



Beginning T-SQL

A Step-by-Step Approach

—

Fourth Edition

—

Kathi Kellenberger
Lee Everest



Apress®

Beginning T-SQL

A Step-by-Step Approach

Fourth Edition

Kathi Kellenberger
Lee Everest

Apress®

Beginning T-SQL: A Step-by-Step Approach

Kathi Kellenberger
Edwardsville, IL, USA

Lee Everest
Euleless, TX, USA

ISBN-13 (pbk): 978-1-4842-6605-2
<https://doi.org/10.1007/978-1-4842-6606-9>

ISBN-13 (electronic): 978-1-4842-6606-9

Copyright © 2021 by Kathi Kellenberger, Lee Everest

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

Trademarked names, logos, and images may appear in this book. Rather than use a trademark symbol with every occurrence of a trademarked name, logo, or image we use the names, logos, and images only in an editorial fashion and to the benefit of the trademark owner, with no intention of infringement of the trademark.

The use in this publication of trade names, trademarks, service marks, and similar terms, even if they are not identified as such, is not to be taken as an expression of opinion as to whether or not they are subject to proprietary rights.

While the advice and information in this book are believed to be true and accurate at the date of publication, neither the authors nor the editors nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

Managing Director, Apress Media LLC: Welmoed Spahr
Acquisitions Editor: Jonathan Gennick
Development Editor: Laura Berendson
Coordinating Editor: Jill Balzano

Cover image designed by Freepik (www.freepik.com)

Distributed to the book trade worldwide by Springer Science+Business Media LLC, 1 New York Plaza, Suite 4600, New York, NY 10004. Phone 1-800-SPRINGER, fax (201) 348-4505, e-mail orders-ny@springer-sbm.com, or visit www.springeronline.com. Apress Media, LLC is a California LLC and the sole member (owner) is Springer Science + Business Media Finance Inc (SSBM Finance Inc). SSBM Finance Inc is a **Delaware** corporation.

For information on translations, please e-mail booktranslations@springernature.com; for reprint, paperback, or audio rights, please e-mail bookpermissions@springernature.com.

Apress titles may be purchased in bulk for academic, corporate, or promotional use. eBook versions and licenses are also available for most titles. For more information, reference our Print and eBook Bulk Sales web page at <http://www.apress.com/bulk-sales>.

Any source code or other supplementary material referenced by the author in this book is available to readers on GitHub via the book's product page, located at www.apress.com/9781484266052. For more detailed information, please visit <http://www.apress.com/source-code>.

Printed on acid-free paper

For my parents, Bill and Marilyn, who have lived lives of joy, gratitude, love, and service. I'm proud to be your daughter.

Table of Contents

About the Authors	xxi
About the Technical Reviewer	xxiii
Acknowledgments	xxv
Introduction	xxvii
Chapter 1: Getting Started	1
Installing SQL Server Developer Edition.....	2
Finding Help for SQL Server.....	19
Download Sample Databases	19
Installing Tools for SQL Server	20
Using Azure Data Studio.....	20
Summary.....	32
Chapter 2: Exploring Database Concepts	33
What Is SQL Server?	33
Service vs. Application.....	35
Database as Container	35
Data Is Stored in Tables	38
Data Types.....	39
Normalization.....	41
Understanding Indexes	44
Database Schemas	45
Summary.....	46

TABLE OF CONTENTS

- Chapter 3: Writing Simple SELECT Queries 47**
- Using the SELECT Statement 48
 - Selecting a Literal Value 48
 - Retrieving from a Table..... 49
 - Generating a SELECT List 51
 - Mixing Literals and Column Names 52
- IntelliSense 54
- Formatting T-SQL Code 55
 - Can the Statement Be Written on One Line? 55
 - Must Keywords Be Uppercase?..... 56
 - Are Column and Table Names Case Sensitive? 56
 - Is the Semicolon Important? 57
 - Why Use Aliases? 57
 - When to Use Single Quotes, Double Quotes, or Square Brackets? 57
- Filtering Data 59
 - Adding a WHERE Clause 59
 - Using WHERE Clauses with Alternate Operators..... 61
 - Using BETWEEN 64
 - Using BETWEEN with NOT 66
 - Filtering on Date and Time 68
 - Using WHERE Clauses with Two Predicates 70
 - Using the IN Operator 73
- Working with NULL..... 75
- Sorting Data 78
- Thinking About Performance..... 80
 - Taking Advantage of Indexes 81
 - Viewing Execution Plans..... 82
- Summary..... 85
- Answers to the Exercises..... 86
 - Solutions to Exercise 3-1: Using the *SELECT* Statement 86

Solutions to Exercise 3-2: Filtering Data	87
Solutions to Exercise 3-3: Using WHERE Clauses with Two Predicates.....	89
Solutions to Exercise 3-4: Working with NULL.....	91
Solutions to Exercise 3-5: Sorting Data.....	92
Chapter 4: Using Built-in Functions and Expressions.....	95
Expressions Using Operators	95
Concatenating Strings	96
Concatenating Strings and <i>NULL</i>	97
CONCAT.....	98
ISNULL and COALESCE	99
Concatenating Other Data Types to Strings	101
Using Mathematical Operators.....	104
Using String Functions.....	107
RTRIM, LTRIM, and TRIM	107
LEFT and RIGHT	109
LEN and DATALENGTH	109
CHARINDEX.....	110
SUBSTRING.....	112
CHOOSE.....	113
REVERSE.....	113
UPPER and LOWER	114
REPLACE	115
STRING_SPLIT and STRING_AGG.....	116
Nesting Functions	117
Using Date and Time Functions.....	120
GETDATE and SYSDATETIME.....	120
DATEADD	120
DATEDIFF	122
DATENAME and DATEPART	123
DAY, MONTH, and YEAR.....	124

TABLE OF CONTENTS

- CONVERT 125
- FORMAT 127
- DATEFROMPARTS 128
- EOMONTH 128
- Using Mathematical Functions..... 129
 - ABS..... 130
 - POWER..... 130
 - SQUARE and SQRT 130
 - ROUND 131
 - RAND 132
- Logical Functions and Expressions..... 134
 - The *CASE* Expression..... 134
 - IIF..... 137
 - COALESCE..... 138
- Administrative Functions 139
- Using Functions in the WHERE and ORDER BY Clauses 141
- The TOP Keyword 143
- Thinking About Performance..... 145
- Summary..... 149
- Answers to the Exercises..... 150
 - Solutions to Exercise 4-1: Expressions Using Operators 150
 - Solutions to Exercise 4-2: Using Mathematical Operators 152
 - Solutions to Exercise 4-3: Using Functions 153
 - Solutions to Exercise 4-4: Using Date and Time Functions 155
 - Solutions to Exercise 4-5: Using Mathematical Functions 157
 - Solutions to Exercise 4-6: Using Logical and System Functions 158
 - Solutions to Exercise 4-7: Using Functions in the WHERE and ORDER BY Clauses..... 160

Chapter 5: Joining Tables	163
Using INNER JOIN.....	164
Joining Two Tables.....	164
Avoiding an Incorrect Join Condition	166
Joining on a Different Column Name.....	168
Joining on More Than One Column.....	169
Joining Three or More Tables	171
Using OUTER JOIN.....	174
Using LEFT OUTER JOIN.....	174
Using RIGHT OUTER JOIN.....	176
Using OUTER JOIN to Find Rows with No Match	177
Adding a Table to the Right Side of a LEFT JOIN	178
Adding a Table to the Main Table of a LEFT JOIN.....	180
FULL OUTER JOIN	181
CROSS JOIN	183
Self-Joins	185
Thinking About Performance.....	188
Merge Join.....	188
Nested Loop.....	190
Hash Match	192
Summary.....	193
Answers to the Exercises.....	193
Solutions to Exercise 5-1: Using INNER JOIN	194
Solutions to Exercise 5-2: Using OUTER JOIN.....	196
Chapter 6: Building on Subqueries, Common Table Expressions, and Unions.....	199
Writing Subqueries	199
Using a Subquery in an IN List	199
Using a Subquery and NOT IN.....	200
Using a Subquery Containing NULL with NOT IN	201

TABLE OF CONTENTS

- Using EXISTS 203
- Using CROSS APPLY and OUTER APPLY..... 204
- Writing UNION Queries..... 205
- Using EXCEPT and INTERSECT..... 208
- Using Derived Tables and Common Table Expressions 211
 - Using Derived Tables 211
 - Using Common Table Expressions..... 213
 - Using a Common Table Expression to Solve a Complicated Join Problem 215
- Thinking About Performance..... 218
- Summary..... 221
- Answers to the Exercises..... 222
 - Solutions to Exercise 6-1: Using Subqueries..... 222
 - Solutions to Exercise 6-2: Using Derived Tables and Common Table Expressions 225
- Chapter 7: Grouping and Summarizing Data 227**
 - Aggregate Functions 227
 - The GROUP BY Clause 231
 - Grouping on Columns 231
 - Grouping on Expressions 233
 - The ORDER BY Clause 235
 - The WHERE Clause 237
 - The HAVING Clause 238
 - Order of Operations..... 240
 - DISTINCT Keyword 242
 - Using DISTINCT vs. GROUP BY..... 242
 - DISTINCT Within an Aggregate Expression 243
 - Aggregate Queries with More Than One Table 245
 - Aggregate Functions and NULL..... 248
 - Thinking About Performance..... 249
 - Summary..... 252

Answers to the Exercises.....	253
Solutions to Exercise 7-1: Aggregate Functions.....	253
Solutions to Exercise 7-2: The GROUP BY Clause.....	254
Solutions to Exercise 7-3: The HAVING Clause.....	256
Solutions to Exercise 7-4: DISTINCT Keyword.....	258
Solutions to Exercise 7-5: Aggregate Queries with More Than One Table.....	259
Chapter 8: Discovering Windowing Functions.....	261
What Is a Windowing Function?.....	261
Ranking Functions and the OVER Clause.....	262
Defining the Window.....	262
Using NTILE.....	265
Dividing the Window into Partitions.....	266
Summarizing Results with Window Aggregates.....	268
Defining the Window with Framing.....	270
Calculating Running Totals.....	272
Understanding the Difference Between ROWS and RANGE.....	273
Using Window Analytic Functions.....	275
LAG and LEAD.....	275
FIRST_VALUE and LAST_VALUE.....	277
PERCENT_RANK and CUME_DIST.....	279
PERCENTILE_CONT and PERCENTILE_DISC.....	280
Applying Windowing Functions.....	283
Removing Duplicates.....	283
Solving an Islands Problem.....	285
Thinking About Performance.....	287
Indexing.....	287
The Trouble with Window Aggregates.....	288
Framing.....	289
Summary.....	291

TABLE OF CONTENTS

- Answers to the Exercises..... 291
 - Solutions to Exercise 8-1: Ranking Functions 291
 - Solutions to Exercise 8-2: Summarizing Results with Window Aggregates 292
 - Solutions to Exercise 8-3: Understanding the Difference Between ROWS and RANGE..... 295
 - Solutions to Exercise 8-4: Using Window Analytic Functions 296
- Chapter 9: Advanced WHERE Clauses..... 299**
 - Pattern Matching 299
 - Using LIKE 299
 - Restricting the Characters in Pattern Matches..... 301
 - Searching for Wildcards 303
 - Combining Wildcards..... 304
 - Using PATINDEX 307
 - Using SOME, ANY, and ALL 308
 - Using WHERE Clauses with Three or More Predicates..... 310
 - Using NOT with Parentheses 313
 - Performing a Full-Text Search 315
 - Using CONTAINS 316
 - Using Multiple Terms with CONTAINS..... 317
 - Searching Multiple Columns..... 318
 - Using FREETEXT 318
 - Using FREETEXTTABLE 319
 - Thinking About Performance..... 322
 - Summary..... 323
 - Answers to the Exercises..... 324
 - Solutions to Exercise 9-1: Using LIKE..... 324
 - Solutions to Exercise 9-2: Using WHERE Clauses with Three or More Predicates..... 326
 - Solutions to Exercise 9-3: Performing a Full-Text Search 327

Chapter 10: Manipulating Data	331
Inserting New Rows	331
Adding One Row with Literal Values.....	332
Avoiding Common Insert Errors.....	334
Inserting Multiple Rows with One Statement.....	337
Inserting Rows from Another Table.....	338
Inserting Missing Rows	340
Creating and Populating a Table in One Statement	341
Inserting Rows into Tables with Default Column Values.....	343
Inserting Rows into Tables with Automatically Populating Columns	345
Deleting Rows	349
Using DELETE	349
Deleting from a Table in a JOIN	352
Truncating.....	356
Updating Existing Rows	357
Using the UPDATE Statement	358
Updating Data with Expressions and Columns.....	359
Updating with a Join.....	361
Thinking About Performance.....	363
Database Cleanup.....	365
Summary.....	366
Answers to the Exercises.....	366
Solutions to Exercise 10-1: Inserting New Rows.....	366
Solutions to Exercise 10-2: Deleting Rows.....	370
Solutions to Exercise 10-3: Updating Existing Rows	371
Chapter 11: Managing Transactions	373
ACID Properties	373
Writing an Explicit Transaction.....	374
Rolling Back a Transaction	376
Using the XACT_ABORT Setting.....	379

TABLE OF CONTENTS

- Error Handling 381
 - Using TRY . . . CATCH 382
 - Viewing Untrappable Errors..... 384
 - Using RAISERROR 385
 - Using TRY . . . CATCH with Transactions 387
 - Using *THROW* Instead of *RAISERROR*..... 389
- Thinking About Performance..... 391
- Summary..... 394
- Answers to the Exercises..... 394
 - Solutions to Exercise 11-1: Writing an Explicit Transaction..... 394
 - Solutions to Exercise 11-2: Error Handling..... 396
- Chapter 12: Understanding T-SQL Programming Logic 399**
 - Variables 399
 - Declaring and Initializing a Variable 399
 - Using Expressions and Functions with Variables 403
 - Using Variables in WHERE and HAVING Clauses 405
 - The IF . . . ELSE Construct..... 409
 - Using IF..... 409
 - Using ELSE 411
 - Using Multiple Conditions..... 413
 - Nesting IF . . . ELSE 414
 - Using IF with a Query 416
 - WHILE..... 418
 - Using a WHILE Loop..... 418
 - Nesting WHILE Loops..... 421
 - Exiting a Loop Early 422
 - Using CONTINUE 423

Temporary Tables and Table Variables	425
Creating Local Temp Tables	426
Creating Global Temp Tables.....	427
Creating Table Variables	428
Using a Temp Table or Table Variable.....	430
Using a Temp Table or Table Variable Like an Array.....	432
Using a Cursor	433
Thinking About Performance.....	436
Summary.....	440
Answers to the Exercises.....	441
Solutions to Exercise 12-1: Variables	441
Solutions to Exercise 12-2: The IF . . . ELSE Construct.....	443
Solutions to Exercise 12-3: WHILE.....	446
Solutions to Exercise 12-4: Temporary Tables and Table Variables	448
Chapter 13: Implementing Logic in the Database.....	453
Tables.....	453
Adding Check Constraints to a Table	454
Adding UNIQUE Constraints	456
Adding a Primary Key to a Table.....	460
Creating Foreign Keys	464
Creating Foreign Keys with Delete and Update Rules	467
Defining Automatically Populated Columns.....	471
Views	476
Creating Views.....	477
Avoiding Common Problems with Views	480
Manipulating Data with Views.....	483
User-Defined Functions.....	487
Creating User-Defined Scalar Functions.....	487
Using Table-Valued User-Defined Functions.....	490

TABLE OF CONTENTS

- Stored Procedures 493
 - Using Default Values with Parameters 497
 - Using the OUTPUT Parameter 498
 - Saving the Results of a Stored Procedure in a Table..... 500
 - Using a Logic in Stored Procedures..... 502
- User-Defined Data Types 504
- Table Types..... 505
- Triggers 508
- Thinking About Performance..... 510
- Database Cleanup 513
- Summary..... 515
- Answers to the Exercises..... 515
 - Solutions to Exercise 13-1: Tables..... 515
 - Solutions to Exercise 13-2: Views 518
 - Solutions to Exercise 13-3: User-Defined Functions 520
 - Solutions to Exercise 13-4: Stored Procedures 522
- Chapter 14: Expanding on Data Type Concepts 527**
 - Large-Value String Data Types (MAX) 528
 - Large-Value Binary Data Types 531
 - Creating VARBINARY(MAX) Data 531
 - Using FILESTREAM 532
 - FileTables..... 540
 - Enhanced Date and Time 542
 - Using DATE, TIME, and DATETIME2..... 543
 - Using DATETIMEOFFSET 544
 - HIERARCHYID 545
 - Viewing HIERARCHYID 546
 - Creating a Hierarchy..... 547
 - Using Stored Procedures to Manage Hierarchical Data..... 549

Spatial Data Types.....	553
Using GEOMETRY	553
Using GEOGRAPHY	555
Viewing the Spatial Results Tab	556
Circular Arcs	557
Sparse Columns.....	559
Graph Databases.....	562
Thinking About Performance.....	568
Summary.....	571
Chapter 15: Working with XML and JSON	573
The Parts of XML.....	573
Converting XML Using OPENXML	575
Retrieving Data as XML Using the FOR XML Clause.....	579
FOR XML RAW.....	580
FOR XML AUTO.....	582
FOR XML EXPLICIT	584
FOR XML PATH.....	587
The XML Data Type.....	590
XML Methods	592
The QUERY Method.....	593
The VALUE Method.....	595
The EXIST Method	597
The MODIFY Method	598
The NODES Method	600
JSON Data.....	602
Returning JSON Data.....	603
Inserting JSON Data	605
Shredding JSON Data	607
Summary.....	610

TABLE OF CONTENTS

- Chapter 16: Writing Advanced Queries..... 611**
 - Advanced CTE Queries 611
 - Alternate CTE Syntax 612
 - Using Multiple CTEs..... 612
 - Referencing a CTE Multiple Times..... 616
 - Joining a CTE to Another CTE 617
 - Writing a Recursive Query 619
 - Data Manipulation with CTEs..... 622
 - Isolating Aggregate Query Logic 624
 - Correlated Subqueries in the SELECT List..... 624
 - Using Derived Tables 626
 - Common Table Expressions..... 627
 - Using CROSS APPLY and OUTER APPLY..... 629
 - The OUTPUT Clause..... 632
 - Using OUTPUT to View Data..... 632
 - Saving OUTPUT Data to a Table 635
 - The MERGE Statement..... 637
 - GROUPING SETS 641
 - CUBE and ROLLUP 643
 - Pivoted Queries 645
 - Pivoting Data with CASE..... 645
 - Using the PIVOT Function 648
 - Using the UNPIVOT Function..... 651
 - Temporal Tables 654
 - Paging 656
 - Summary..... 658
- Chapter 17: Where to Go Next?..... 659**
 - Online Resources 660
 - Conferences 661
 - User Groups 661

Vendors	662
Books	662
Classes.....	662
SQL Server Documentation.....	663
Practice, Practice, and More Practice	663
Teach Someone Else	663
Appendix A: SQL Server for Linux and macOS.....	665
Installing a SQL Server Instance in a Container	665
Copy Sample Databases to the Container	670
Restore Sample Databases.....	671
Appendix B: Using SSMS	677
Installing SQL Server Management Studio	677
Launching SQL Server Management Studio	677
Installing the Sample Databases	680
Get Started with SSMS.....	686
Summary.....	688
Appendix C: SQL Notebooks.....	689
Opening a SQL Notebook	689
Adding Code to the Notebook	690
Adding a Text Cell.....	691
Organizing Your Notebooks	693
Summary.....	694
Index.....	695

About the Authors



Kathi Kellenberger is an editor and DevOps advocate at Redgate Software and a Microsoft Data Platform MVP. She has been working with SQL Server for 22 years, starting with version 6.5. She has worked as a developer, database administrator, and consultant. Kathi has been involved with almost 20 book projects as an author, coauthor, or technical editor and enjoys presenting at events, webinars, and user groups. When not working, she teaches T-SQL to beginners at a nonprofit in St. Louis, Missouri, that helps people transition to tech careers. Kathi loves spending time with family and friends, cycling, and singing.



Lee Everest is a SQL Server developer who has worked with the product since version 6.5. He has taught part-time at Dallas College North Lake Campus for 18 years and has had several students move on to companies such as Microsoft, filling roles from support engineer to data scientist to vice president. When Lee isn't working, he enjoys computers, golf, and fishing.

About the Technical Reviewer



It was 2 a.m. when **Forrest McDaniel** looked at the clock again and realized he was hooked on this SQL thing. After years of teaching (and a failed finance career aborted by the Great Recession), this mathematician set his sights on SQL Server.

Forrest now gets to combine his love of teaching and passion for algorithms and is a self-confessed B-tree hugger. Weirdly addicted to SQL Server internals and performance tuning, his goal is to convince others that these things are actually fun or at least worth paying attention to!

Acknowledgments

This book would not be possible without the great team at Apress, especially Jonathan Gennick and Jill Balzano. I'm sure there are countless others working behind the scenes whose names I will never know. Thanks to all of you.

I would like to thank Forrest McDaniel for his wonderful technical review and Lee Everest for helping with the exercise questions. You have both made this book better, and I appreciate your work and commitment.

Most of all, I would like to thank you, the reader. I hope that this book is just the starting point for all you will learn about T-SQL, and I thank you for starting your journey with me.

Introduction

The card catalog at the local public library was my first database. The catalog made it possible to find books based on titles, authors, or subjects just like writing a SQL query. Of course, I could walk around and locate books because they were arranged thanks to the Dewey Decimal System, but having that old drawer-filled cabinet made it even easier.

Decades ago, most businesses did everything with paper stored in filing cabinets. Computers and databases existed, but they were not commonly used in schools or many businesses until the 1980s and 1990s. Now, it's easy for almost anyone to keep track of data in a local database or at least a spreadsheet.

The ability to query a database is vital for many professions. Of course, application developers, database administrators, business intelligence developers, database developers, and data scientists must be able to work with databases. What might be surprising is that professionals working in human resources, insurance, health care, government records, grant writing, publishing, real estate, and social work, to name a few, now must query databases. I often run into these “nontech” professionals at SQL Server events or the classes that I teach, so I know that SQL querying is an important in-demand skill in many industries and positions.

There are several database vendors, and this book is meant to teach T-SQL, the query language used for SQL Server and Azure SQL Database from Microsoft. Many professionals will find that they end up working with other databases such as Oracle or MySQL databases from time to time. The basics do carry from one system to another, but each vendor supports its own extensions, or flavor, of the SQL language. For SQL Server, it's T-SQL.

Who's This Book For?

This book is meant to teach T-SQL (Transact SQL) to absolute beginners. No database experience is required, but the reader should have at least average computer skills. The reader should be able to do a Google search, download files, install software, and follow instructions. The book starts out with the basics, and each chapter builds on the knowledge obtained in earlier chapters.

The book may also be used as a reference for others with intermediate or advanced skills who need to brush up on particular topics. It's easy to forget how to write certain queries if you don't do it often, and this book will reteach it to you!

What's in This Book?

This book starts with instructions for setting up your own SQL Server instance where you can practice writing queries, creating objects, and modifying data without the chance of causing issues in your company's production systems. (If you happen to be running a Linux or Mac, check out Appendix A for instructions on running a SQL Server inside a container.)

Following a discussion on database concepts, each chapter covers a new T-SQL topic that builds on the previous skills learned. You first must understand how to write queries involving one table before you can learn how to join tables, for example. The chapters contain many example queries that I encourage you to type out (or even write out!) and run. You will also find exercise questions to allow you to practice what you have learned. Because getting the right results is just part of the battle, you'll also find best practices and information about query performance.

The nice thing about T-SQL is that query writing basics haven't changed since SQL Server 2005 came out. Each new version of SQL Server has additional functionality that makes it even more powerful, and this book will include that functionality (up to SQL Server 2019 and the latest Azure SQL Database) when it makes sense for a beginner book.

The book is broken down like this:

- Chapters [1](#) and [2](#) provide an introduction to databases and some background information you'll need to understand to read the rest of the book.
- Chapters [3](#) through [9](#) cover how to write queries to retrieve data from SQL Server.
- Chapters [10](#) and [11](#) cover updating, deleting, and inserting data.
- Chapters [12](#) and [13](#) cover how to implement logic in the database.
- Chapters [14](#), [15](#), and [16](#) are bonus chapters with advanced querying topics.

- Chapter [17](#) contains many resources for learning more.
- Appendices A, B, and C contain information for alternate tools for running and querying SQL Server.

I expect beginners will want to start at the beginning and read each chapter in order. For those of you who are more advanced, this might be a good reference to keep handy. However you wish to read it, I hope it is the first step toward a fulfilling and fruitful career.

CHAPTER 1

Getting Started

T-SQL, also known as Transact-SQL, is Microsoft's implementation of the Structured Query Language (SQL) for SQL Server. Most database professionals pronounce SQL like the word "sequel," but you will occasionally hear someone say it as S-Q-L.

T-SQL is the language that is most often used to extract or modify data stored in a SQL Server database, regardless of which application or tool you use. SQL Server 2019 T-SQL is based on standards created by the American National Standards Institute (ANSI), but Microsoft has added several functionality enhancements. You will find that T-SQL is a very versatile and powerful language.

T-SQL consists of Data Definition Language (DDL), Data Manipulation Language (DML), Data Control Language (DCL), Transaction Control Language (TCL), and control-of-flow statements. Although the book focuses primarily on the DML statements, which you will use to retrieve and manipulate data, this book covers DDL statements and programming logic as well.

This chapter will explain how to install a free edition of SQL Server and get it ready for running the example code and performing the exercises in the rest of this book. This chapter also gives you a quick tour of Azure Data Studio (ADS). Database professionals have used another tool, SQL Server Management Studio (SSMS), for the past 15 years, but ADS is the new kid on the block which runs on Linux and macOS, not just on Windows. ADS is missing some of the functionality, especially for database administration that SSMS has, but Microsoft adds new features to ADS frequently. If you would prefer to use SSMS, take a look at Appendix B for more information.

Installing SQL Server Developer Edition

Microsoft makes SQL Server 2019 available in several editions depending on the needs and budget of the organization. As a learner or developer, you can download and install the free SQL Server Developer Edition from Microsoft’s website on your local computer. At the time of this writing, it can be found at www.microsoft.com/en-us/sql-server/sql-server-downloads, but be sure to search for it if the location has changed. Figure 1-1 shows the download link on the page.



Developer

SQL Server 2019 Developer is a full-featured free edition, licensed for use as a development and test database in a non-production environment.



Figure 1-1. SQL Server Developer Edition download link

Note The instructions for installing a local SQL Server in this chapter work for Windows. If you are running macOS or Linux, see Appendix A to install SQL Server in a container.

Before installing, make sure that your computer meets the requirements for SQL Server 2019. Search for the Microsoft page “SQL Server 2019: Hardware and software requirements” to find out.

You may hear someone refer to “instances” of SQL Server. An instance of SQL Server consists of all the files, settings, and services required to run SQL Server. You can have more than one instance of SQL Server running on one machine, and each instance has its

own databases. Follow these instructions to install a local SQL Server instance with just the features you'll need to follow along with this book as you learn T-SQL. The instructions here are not adequate for database administrators installing in a production environment.

1. After downloading the file, run it, and it will prompt you for the installation type (Figure 1-2). My advice is to choose Download Media because then the media will be available if you wish to install additional instances of SQL Server or add features.

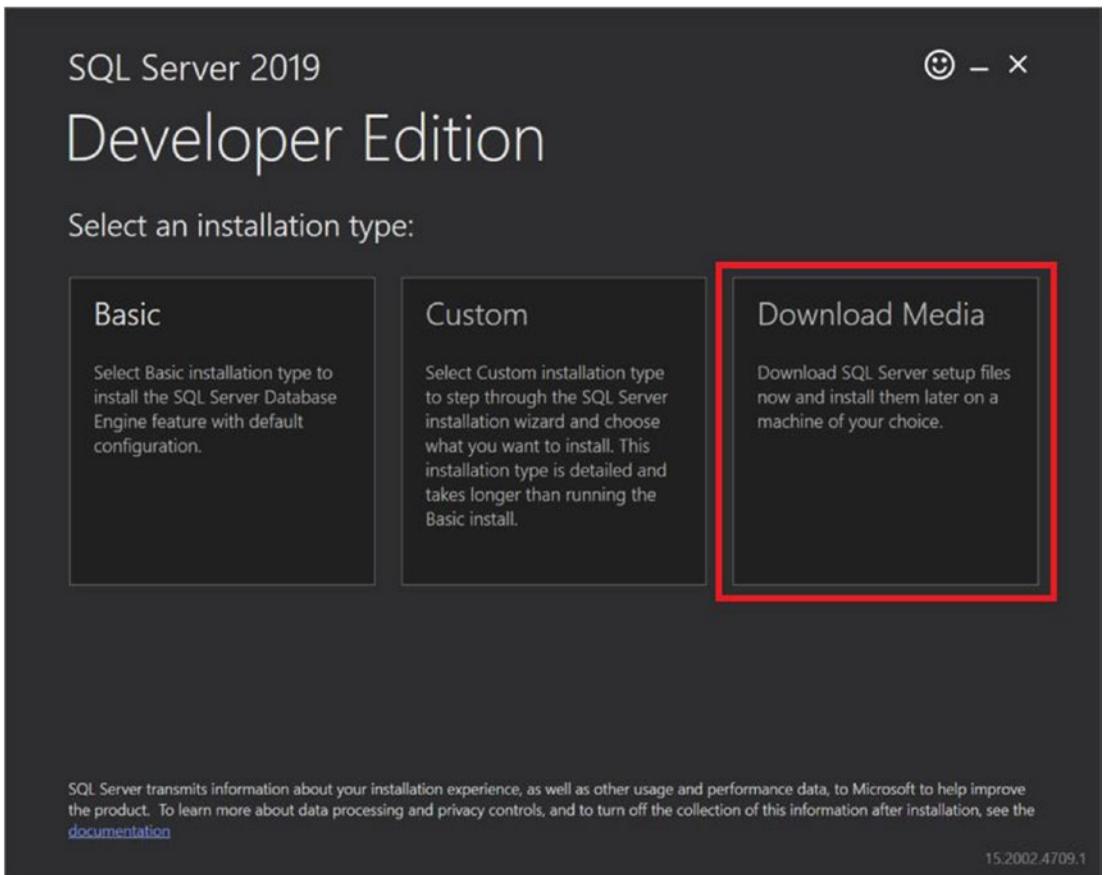


Figure 1-2. *Select an installation type*

2. The downloader will ask which type of file to download, ISO or CAB. The ISO file will look like a DVD to your computer, so that is what I recommend. Be sure to note the download location because that is needed in the next step. Figure 1-3 shows how this should look.

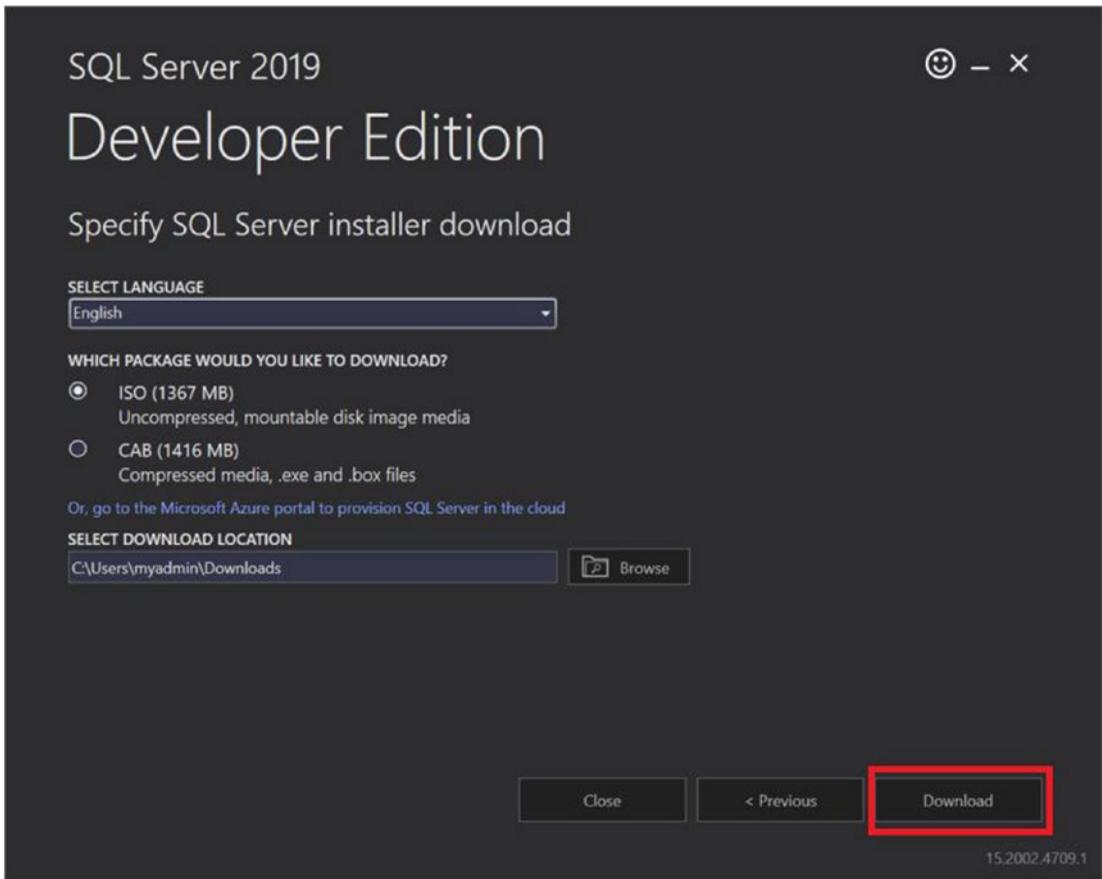


Figure 1-3. *The download properties*

3. Click Download. Once the download has completed, navigate to the folder by clicking the Open folder link shown in Figure 1-4.

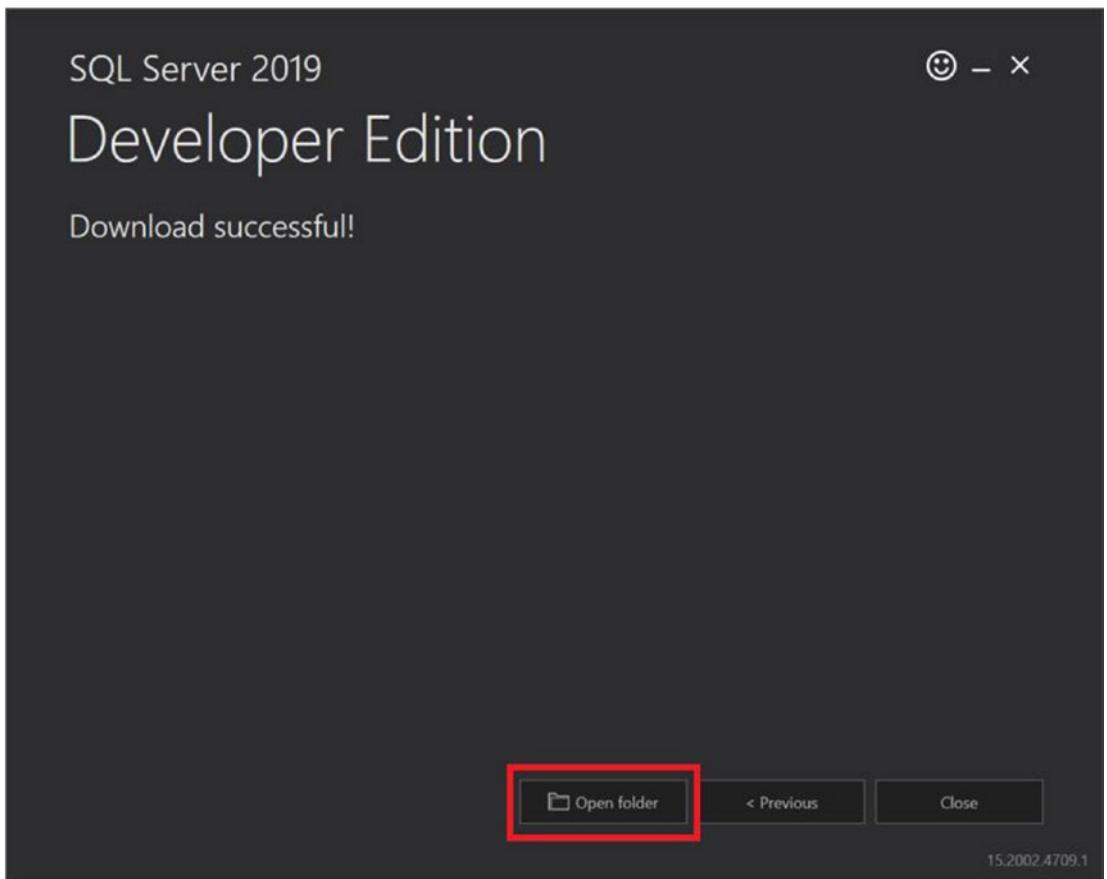


Figure 1-4. *The download is complete*

4. When the folder opens, look for `SQLServer2019-x64-ENU-Dev.ISO`. Double-click the file to navigate to the contents of the ISO shown in Figure 1-5. When teaching students over the years, I've seen situations where ISO utilities installed on their laptops required that the ISO file be mounted. If you get an error message at this point, right-click and select to mount the ISO file. Then try to double-click again.