

MySQL Cookbook

*100+ recipes for database development and
administration in MySQL*

Elias Negrin



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Kup ksi k

Dedicated to

My beloved parents:

Aris Negrin (*Rest In Peace Dad*)

Anna Negrin

and

My wife Vayia and my son Aris

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Elias Negrin, a multifaceted IT and Business professional with over 20 years of combined experience in diverse industries like Banking, Healthcare, Telecommunications, and Industrial Automation across international markets. Originally born and raised in Greece, he studied Business Administration and Computer Information Systems and specialized in Databases, Data Management, Software Engineering, Business Intelligence, Analytics and Business Computing. He is also certified in Scaled Agile and Scrum frameworks (SAFe 6 POPM, PSPO II, PSM II), leading implementation teams and product development. He has been working with major corporations in EMEA, Eurasia, Emerging, and APAC regions across various roles and positions, which has equipped him with a diverse and broad skill set. Since 2017, he has lived and worked in the Netherlands as an IT-Product Manager. Since 2023, he has also given presentations at Knowledge and Business Summits on topics around Agile Leadership and how to use data to help decision-making. Outside working hard, he enjoys doing sports, playing and listening to music (still collecting vinyls and CDs), reading, and traveling.

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My thanks and respect also go to the team at BPB Publications for being supportive enough to give me quite a long time to finish the book.

Preface

This book provides answers to your data-related problems, quick solutions, and techniques, as well as focuses on bite-size to moderately sized pieces of code, worked-out examples, and clear-concise explanations on one of the most popular open-source databases in the world. The book starts simple with connecting, issuing queries, and retrieving results and data from the MySQL Server, continues with working with data types, strings, and dates formatting and manipulation, sorting and grouping/aggregating results, and more similar areas. This book also covers more advanced concepts and objects like dataset characteristics, working with procedures and functions, routines, triggers, events, and scheduling. Additionally, the book shows how to perform simple MySQL administration tasks, understand monitoring fundamentals, and how to set up replication.

This book is divided into 15 chapters. They cover installation, MySQL development environment and tools, SQL basics, and more advanced concepts in MySQL and database development. This will increase learners' interest and understanding of MySQL and database tools. The details are listed below:

Chapter 1: Using the MySQL Client Program - will cover an overview of the MySQL Client Program (Workbench) and its main features. We will also cover the development environment to be used throughout this book, learn how to Connect and Manage connections, query the server and retrieve results, use the Modeller, and save and open scripts.

Chapter 2: Using MySQL Shell - will introduce the MySQL Shell tool, where we can perform our tasks in a command line Shell fashion. We will learn how to use the different topics and commands: Introduction and getting help, using a working schema, using Shell commands and retrieving results, executing SQL statements from a text file, executing multi-line statements, displaying results vertically, switching to JavaScript mode and run SQL or getting session information and Global objects or modules.

Chapter 3: Using MySQL Replication - will cover how to set up MySQL Replication (on Windows) using the minimum possible installation and a single (physical) server in a master/slave relationship. Will explain the prerequisites and set up a second Windows server and MySQL (slave) instance. Then, it will show how to configure the installation, create a replication user, synchronize and lock tables on the master before starting the process (optional), create a snapshot of the data, connect the slave to the master, and finally start the slave and verify the replication process.

Chapter 4: Writing MySQL-based Programs - will cover the essential elements of MySQL programming using Python language as an example: how to connect to the server, issue queries, retrieve the results, and handle errors. We will also discuss how to handle special characters and NULL values in queries, introduce regular expressions as a powerful string pattern searching and replacing mechanism, how to write library files to encapsulate code for commonly used operations, and various ways to gather server variables and parameters.

Chapter 5: Querying Data from Tables: Tables Management - will cover various ways to: select data from Tables, join Tables, use of sub-queries and common data manipulation statements to insert, update and delete data in tables. Moreover, will also cover data definition statements to create, alter, drop, truncate and rename Tables. Finally, will cover how to acquire exclusive table access to perform transactions.

Chapter 6: Working with Strings - will cover and deep dive into various string data types such as CHAR, VARCHAR, BINARY, VARBINARY, BLOB, TEXT, ENUM, and SET. It will additionally cover string manipulation techniques using functions and operators to do comparisons, use regular expressions, character sets, and collation of function results.

Chapter 7: Working with Dates and Times - will cover different date and time data types like DATETIME and TIMESTAMP, how to work with dates and times and handle common issues, how to do comparisons between dates and how to do conversions between date and time types. Moreover, it will show how to work with date and time functions in order to return certain information from a date value.

Chapter 8: Sorting Query Results - will cover different ways of using the ORDER BY clause to sort query results. In other words, the order in which the rows are returned for a given query result set. It will also cover the most common ways to use expressions, date-based, variable-length substrings, and ENUM values or special considerations like treating nulls and character set (collation). Many database (even experienced) professionals can benefit by reading this chapter, as it is common that some options are not widely known and can be handy in many situations.

Chapter 9: Using Stored Routines, Triggers, and Scheduled Events - will cover how to work with Stored Objects and Programs, create Procedures, Functions, and how they best fit in different applications. Moreover, will see Triggers and how to schedule and execute Events. Stored programs, procedures, functions, and triggers in MySQL provide a way to encapsulate and manage SQL logic within the database. They enhance code organization, promote reusability, and allow for the execution of complex operations. Developers can leverage these database objects to streamline their applications and enforce business rules directly at the database level.

Chapter 10: Importing and Exporting Data - will cover the Import and Export data capabilities of MySQL Server. These features are essential for managing data, backups, and migrations. It will show how to export using SQL statements, our complete database, a schema, or only selected objects and see advanced options available. Then, it will show how to import data from a disk using either a Dump Project Folder or SQL / dump file. Use cases include sharing data, backup, migrations, setting up development environments, or restoring databases.

Chapter 11: Validating and Reformatting Data - will cover how to convert values from one type to another, grouping data, using encryption, compression, numeric, aggregate, window, ranking, partition and related row calculations in a result set and Extensible Markup Language (XML) functions. Validating and reformatting data in MySQL involves several techniques to ensure data accuracy, integrity, consistency, and efficiency in database operations. These techniques play a crucial role in optimizing data management and analysis processes within MySQL databases.

Chapter 12: Generating and Using Sequences - will cover how to create and use sequences. We will learn what the AUTO_INCREMENT column attribute is and how it works using practical, ready-to-use data manipulation statements like adding, updating, deleting and altering tables having an AUTO_INCREMENT column. Moreover, will show how to use a sequence in a multiple-column index and finally how to use LAST_INSERT_ID() function in a sequence.

Chapter 13: Working with JSON - will cover the JavaScript Object Notation (JSON) data type. This chapter will show how to create a column, insert and pull data from a JSON column using a website configuration practical example, searching, modifying, ordering and converting between JSON and non-JSON values. In the last section will show how to use JSON in order to manage event-related data.

Chapter 14: Server Administration - will cover the MySQL Server Administration essentials. In this chapter, we will learn how to perform common database administration tasks like, starting and stopping the server, managing users, getting schema and tables metadata information, backup and restore. Will also cover maintaining database and tables, as well as, finding out what activity is taking place through server logs.

Chapter 15: Monitoring the Database Server and Security - will cover practical Database Server Monitoring capabilities like; managing the server status, client connections, performance dashboard and reports, and setting up performance schema. Moreover, it will show how to use authentication plug-ins and the password validation component. Additionally, readers will learn how to use MySQL and PowerShell clients to send emails as a proactive monitoring and maintenance mechanism, for example, in case of certain database server events or to alert database users.

Code Bundle and Coloured Images

Please follow the link to download the
Code Bundle and the *Coloured Images* of the book:

<https://rebrand.ly/22ef27>

The code bundle for the book is also hosted on GitHub at
<https://github.com/bpbpublications/MySQL-Cookbook>.

In case there's an update to the code, it will be updated on the existing GitHub repository.

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Table of Contents

1. Using the MySQL Client Program	1
Introduction	1
Structure	1
Objectives	2
Installation guidance	2
Recipe 1: Licensing consideration.....	12
Main features of the client program (Workbench)	12
<i>The main toolbar</i>	13
<i>The Navigator pane</i>	13
<i>Administration view</i>	13
<i>Schemas view</i>	14
Recipe 2: Connecting to a database	15
Recipe 3: Managing connections.....	16
Recipe 4: Using the query editor: Hello World!.....	17
Recipe 5: Using the modeler.....	19
Recipe 6: Saving and opening scripts: Hello World again!	21
Conclusion	22
2. Using MySQL Shell	23
Introduction	23
Structure	23
Objectives	24
Introduction and getting help	24
Recipe 7: Showing schemas and setting a working one.....	26
Recipe 8: Using Shell commands, viewing history and retrieving results	27
Recipe 9: Executing SQL statements from a text file.....	30
Recipe 10: Executing multiline statements.....	31
Recipe 11: command to MySQL server: Display results vertically	32
Recipe 12: Executing a system shell command.....	32
Recipe 13: Switching to JavaScript mode and run SQL.....	33

Recipe 14: Getting session information.....	34
Conclusion	35
3. Using MySQL Replication	37
Introduction	37
Structure	37
Objectives	38
Introduction and prerequisites.....	38
Setup the Virtual Machine software	38
Recipe 15: Creating a Windows .iso image.....	39
Recipe 16: Creating the VM and setup Windows.....	40
Recipe 17: Setup VirtualBox Guest Additions	42
Recipe 18: Setup MySQL Server on the VM.....	43
Recipe 19: Testing MySQL connection from Host to Guest	46
<i>Configuring the Master and Slave Servers</i>	<i>47</i>
Recipe 20: Enabling binary logging on the master server.....	47
Recipe 21: Configuring server ID on every slave server	49
Recipe 22: Creating the replication user	51
Recipe 23: Synchronizing the master before starting replication.....	53
Recipe 24: Creating a snapshot of the data	53
Recipe 25: Connecting the Slave to the Master	54
Recipe 26: Starting the slave	57
Recipe 27: Verifying process and changing replication parameters	58
Recipe 28: Unlocking tables	59
Conclusion	60
4. Writing MySQL-based Programs	61
Introduction	61
Structure	61
Objectives	62
Recipe 29: Starting Python client	62
Recipe 30: Encapsulating code for commonly used operations.....	64
Recipe 31: Connecting to and disconnect from the server	65

Recipe 32: Issue queries and retrieve the results – “engines” example.....	68
Recipe 33: Errors handling.....	71
Handling special characters and NULL values	73
Recipe 34: NULL value examples	73
Recipe 35: SET NULL values in UPDATE statement.....	75
<i>NULL values related functions</i>	75
Recipe 36: Handling special characters.....	76
Recipe 37: Writing an escape special characters program in Python	78
Recipe 38: Ways to gather server parameters and system variables	80
Conclusion	84
5. Querying Data from Tables: Tables Management	85
Introduction	85
Structure	85
Objectives	86
Recipe 39: Querying data from tables	86
Recipe 40: <i>Joining tables</i>	94
<i>INNER JOIN</i>	94
<i>LEFT OUTER JOIN</i>	95
<i>RIGHT OUTER JOIN</i>	96
<i>SELF JOIN</i>	96
<i>UNION, UNION ALL and INTERSECT</i>	97
Recipe 41: Issuing sub-queries	99
<i>SQL EXISTS</i>	99
<i>SQL ANY and ALL</i>	100
<i>SQL IN</i>	101
Recipe 42: Using INSERT, UPDATE, DELETE and DO	103
<i>INSERT</i>	103
<i>INSERT INTO SELECT</i>	105
<i>UPDATE</i>	106
<i>How to disable auto-commit transactions</i>	107
<i>DELETE</i>	107
<i>DO</i>	108

Recipe 43: Tables management: CREATE, ALTER, DROP, RENAME and TRUNCATE data definition statements.....	109
INDEXES.....	111
FOREIGN KEY.....	112
ALTER TABLE MODIFY Column	113
ALTER TABLE ADD Column	113
ALTER TABLE DROP Column	114
ALTER TABLE RENAME Column	114
CREATE INDEX.....	115
RENAME TABLE.....	115
TRUNCATE TABLE	115
DROP TABLE.....	116
Recipe 44: LOCK TABLES and UNLOCK TABLES statements	116
Conclusion	118
6. Working with Strings	119
Introduction	119
Structure	119
Objectives	120
Recipe 45: String data types: CHAR, VARCHAR, BINARY, VARBINARY	120
Recipe 46: More string data types: BLOB, TEXT, ENUM and SET	123
Recipe 47: String manipulation: Functions and operators	126
MySQL string functions.....	126
CHAR_LENGTH and LENGTH.....	127
ASCII	127
CONCAT and CONCAT_WS	128
FIELD, FIND_IN_SET and INSTR	129
LCASE, LOWER and UCASE, UPPER.....	130
LEFT, LPAD, LTRIM, RIGHT, RPAD, RTRIM.....	131
MID, SUBSTR, SUBSTRING and SUBSTRING_INDEX.....	132
Recipe 48: String comparison	134
SOUNDEX and SOUNDS LIKE	136
Recipe 49: Using regular expressions.....	137

<i>REGEXP_REPLACE</i>	139
Recipe 50: Character sets and collation of results.....	140
Conclusion	142
7. Working with Dates and Times	143
Introduction	143
Structure	143
Objectives	144
Recipe 51: Date data types	144
Recipe 52: DATETIME and TIMESTAMP data types	145
<i>YEAR data type</i>	147
Recipe 53: Working with and handling dates	147
Recipe 54: Comparing dates	149
DATEDIFF and TIMEDIFF	149
Recipe 55: Doing conversions between date and time types.....	150
<i>STR_TO_DATE</i>	150
<i>DATE_FORMAT</i>	151
<i>TIME_FORMAT</i>	152
Recipe 56: Using MySQL date and time functions.....	153
<i>MAKEDATE and MAKETIME</i>	156
<i>PERIOD_ADD, PERIOD_DIFF and QUARTER</i>	157
Conclusion	160
8. Sorting Query Results	161
Introduction	161
Structure	161
Objectives	162
Recipe 57: Using ORDER BY to sort query results.....	162
Recipe 58: Sorting with multiple columns.....	164
Recipe 59: Using expression for sorting.....	164
Recipe 60: Date based sorting.....	166
Recipe 61: Sorting by variable-length substrings	168
Recipe 62: Sorting ENUM values.....	169

Recipe 63: Sorting hostnames in domain order	169
Recipe 64: Special considerations when sorting	171
<i>COLUMN position</i>	171
<i>COALESCE function</i>	172
<i>COLLATE</i>	173
<i>LIMIT</i>	173
Conclusion	174
9. Using Stored Routines, Triggers, and Scheduled Events	175
Introduction	175
Structure	175
Objectives	176
Recipe 65: Stored objects and programs	176
Recipe 66: Using procedures	176
Recipe 67: Using functions	187
Recipe 68: Using views	190
<i>INSERTABLE or UPDATABLE VIEWS</i>	192
Recipe 69: Using triggers	194
Recipe 70: Using the event scheduler	196
Conclusion	200
10. Importing and Exporting Data	201
Introduction	201
Structure	201
Objectives	202
Recipe 71: Data export using SQL statements	202
<i>How to stop and start the MySQL Server</i>	204
Recipe 72: Data export a complete database	205
Recipe 73: Data export only selected schema(s) and objects	208
Recipe 74: Data export using the advanced options	211
Recipe 75: Data import from dump project folder	212
Recipe 76: Data import from self-contained file	213

Conclusion	215
11. Validating and Reformatting Data.....	217
Introduction	217
Structure	217
Objectives	218
Recipe 77: Using BINARY, CAST(), and CONVERT() to perform type casting.....	218
Recipe 78: GROUP BY clause and how to group data.....	222
Recipe 79: Using numeric and aggregate functions	224
<i>CEIL(X) and FLOOR(X)</i>	226
<i>GREATEST() and LEAST()</i>	227
<i>Absolute function and primary inverse trigonometric functions</i>	228
<i>DIV() and MOD()</i>	229
<i>Logarithmic functions</i>	230
Recipe 80: Encrypt, decrypt, compress and calculate checksum	231
Recipe 81: Using window functions, ranking and partitioning in a result set.....	234
<i>ROW_NUMBER(), RANK(), DENSE_RANK()</i>	234
<i>FIRST_VALUE(), LAST_VALUE(), NTH_VALUE() and using PARTITION</i>	236
Recipe 82: Extracting value from an XML string and returning replaced XML fragment.....	237
<i>Understanding XPath expressions basics</i>	239
Conclusion	240
12. Generating and Using Sequences	241
Introduction	241
Structure	241
Objectives	242
Recipe 83: Creating a sequence in MySQL and adding rows	242
Recipe 84: Deleting a row from a table having a sequence	243
Recipe 85: Updating a table row with an AUTO_INCREMENT column	245
Recipe 86: Altering a table with an AUTO_INCREMENT column	245
Recipe 87: Using a sequence in a multicolumn index.....	245
Recipe 88: Using LAST_INSERT_ID() function in a sequence	247

Conclusion	248
13. Working with JSON.....	249
Introduction	249
Structure	249
Objectives	250
Recipe 89: Creating a column of JSON data type	250
Recipe 90: Storing website configuration in JSON	252
Recipe 91: Getting values out of JSON columns.....	256
Recipe 92: Searching and modifying JSON values.....	257
Recipe 93: Ordering of JSON values.....	259
Recipe 94: Casting values as JSON and non-JSON	261
Recipe 95: Using JSON to manage events	262
Conclusion	266
14. Server Administration.....	267
Introduction	267
Structure	267
Objectives	268
Recipe 96: Start, stop and restart server.....	268
Recipe 97: Managing users, roles and privileges.....	273
Recipe 98: Using show commands to get database information.....	280
Recipe 99: Backup and restore database	284
<i>Copying table files to create a backup</i>	291
<i>FLUSH TABLES</i>	291
<i>Exporting to delimited-text flat file</i>	292
<i>Enabling point-in-time recovery</i>	293
<i>Backup using replicas</i>	294
Recipe 100: Maintaining database and tables	294
<i>Database maintenance</i>	294
<i>Table maintenance operations</i>	295
Recipe 101: Using server logs and checking user activity.....	298

Conclusion	300
15. Monitoring the Database Server and Security	301
Introduction	301
Structure	301
Objectives	302
Recipe 102: Managing server status	302
Recipe 103: Managing client connections	308
<i>Client connection types</i>	309
Recipe 104: Using performance dashboard	313
<i>Network status</i>	313
<i>MySQL status</i>	314
<i>InnoDB status</i>	315
Recipe 105: Using performance reports	316
<i>Sorting performance reports results</i>	322
Recipe 106: Performance schema setup	323
<i>Easy setup</i>	324
<i>Advanced</i>	325
Recipe 107: Creating a password validation policy	333
Recipe 108: Creating a user using SHA Pluggable Authentication	335
Recipe 109: Setting up MySQL to send emails	337
<i>Connecting PowerShell to MySQL Database</i>	339
Conclusion	343
Index	345-351

CHAPTER 1

Using the MySQL Client Program

Introduction

In this chapter, we will cover an overview of the MySQL client program (Workbench) and its main features. We will also be covering the development environment to be used throughout this book. We will learn how to connect and manage connections, query the server and retrieve results, using the modeler, saving and opening scripts.

Structure

In this chapter, we will discuss the following topics:

- Installation guidance
- Recipe 1: Licensing consideration for installation software
- Main features of the client program (Workbench)
 - The main toolbar
 - The navigator pane
 - Administration view
 - Schemas view
- Recipe 2: Connecting to a database
- Recipe 3: Managing connections

- Recipe 4: Using the query editor and retrieve results from the server
- Recipe 5: Using the modeler
- Recipe 6: Saving and opening scripts

Objectives

In the first chapter of our journey, we will cover an overview of the MySQL client program (Server and Workbench) to be used in the book and its main features. We will also be covering the development environment to be used throughout this book. We will learn how to connect and manage connections, query the server and retrieve results, using the modeler, saving and opening scripts.

Installation guidance

The main client program to be used throughout this book is the MySQL Workbench as part of the MySQL Installer for Windows, which you can download for free at the following link:

<https://dev.mysql.com/downloads/>

MySQL Workbench client is a GUI tool that can help accomplish any common or more complex task whether it is development or administration. Additionally, MySQL Shell client tool which is described in detail in *Chapter 2, Using MySQL Shell*, is another tool installed which offers a command-line interface where we can interact with the database. It offers SQL and JavaScript modes as well as interacting with the operating system (Windows, Linux or other).

Our installation guide will be based on Windows however all recipes and code snippets should work in any supported operating system (like Linux, Ubuntu, Fedora and macOS).

After you download the installer program, start it, choose the Developer Default option like shown in the following figure and then click on Next:

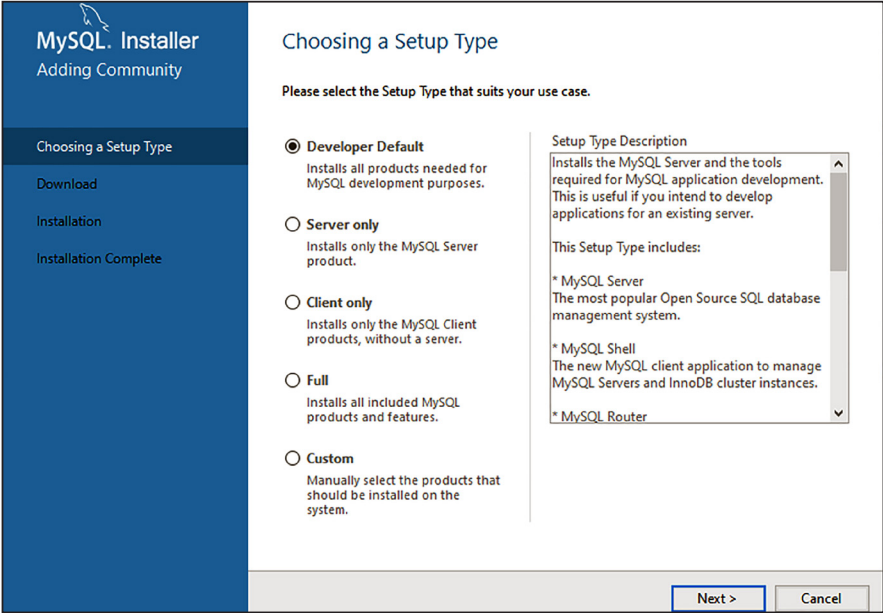


Figure 1.1: MySQL installer Choosing a Setup Type screen

In the following screen, you can leave the pre-selected **Path** and click Next or choose another installation folder (in our example, there is a Path Conflict due to a previous installation, you can ignore it if the previous installation is removed. Same folder will be reused and overwritten), as shown in the following figure:

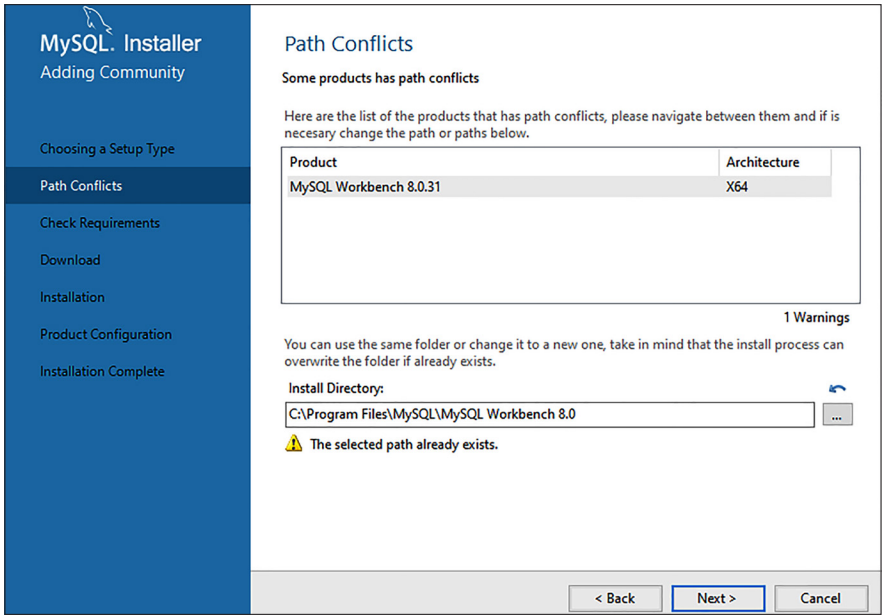


Figure 1.2: MySQL Installer Path Conflicts screen

In the following screen, certain requirements are checked based on the option chosen in the first screen, you will need to manually resolve these and download respective software (like Python and Visual Studio, as shown).

- Python software can be downloaded for free at:
<https://www.python.org/downloads/>
- Visual Studio (free Community 2019 version) can be downloaded at:
<https://visualstudio.microsoft.com/vs/older-downloads/>

Click Check and then Next when requirements are resolved and you will be ready to download MySQL software, as shown in the following figure:

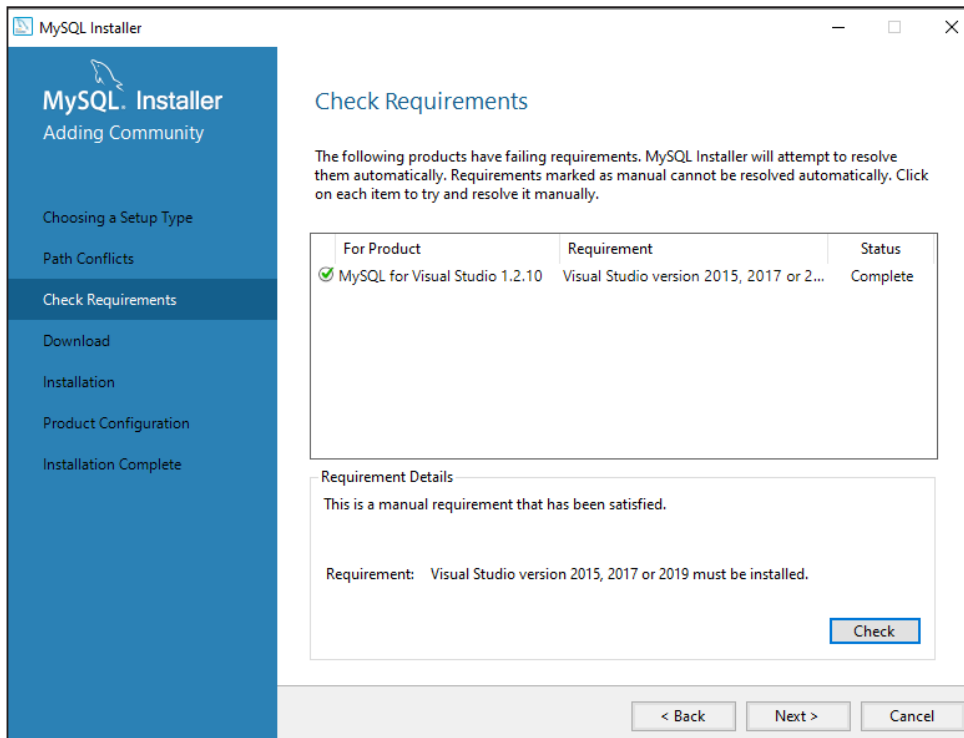


Figure 1.3: MySQL Installer Check Requirements screen

We are now ready to download and install MySQL software, click **Execute** in the screen as follows:

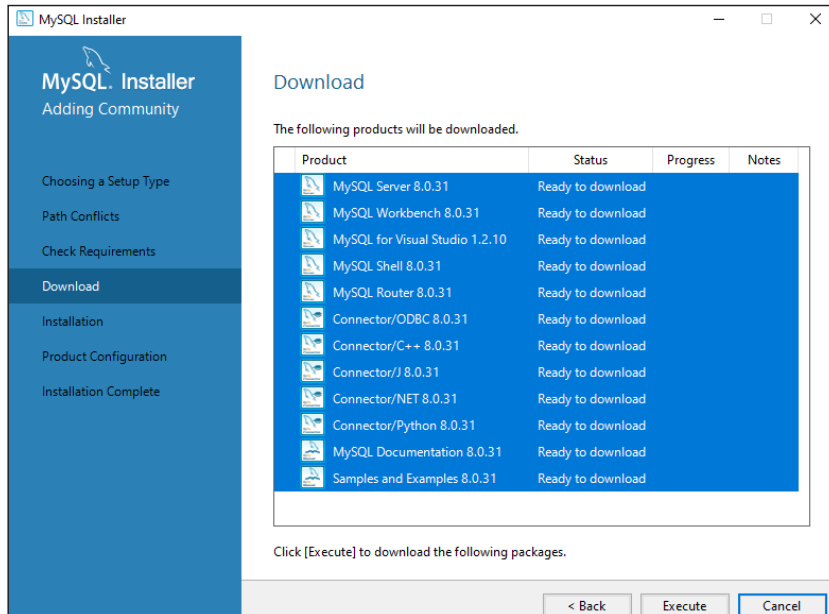


Figure 1.4: MySQL Installer Download screen

Once all the packages are downloaded successfully as shown in the following screen, you can click **Next** and then **Execute** to continue with installation:

Note: You might need to retry | click on Try again | if some package(s) fail to download, until all are done.

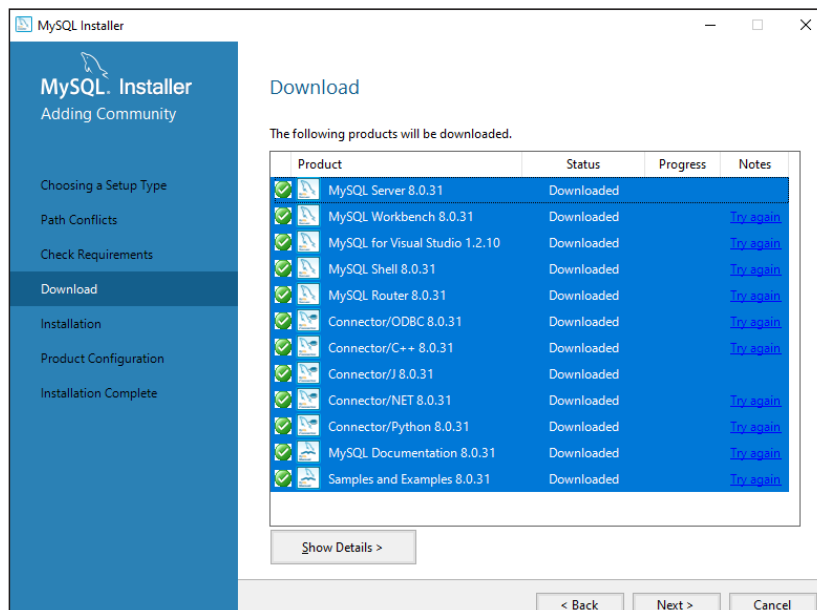


Figure 1.5: MySQL Installer Download screen (cont.)