



Hands-on Lab : Keys and Constraints in MySQL

Estimated time needed: 20 minutes

In this lab, you will learn how to add keys to create relationships between the tables and how to use constraints to enforce rules on the data entry in the MySQL database service using the phpMyAdmin graphical user interface (GUI) tool.

Software Used in this Lab

In this lab, you will use [MySQL](#). MySQL is a Relational Database Management System (RDBMS), designed to efficiently store, manipulate, and retrieve data.

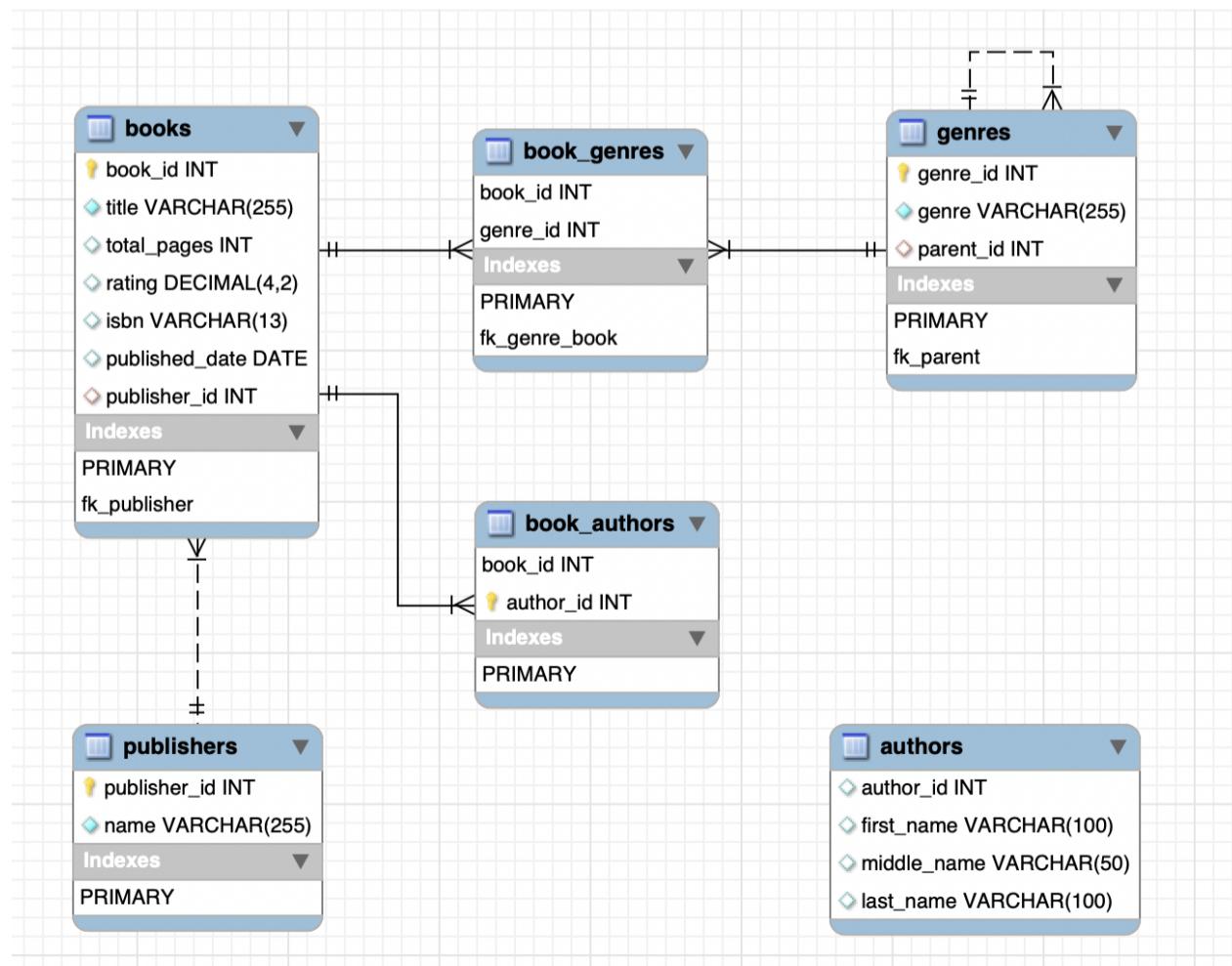


To complete this lab you will utilize MySQL relational database service available as part of IBM Skills Network Labs (SN Labs) Cloud IDE. SN Labs is a virtual lab environment used in this course.

Database Used in this Lab

The eBooks database has been used in this lab.

The following entity relationship diagram (ERD) shows the current status of the schema of the eBooks database used in this lab:



Objectives

After completing this lab, you will be able to use MySQL phpMyAdmin to:

- Create primary and foreign keys.
- Add constraints to data columns.

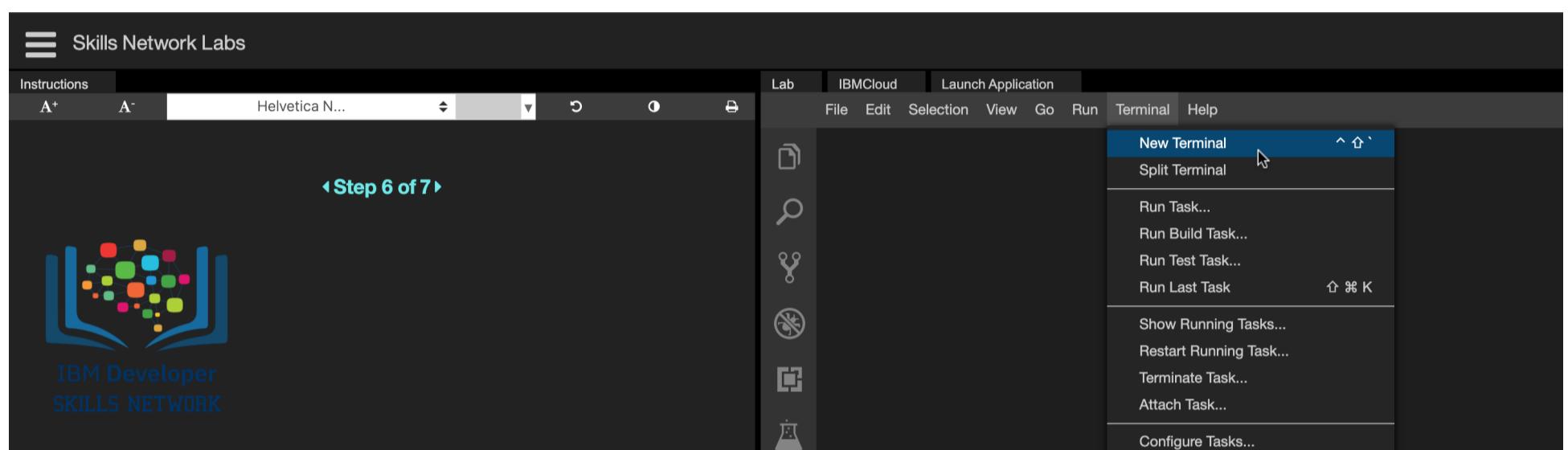
Exercise

In this exercise, you will learn how to add keys to create relationships between the tables and how to use constraints to enforce rules on the data entry in the MySQL database service using the phpMyAdmin graphical user interface (GUI) tool.

1. To start, download the the **eBooks** mysql dump file (containing the eBooks database table definitions and data) below to your local computer storage. A dump file is a text file that contains the data from a database in the form of SQL statements. This file can then be imported in phpMyAdmin.

- [eBooks_mysql_dump.sql](#)

2. Go to **Terminal > New Terminal** to open a terminal from the side by side launched Cloud IDE.



3. Start the MySQL service session in the Cloud IDE using the command below in the terminal. Find your MySQL service session password from the highlighted location of the terminal shown in the image below. Note down your MySQL service session password because you may need to use it later in the lab.

```
start_mysql
```

```
theia@theiadocker-sandipsahajo:/home/project$ start_mysql
Starting your MySQL database....
This process can take up to a minute.

MySQL database started, waiting for all services to be ready....

Your MySQL database is now ready to use and available with username: root password: MTY5MTUtc2FuZGlw

You can access your MySQL database via:
  • The browser at: https://sandipsahajo-8080.theiadocker-27.proxy.cognitiveclass.ai
  • CommandLine: mysql --host=127.0.0.1 --port=3306 --user=root --password=MTY5MTUtc2FuZGlw
theia@theiadocker-sandipsahajo:/home/project$
```

4. Copy your phpMyAdmin weblink from the highlighted location of the terminal shown in the image below and paste it to a new tab of your web browser.

```
theia@theiadocker-sandipsahajo:/home/project$ start_mysql
Starting your MySQL database....
This process can take up to a minute.

MySQL database started, waiting for all services to be ready....

Your MySQL database is now ready to use and available with username: root password: MTY5MTUtc2FuZGlw

You can access your MySQL database via:
  • The browser at: https://sandipsahajo-8080.theiadocker-27.proxy.cognitiveclass.ai
  • CommandLine: mysql --host=127.0.0.1 --port=3306 --user=root --password=MTY5MTUtc2FuZGlw
theia@theiadocker-sandipsahajo:/home/project$
```

5. You will see the phpMyAdmin GUI tool.

General settings

Server connection collation: utf8mb4_unicode_ci

Appearance settings

Language: English

Theme: pmahomme

Database server

- Server: mysql via TCP/IP
- Server type: MySQL
- Server connection: SSL is not being used
- Server version: 8.0.22 - MySQL Community Server - GPL
- Protocol version: 10
- User: root@172.18.0.2
- Server charset: UTF-8 Unicode (utf8mb4)

Web server

- Apache/2.4.38 (Debian)
- Database client version: libmysql - mysqld 7.4.15
- PHP extension: mysqli curl mbstring
- PHP version: 7.4.15

phpMyAdmin

- Version information: 5.0.4, latest stable version: 5.1.0
- Documentation
- Official Homepage
- Contribute
- Get support
- List of changes
- License

6. Go to the **Import** tab. Click **Choose File** and load the **eBooks_mysql_dump.sql** file you downloaded earlier to your local computer storage. Next, uncheck **Enable foreign key checks** and select SQL as **Format**. Then click **Go**.

Importing into the current server

File to import:

File may be compressed (gzip, bzip2, zip) or uncompressed.
A compressed file's name must end in **[format].[compression]**. Example: **.sql.zip**

Browse your computer: **Choose File** eBooks_mysql_dump.sql (Max: 2,048KiB) **2**

You may also drag and drop a file on any page.

Character set of the file: utf-8

Partial import:

Allow the interruption of an import in case the script detects it is close to the PHP timeout limit. (This might be a good way to import large files, however it can break transactions.)

Skip this number of queries (for SQL) starting from the first one: 0

Other options:

Enable foreign key checks **3**

Format:

SQL **4**

Format-specific options:

SQL compatibility mode: NONE

Do not use AUTO_INCREMENT for zero values **5**

7. You will be notified that the import has successfully finished. Click the database **eBooks** as shown below to expand (if necessary click the + icon beside **eBooks**). You will see the list of tables from the eBooks database.

The screenshot shows the phpMyAdmin interface with the eBooks database selected. A green success message at the top states: "Import has been successfully finished, 81 queries executed. (eBooks_mysql_dump.sql)". The eBooks schema is highlighted with a red box.

8. Primary Keys: A primary key is a column or group of columns that uniquely identify every row in a table. They constrain the table by only accepting unique, non-NULL values for that column. Non-NULL data is data where the values exist.

Creating a primary key on a table automatically creates an index on the key. You will create a primary key for the **author** table to uniquely identify every row in the table. You will set the **author_id** column of the **author** table as a primary key.

- In the tree-view, click the **authors** table. Switch to the **Structure** tab and make sure you are inside **Table structure** subtab.
- Check the **author_id** column.
- Click the **Primary** option.

The screenshot shows the phpMyAdmin interface with the eBooks database selected. The authors table is selected in the tree-view. The Structure tab is active. The Table structure subtab is selected. The author_id column is checked. The Primary button is highlighted with a red box.

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
1	author_id	int		Yes	NULL				Change Drop More
2	first_name	varchar(100)	utf8mb4_0900_ai_ci	Yes	NULL				Change Drop More
3	middle_name	varchar(50)	utf8mb4_0900_ai_ci	Yes	NULL				Change Drop More
4	last_name	varchar(100)	utf8mb4_0900_ai_ci	Yes	NULL				Change Drop More

Step 1: eBooks
New
eBooks
New
authors 1
books
book_authors
book_genres
genres
publishers
information_schema
mysql
performance_schema
sys

Step 2: eBooks
New
eBooks
Structure 2
MySQL
information_schema
mysql
performance_schema
sys

Step 3: eBooks
New
eBooks
Structure 2
MySQL
information_schema
mysql
performance_schema
sys

Step 4: eBooks
New
eBooks
authors 1
books
book_authors
book_genres
genres
publishers
information_schema
mysql
performance_schema
sys

Step 5: eBooks
New
eBooks
authors 1
books
book_authors
book_genres
genres
publishers
information_schema
mysql
performance_schema
sys

9. Auto-increment: Auto-increment enables a unique number to be generated automatically when a new record is inserted into a table.

Often this is used for the primary key field to be created automatically every time a new record is inserted. You will set the auto-increment feature for the primary key of the **author** table.

- In the tree-view, click the **authors** table. Switch to the **Structure** tab and make sure you are inside the **Table structure** subtab.
- Check the **author_id** column.
- Click the **Change** option.
- Check **A_I** option (**A_I** = Auto_Increment).
- Click **Save**.

The screenshot shows the 'Structure' tab for the 'authors' table. The 'author_id' column is highlighted with a red box. The 'Null' checkbox for this column is checked. A red box also highlights the 'Change' button at the bottom of the table structure panel.

The screenshot shows the 'Structure' tab for the 'authors' table. The 'first_name' column is highlighted with a red box. The 'Null' checkbox for this column is unchecked. A red box highlights the 'Save' button at the bottom right of the panel.

10. Null constraints: By default, a column can hold NULL values. If you do not want a column to have a NULL value, you can restrict the column from having a NULL value. You will restrict the **first_name** column of the **authors** table from having a NULL value.

- In the tree-view, click the **authors** table. Switch to the **Structure** tab and make sure you are inside the **Table structure** subtab.
- Check the **first_name** column.
- Click the **Change** option.
- Uncheck the **Null** option.
- Click **Save**.

The screenshot shows the 'Structure' tab for the 'authors' table. The 'first_name' column is highlighted with a red box. The 'Null' checkbox for this column is unchecked. A red box highlights the 'Change' button at the bottom of the table structure panel.

The screenshot shows the 'Structure' tab for the 'authors' table. The 'first_name' column is highlighted with a red box. The 'Null' checkbox for this column is unchecked. A red box highlights the 'Save' button at the bottom right of the panel.

The screenshot shows the 'Structure' tab for the 'book_authors' table. The 'author_id' column is highlighted with a red box. The 'Null' checkbox for this column is checked. A red box highlights the 'Save' button at the bottom right of the panel.

11. Foreign keys: A foreign key is a column that establishes a relationship between two tables. It acts as a cross-reference between two tables as it points to the primary key of one table (the parent table), constraining the data in another table (the child table) by the data in the parent table. You will create a foreign key for the **book_authors** table by setting its **author_id** column as a foreign key, to establish a relationship between the **book_authors** and **authors** tables.

- In the tree-view, click the **book_authors** table. Switch to the **Structure** tab and make sure you are inside the **Relation view** subtab.
- If necessary, click **Add constraint** to create a new foreign key constraint placeholder.
- Fill the placeholders as shown in a image below.
- Click **Save**.

Table structure

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
1	book_id	int			No	None			Change Drop More
2	author_id	int			No	None			Change Drop More

Indexes

Action	Keyname	Type	Unique	Packed	Column	Cardinality	Collation	Null	Comment
Edit Drop	PRIMARY	BTREE	Yes	No	book_id	1091	A	No	
					author_id	1717	A	No	

Foreign key constraints

Actions	Constraint properties	Column	Foreign key constraint (INNODB)				
Drop	fk_book	ON DELETE CASCADE	ON UPDATE RESTRICT	book_id	eBooks	books	book_id
	fk_author	ON DELETE CASCADE	ON UPDATE RESTRICT	author_id	eBooks	authors	author_id
+ Add constraint							

Your SQL query has been executed successfully.

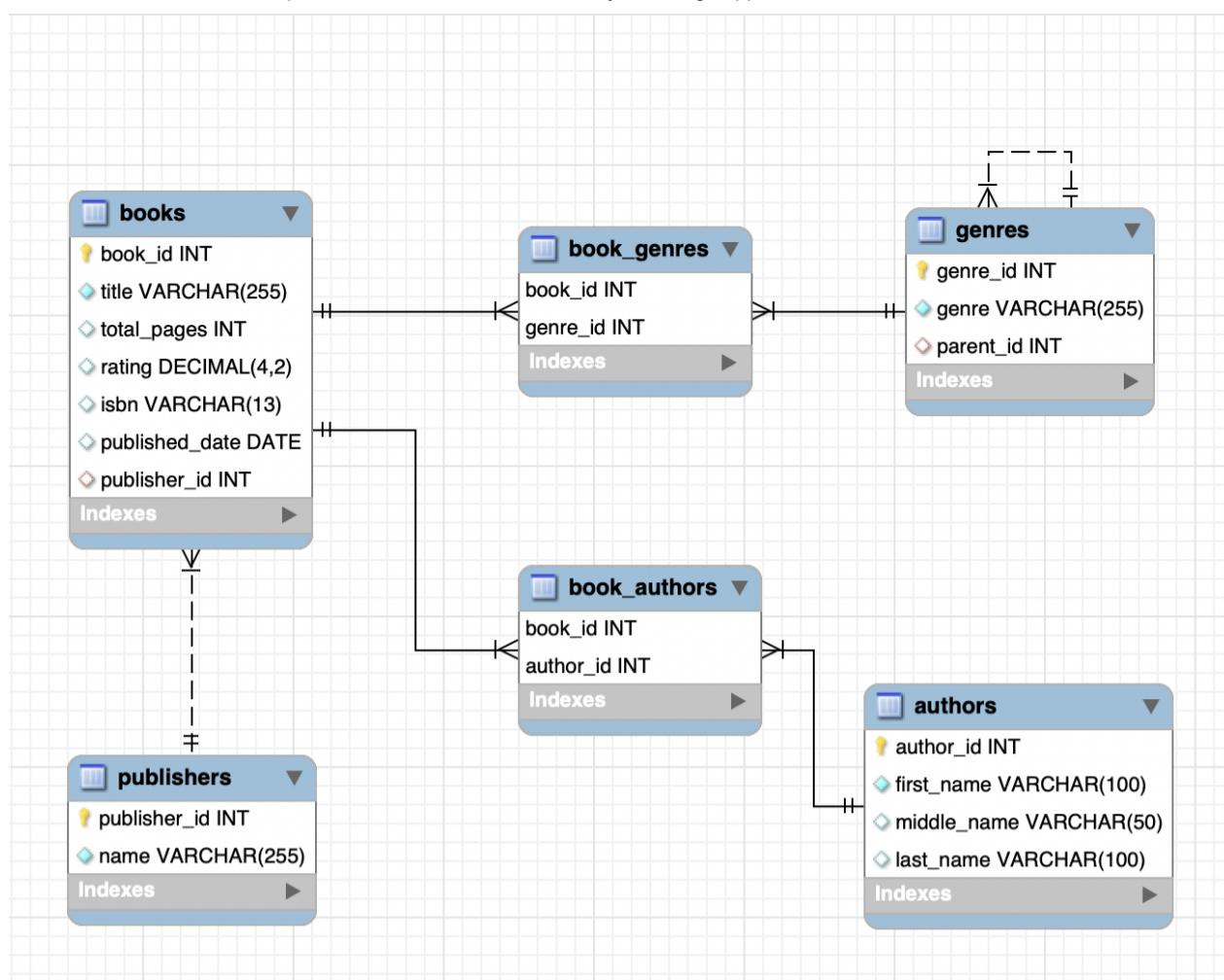
```
ALTER TABLE `book_authors` ADD CONSTRAINT `fk_author` FOREIGN KEY (`author_id`) REFERENCES `authors`(`author_id`) ON DELETE CASCADE ON UPDATE RESTRICT;
```

CASCADE means that when rows are deleted or updated in the parent table, the corresponding rows in the child table will also be deleted or updated.

RESTRICT means that rows cannot be deleted or updated in the parent table if there are corresponding rows in the child table.

12. After creating/adding all the above necessary primary keys, foreign keys, and constraints, the schema of the complete eBooks database will look like the following ERD diagram:

- Note:** You don't need to generate any ERD diagram like below for this lab. By comparing the earlier eBooks schema ERD (shown in the section "Database Used in this Lab") and this complete eBooks schema ERD, just try to understand how all the operations you did above made the eBooks database complete.



Congratulations! You have completed this lab, and you are ready for the next topic.

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Other Contributor(s)

- Kathy An

Changelog

Date	Version	Changed by	Change Description
2021-03-22	1.0	Sandip Saha Joy	Created initial version
2021-10-18	1.1	Kathy An	Updated lab instructions

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