. Right click on the table name and click **select rows**.
2. In the result grid, double click on a row and column to add a value.

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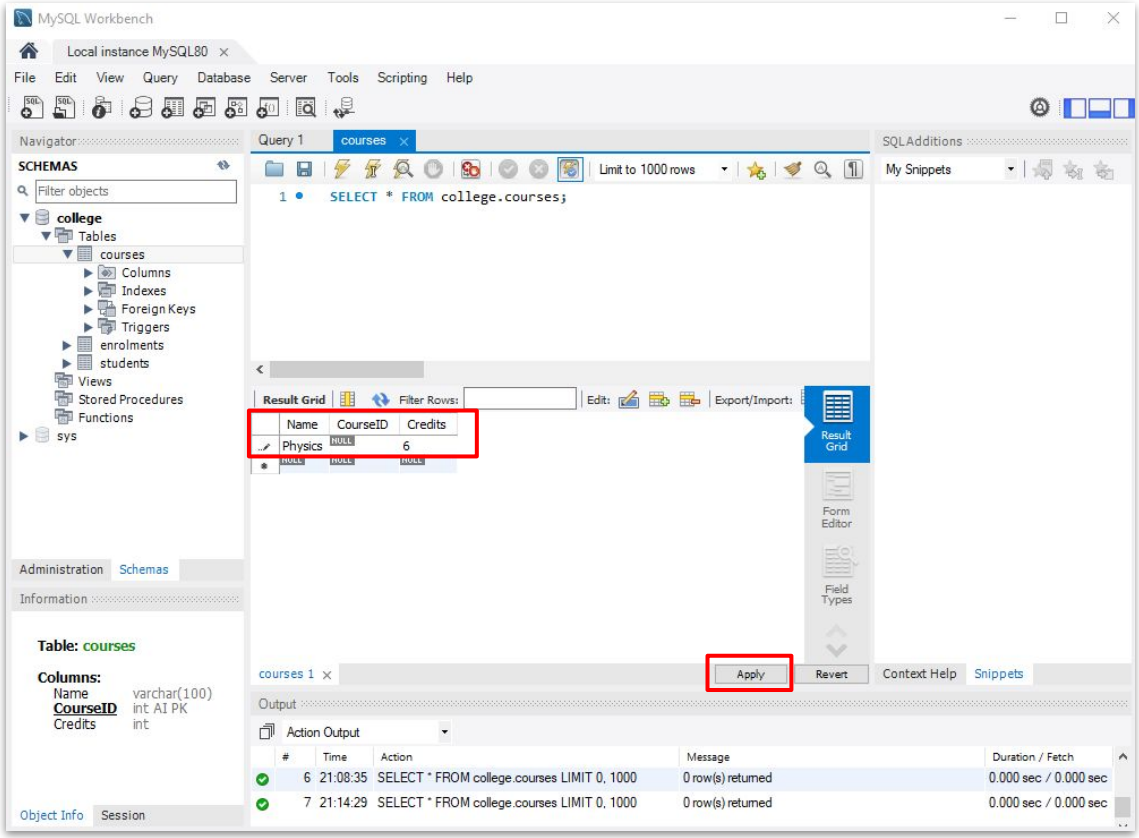

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1. Right click on the table name and click **select rows**.
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3. After adding all required column values (with the exception of **auto-incrementing** primary key columns), click **apply**.

EXPLORE | DIGITAL SKILLS

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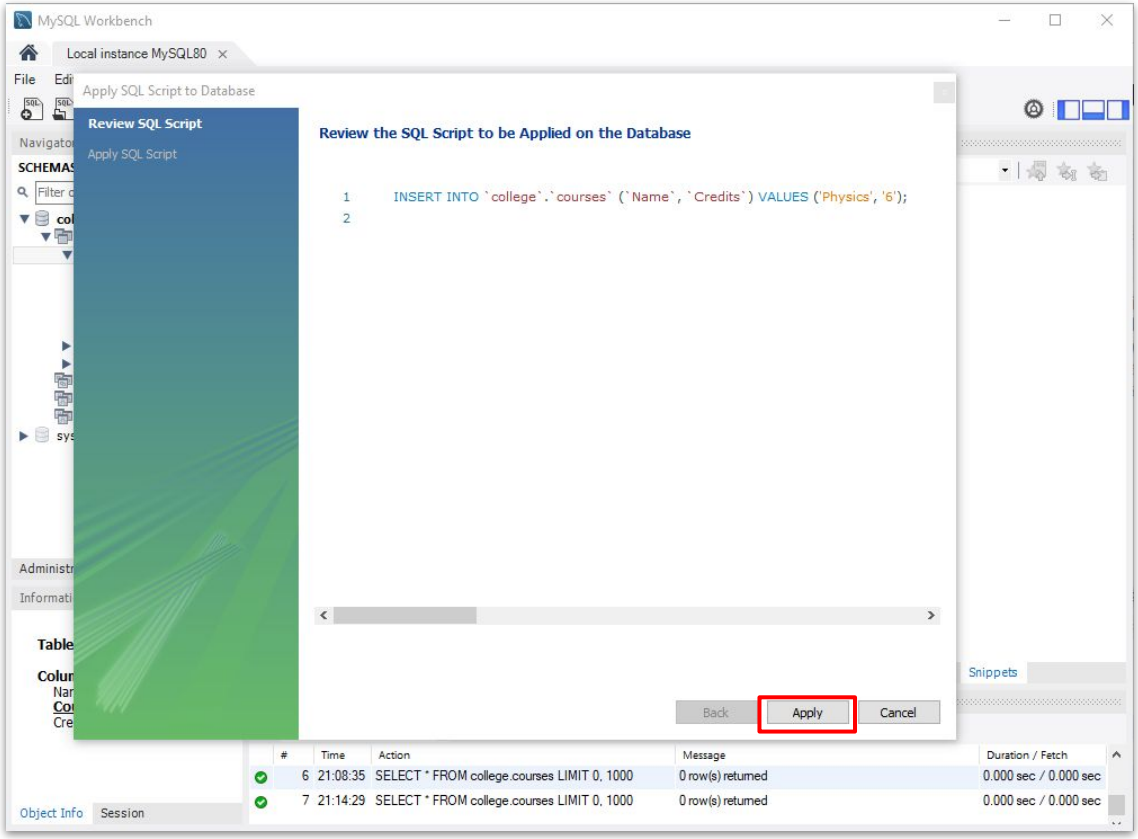

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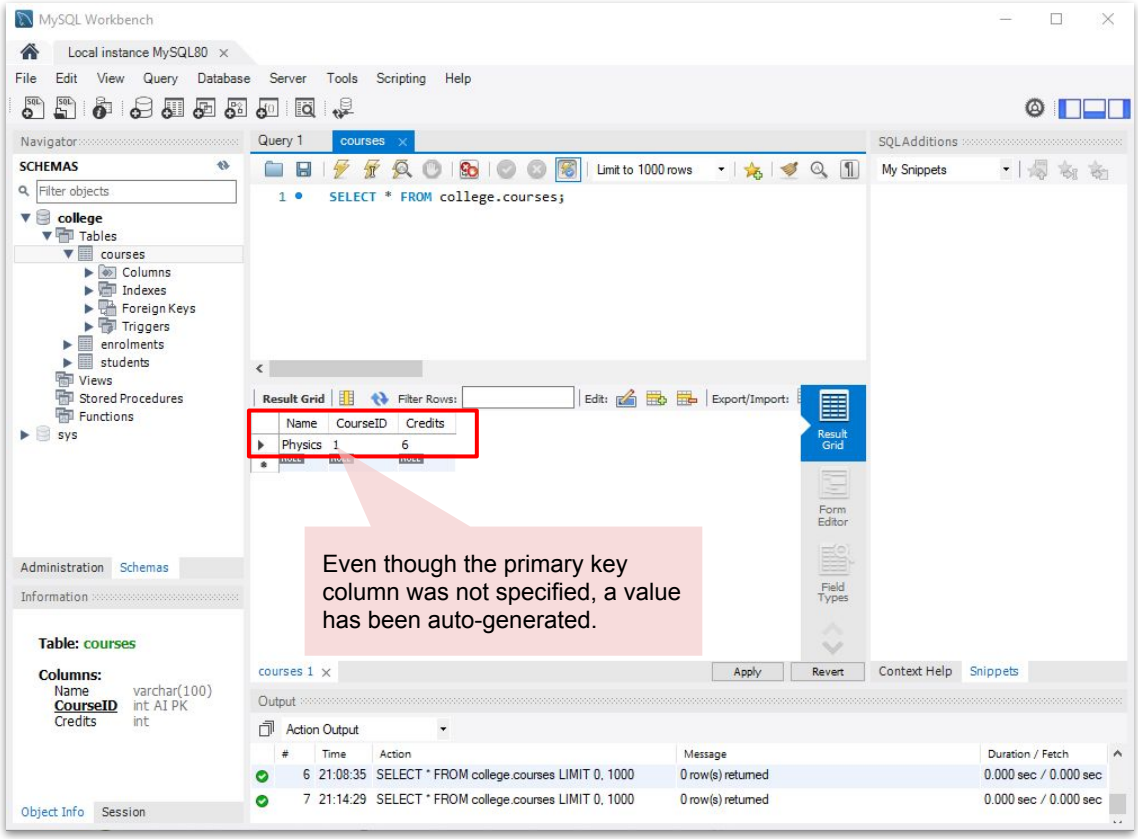

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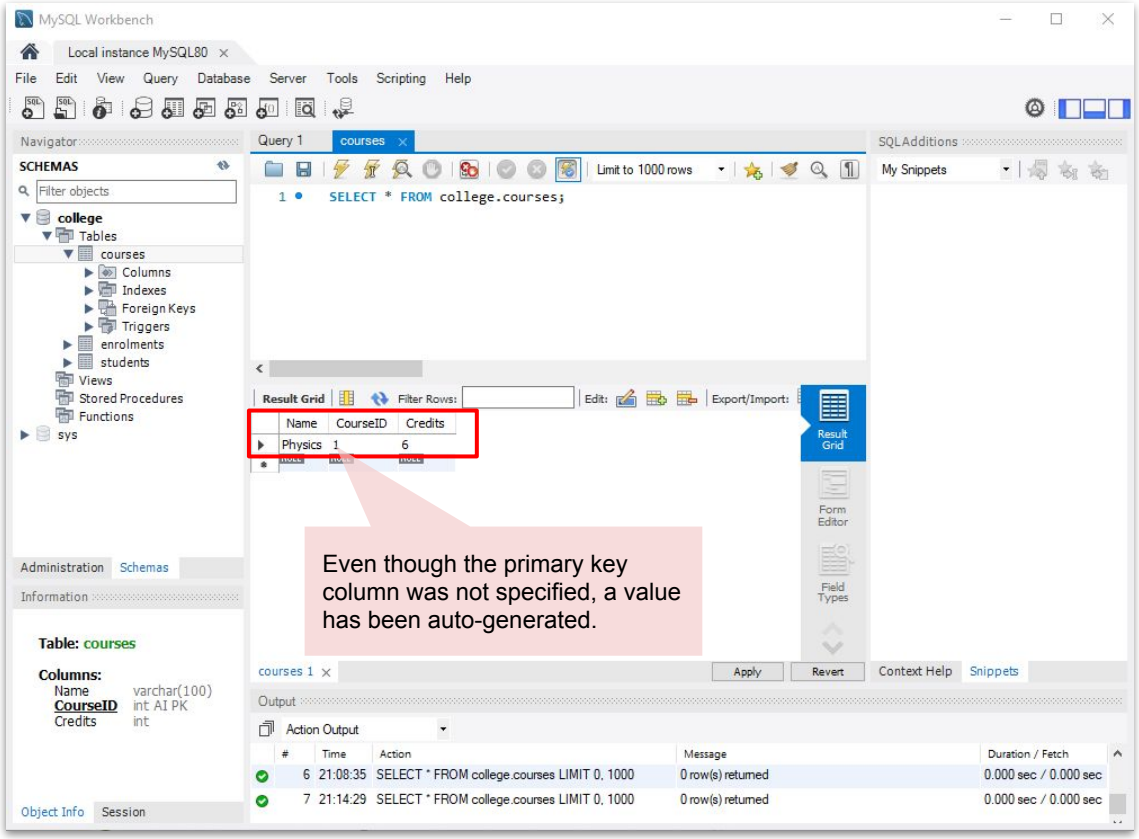


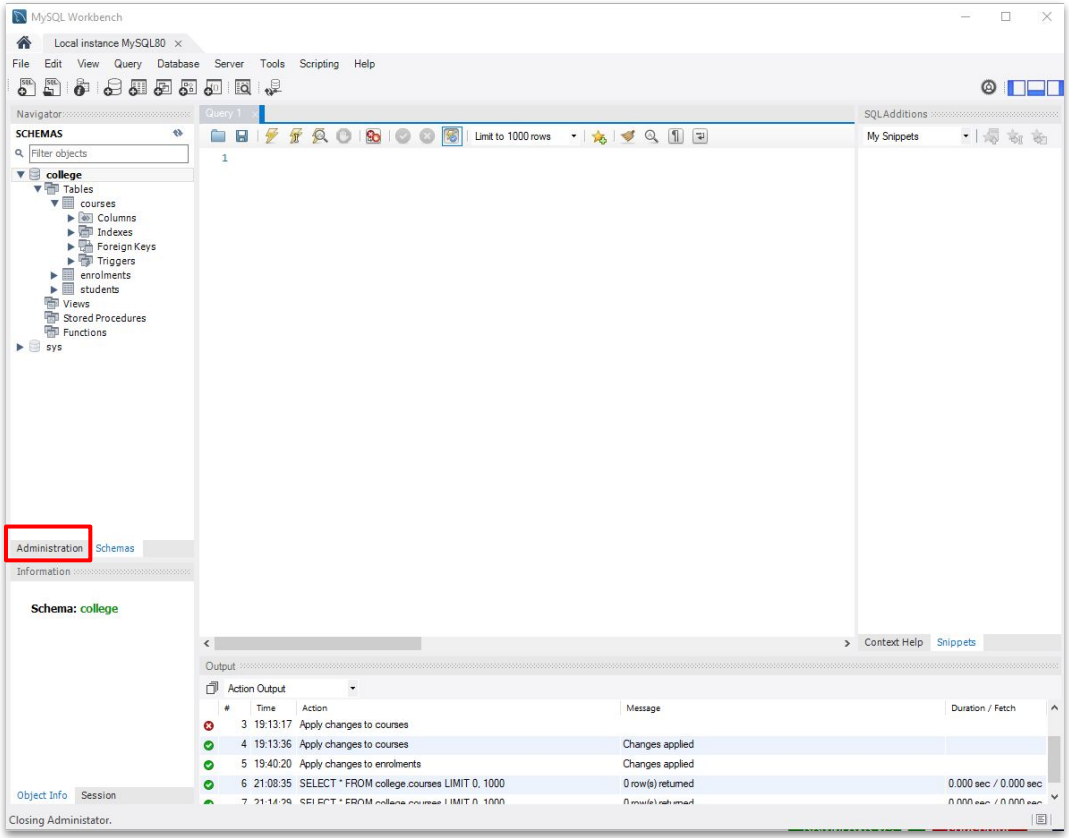
Adding data to tables

1. Right click on the table name and click **select rows**.
2. In the result grid, double click on a row and column to add a value.
3. After adding all required column values (with the exception of **auto-incrementing** primary key columns), click **apply**.
4. Click **apply**.
5. Repeat process to add data to other tables.

EXPLORE DIGITAL SKILLS

Creating a Relational Database

To save the database to a file, we use the **Data Export** wizard in the administration wizard:



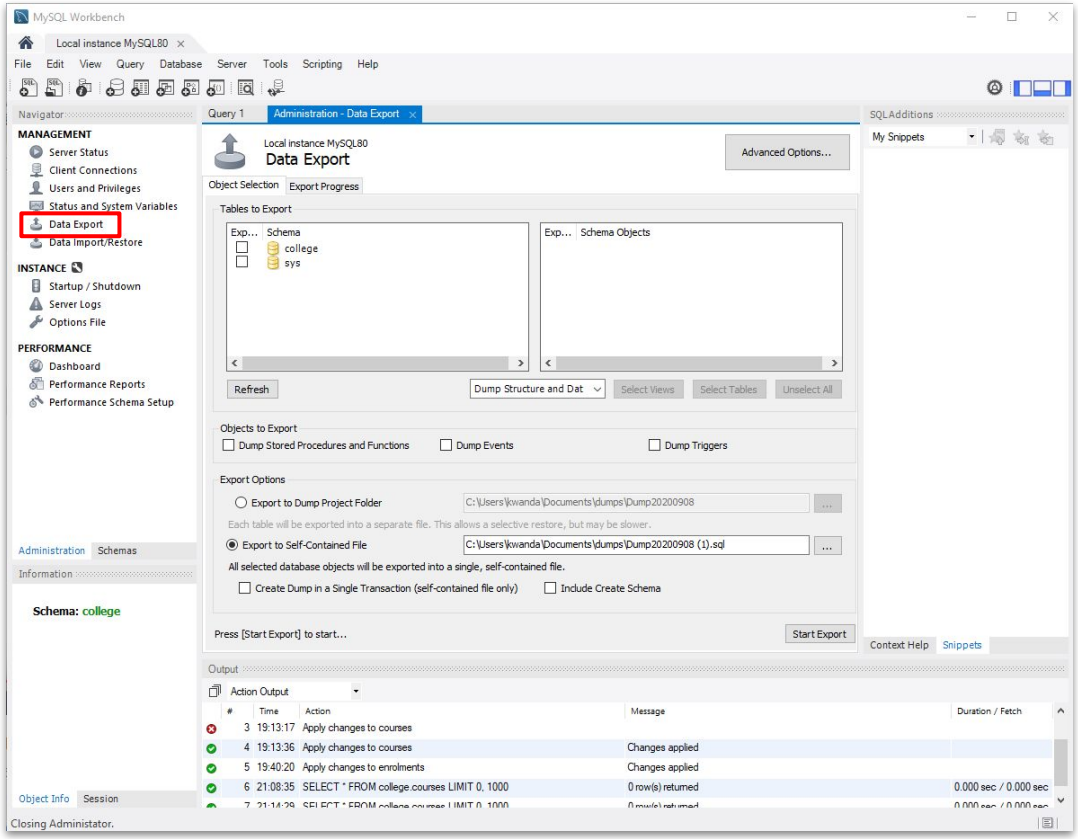
Saving the DB to file

1. Click on the administration tab.

EXPLORE DIGITAL SKILLS

Creating a Relational Database

To save the database to a file, we use the **Data Export** wizard in the administration wizard:



Saving the DB to file

1. Click on the administration tab.
2. Select **Data Export**.

EXPLORE DIGITAL SKILLS

Creating a Relational Database

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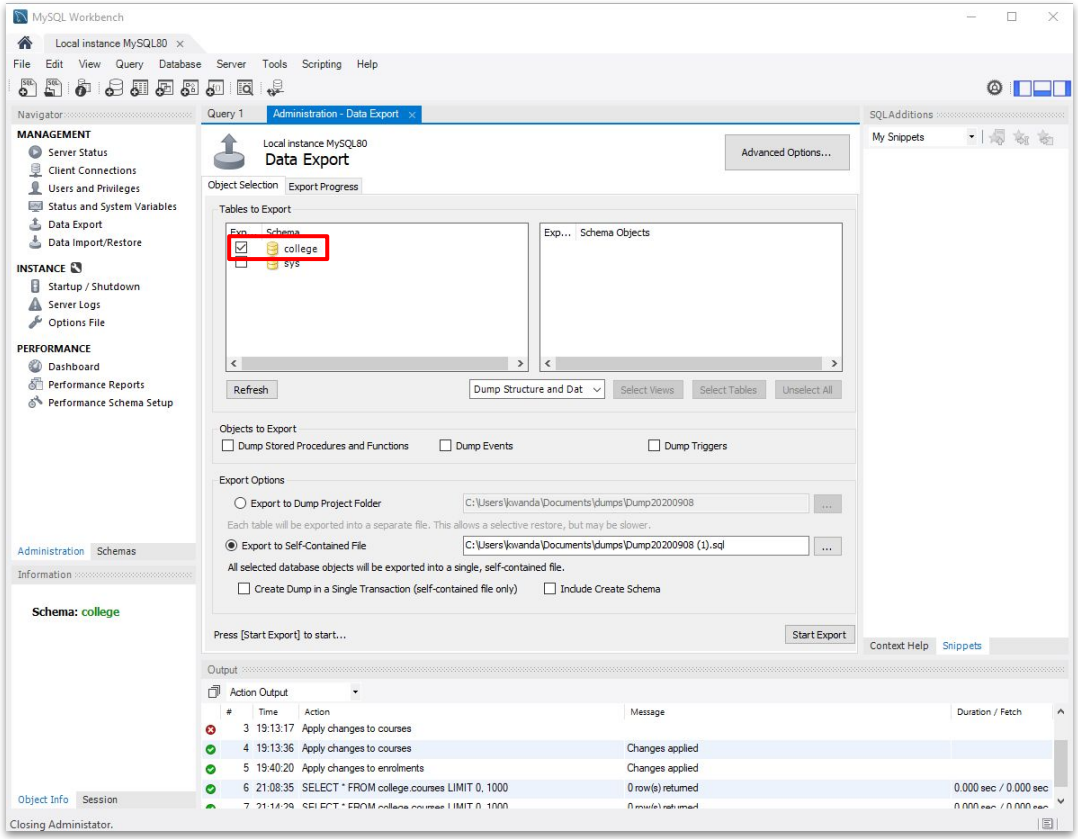


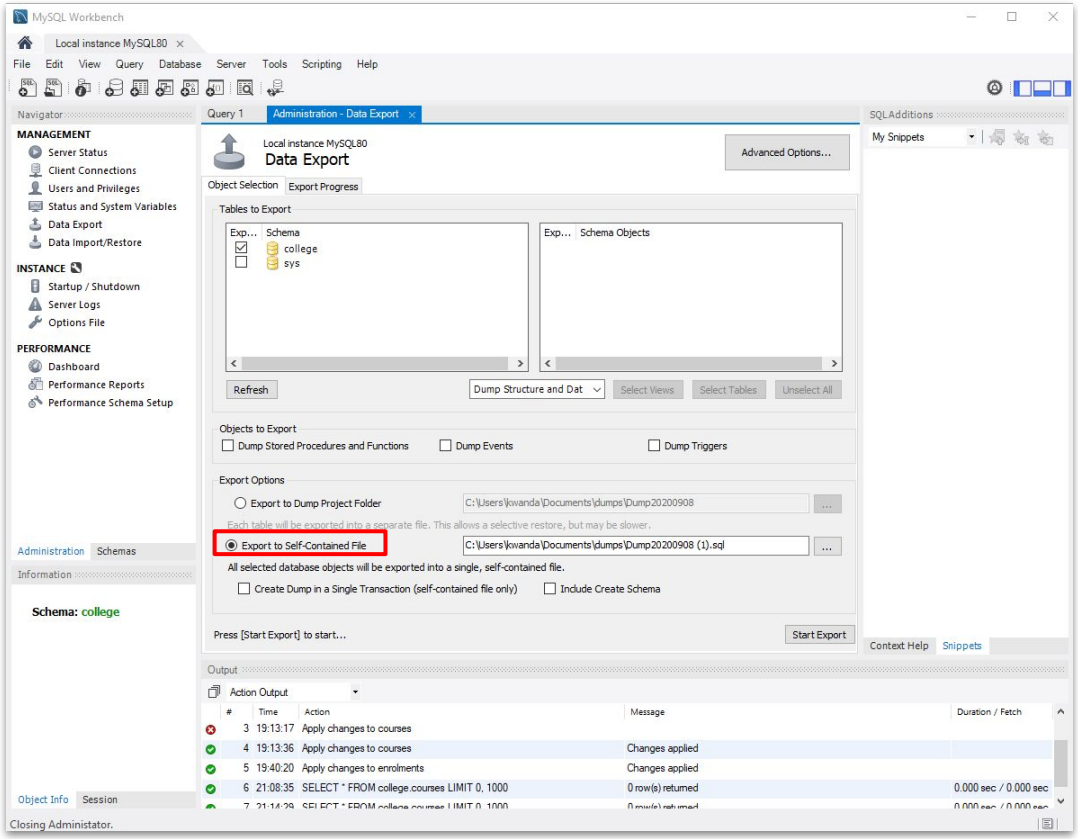
Saving the DB to file

1. Click on the administration tab.
2. Select **Data Export**.
3. Select database to export.

EXPLORE DIGITAL SKILLS

Creating a Relational Database

To save the database to a file, we use the **Data Export** wizard in the administration wizard:



Saving the DB to file

1. Click on the administration tab.
2. Select **Data Export**.
3. Select database to export.
4. Select “Export to self-contained file”

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Creating a Relational Database

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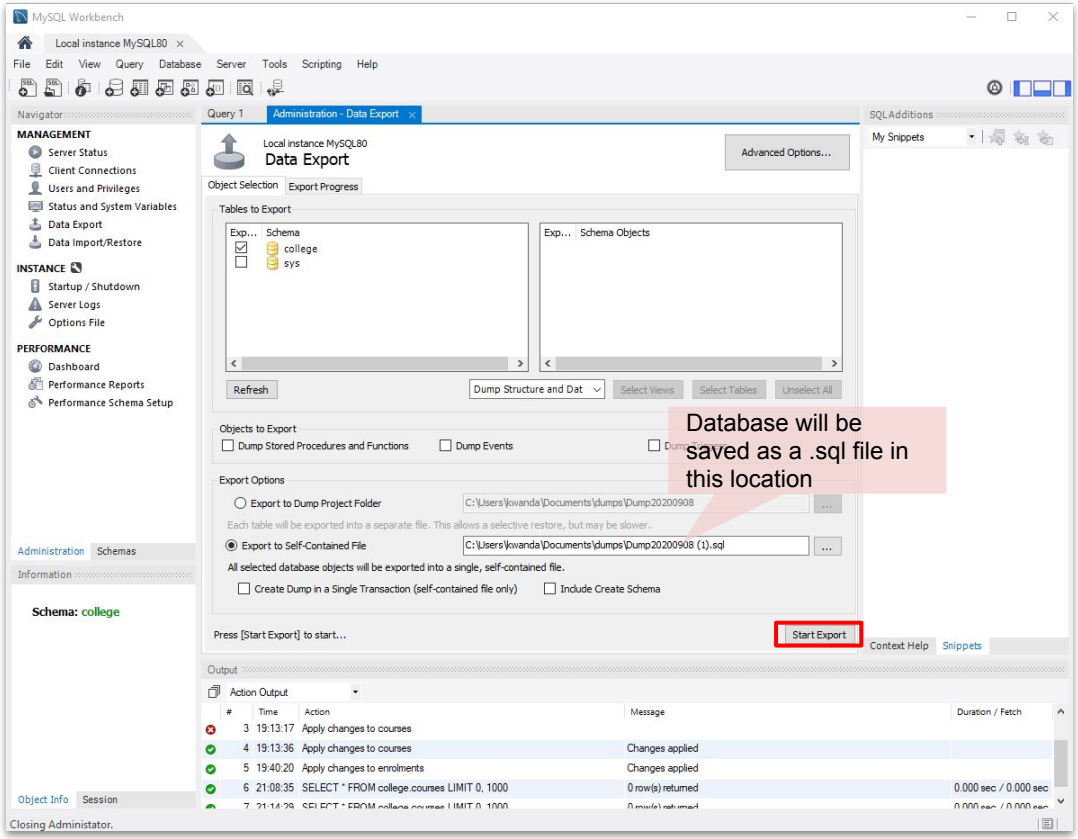

Saving the DB to file

1. Click on the administration tab.
2. Select **Data Export**.
3. Select database to export.
4. Select “Export to self-contained file”
5. Click the **Start Export** button.

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Creating a Relational Database

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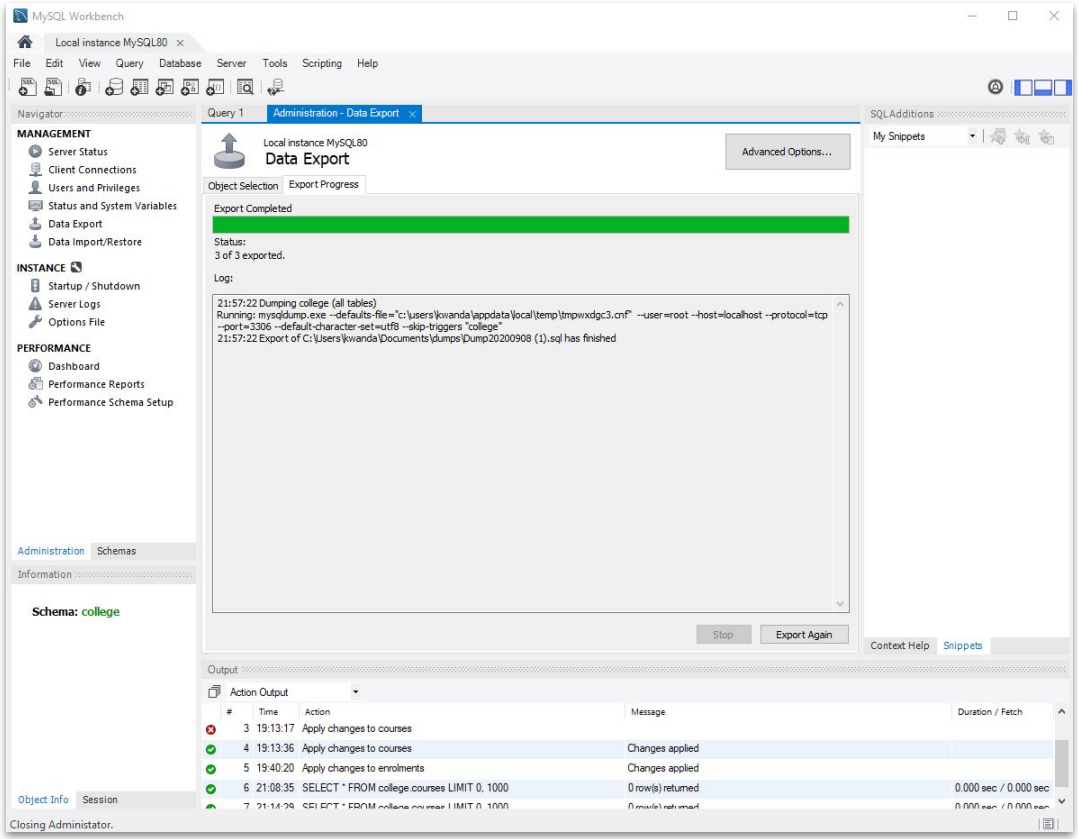

Saving the DB to file

1. Click on the administration tab.
2. Select **Data Export**.
3. Select database to export.
4. Select “Export to self-contained file”
5. Click the **Start Export** button.

The exported .sql file can be used as a backup file that can be reloaded into MySQL or a different database management system.

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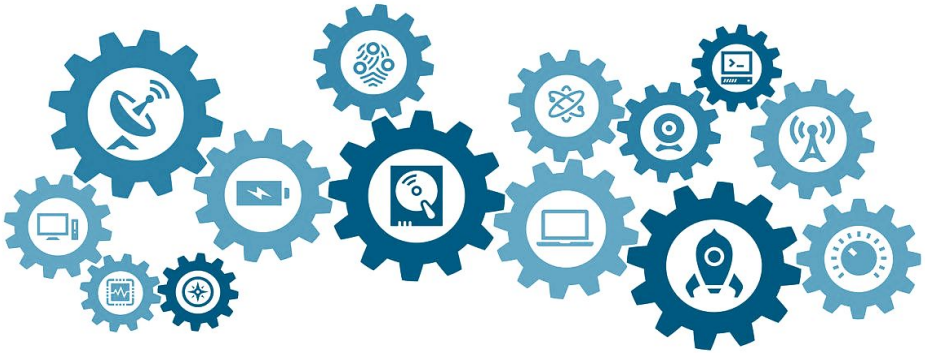
Conclusion

In this tutorial, we learnt how to:

- Install and configure MySQL workbench;
- Connect to a running MySQL server;
- Create a simple database;
- Create and connect tables using primary/foreign key relationships; and
- Backup the simple database.



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