



Relational Database Management System, DML

.NET CORE

*A software system used to maintain relational databases is a **Relational Database Management System (RDBMS)**. Many relational database systems use **Structured Query Language (SQL)** for querying and maintaining the database.*

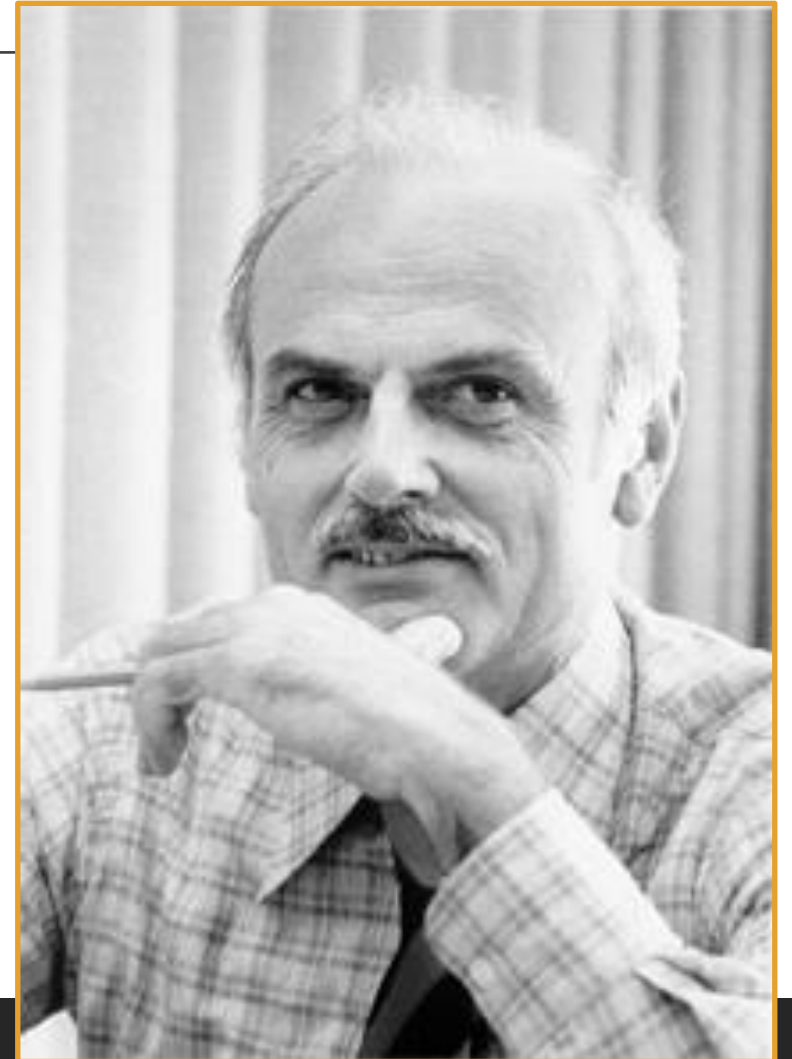
[HTTPS://DOCS.MICROSOFT.COM/EN-US/SQL/T-SQL/LANGUAGE-REFERENCE?VIEW=SQL-SERVER-VER15](https://docs.microsoft.com/en-us/sql/t-sql/language-reference?view=sql-server-ver15)

(RDBMS) Relational Database Management System – History

https://en.wikipedia.org/wiki/Relational_database

Relational databases are based on the relational model of data, as proposed by E. F. Codd in 1970.

Edgar Frank "Ted" Codd (August 23, 1923 – April 18, 2003) was a British computer scientist and winner of the 1981 Turing Award.



SQL (Structured Query Language)

<https://en.wikipedia.org/wiki/SQL>

SQL was originally based upon relational algebra and tuple relational calculus. SQL is a declarative language. We say what data we want, not how to get it. We cannot manage how SQL obtains the data.

The scope of SQL includes data query, data manipulation (insert, update and delete), data definition (schema creation and modification), and data access control.

SQL consists of two main types of statements:

- Data Definition Language (DDL)
- Data Manipulation Language (DML).

The diagram illustrates the components of an SQL statement. It lists three clauses: 'UPDATE clause', 'SET clause', and 'WHERE clause'. Each clause is followed by a set of curly braces containing a sample SQL snippet. The 'UPDATE clause' snippet is '{UPDATE country'. The 'SET clause' snippet is '{SET population = population + 1', with a bracket above 'population + 1' labeled 'expression'. The 'WHERE clause' snippet is '{WHERE name = 'USA';', with a bracket below 'name = 'USA'' labeled 'predicate'. A large right-facing curly brace on the far right groups all three clauses and their snippets under the label 'statement'.

UPDATE clause	{UPDATE country		} statement
SET clause	{SET population =	$\overbrace{\text{population} + 1}^{\text{expression}}$	
WHERE clause	{WHERE name =	$\underbrace{\text{'USA'}}_{\text{predicate}};$	

Microsoft and T-SQL

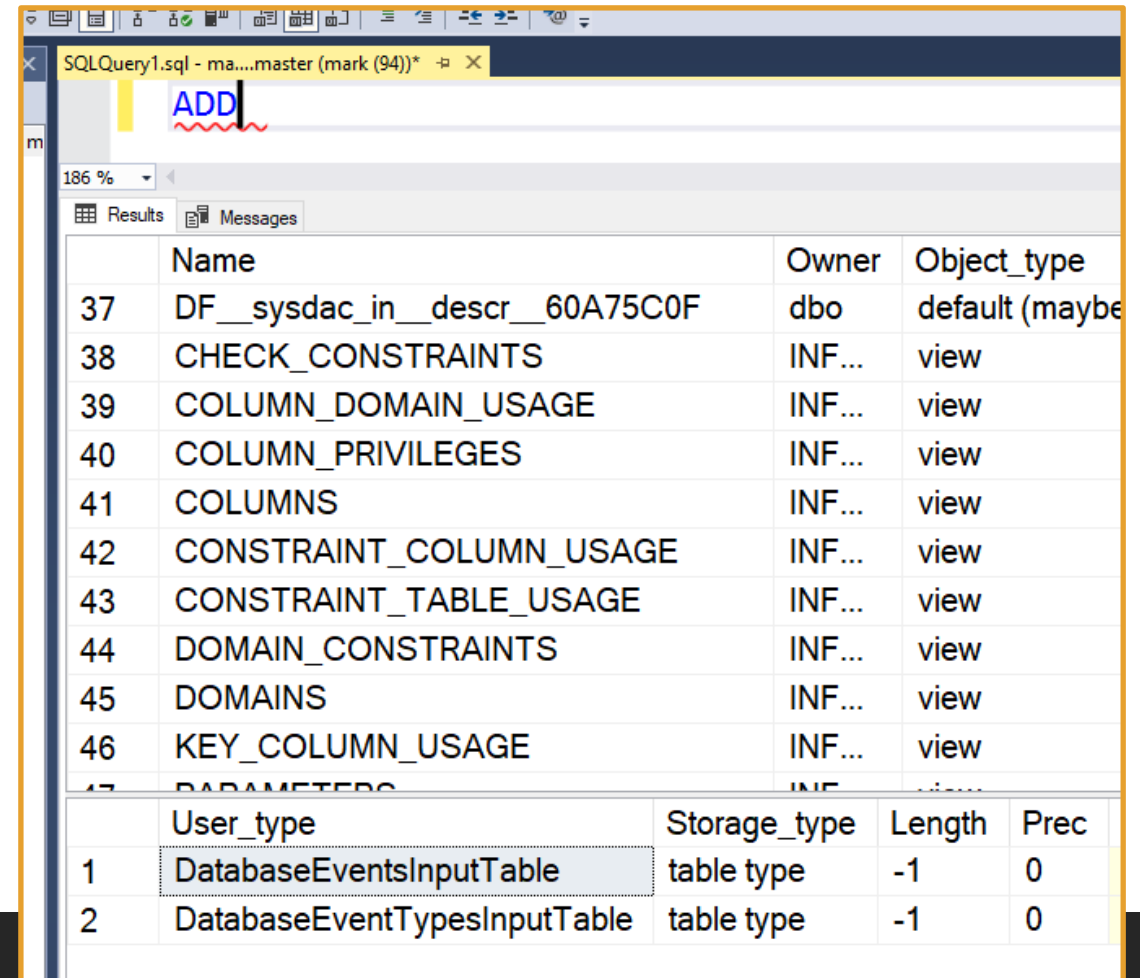
<https://docs.microsoft.com/en-us/sql/t-sql/language-reference?view=sql-server-ver15#tools-that-use-t-sql>

T-SQL is central to using Microsoft SQL products and services. All tools that communicate with a SQL database send T-SQL commands. SQL works on top of T-SQL.

Some of the Microsoft tools that issue T-SQL commands are:

- SQL Server Management Studio (SSMS)
- SQL Server Data Tools (SSDT)
- Azure Data Studio

*You can type a T-SQL keyword in the SSMS Query Editor window and press F1 to get data about any T-SQL Keyword.

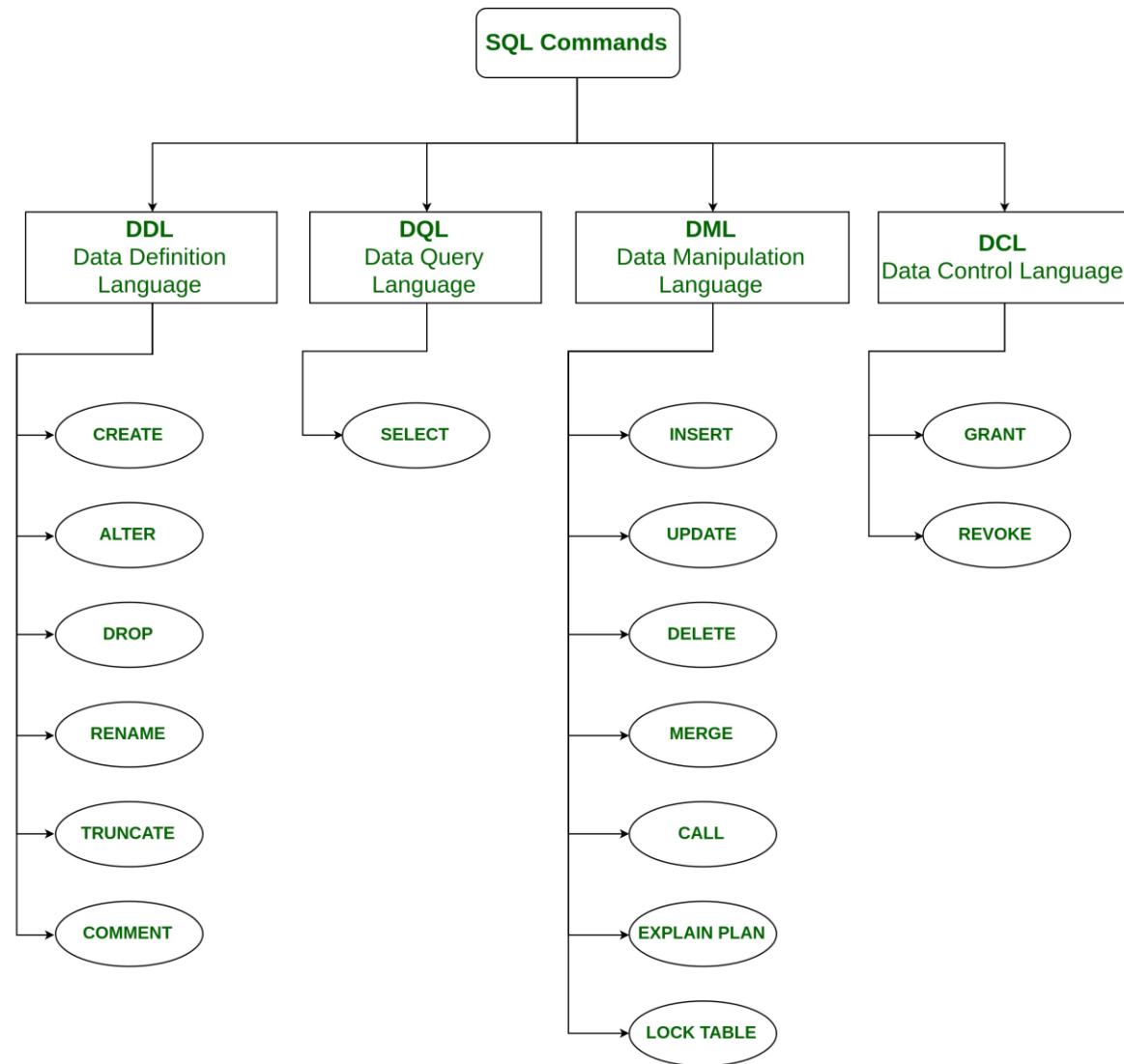


The screenshot shows the SQL Server Enterprise Edition interface. The top bar indicates the current query is 'SQLQuery1.sql - ma...master (mark (94))*'. The 'ADD' keyword is entered in the query editor, and a red wavy line indicates a search. The 'Results' tab is active, displaying a table of search results. The table has columns for 'Name', 'Owner', and 'Object_type'. The results list various system objects, including 'DF__sysdac_in__descr__60A75C0F', 'CHECK_CONSTRAINTS', 'COLUMN_DOMAIN_USAGE', 'COLUMN_PRIVILEGES', 'COLUMNS', 'CONSTRAINT_COLUMN_USAGE', 'CONSTRAINT_TABLE_USAGE', 'DOMAIN_CONSTRAINTS', 'DOMAINS', 'KEY_COLUMN_USAGE', and 'PARAMETERS'. The bottom of the table shows 'User_type', 'Storage_type', 'Length', and 'Prec' for the first two results: 'DatabaseEventsInputTable' and 'DatabaseEventTypesInputTable'.

	Name	Owner	Object_type
37	DF__sysdac_in__descr__60A75C0F	dbo	default (maybe)
38	CHECK_CONSTRAINTS	INF...	view
39	COLUMN_DOMAIN_USAGE	INF...	view
40	COLUMN_PRIVILEGES	INF...	view
41	COLUMNS	INF...	view
42	CONSTRAINT_COLUMN_USAGE	INF...	view
43	CONSTRAINT_TABLE_USAGE	INF...	view
44	DOMAIN_CONSTRAINTS	INF...	view
45	DOMAINS	INF...	view
46	KEY_COLUMN_USAGE	INF...	view
47	PARAMETERS	INF...	view

	User_type	Storage_type	Length	Prec
1	DatabaseEventsInputTable	table type	-1	0
2	DatabaseEventTypesInputTable	table type	-1	0

Types of SQL Commands



Data Manipulation Language

<https://docs.microsoft.com/en-us/sql/t-sql/statements/statements?view=sql-server-ver15#data-manipulation-language>

Data Manipulation Language (DML) is used to query a Database to retrieve and modify data from an SQL Database. Use *Data Manipulation Language* statements to *INSERT*, *UPDATE*, *DELETE*, *TRUNCATE*, and query the rows in the database.

[INSERT](#) – Adds one or more rows to a table or a view.

[DELETE](#) – Removes one or more rows from a table or view in SQL Server.

[UPDATE](#) – Changes existing data in a table.

[TRUNCATE](#) - Removes all rows from a table without deleting the table. Similar to the *DELETE* statement with no *WHERE* clause, but faster.

SQL - SELECT, FROM, WHERE

<https://docs.microsoft.com/en-us/sql/t-sql/queries/select-transact-sql?view=sql-server-ver15#logical-processing-order-of-the-select-statement>

The three most common keywords in SQL Queries are ***SELECT***, ***FROM***, and ***WHERE***.

- ***SELECT*** - Retrieves rows from the database
- ***FROM*** - Usually required on the ***SELECT*** statement. Specifies from which table(s) the results will come.
- ***WHERE*** - Specifies the search conditions for the rows returned by the query.

```
SELECT first_name, last_name FROM  
student_details  
WHERE id = 100;
```


SQL – UPDATE a table

<https://docs.microsoft.com/en-us/sql/t-sql/queries/update-transact-sql?view=sql-server-ver15>

<https://docs.microsoft.com/en-us/sql/t-sql/queries/update-transact-sql?view=sql-server-ver15#a-using-a-simple-update-statement>

UPDATE changes existing data in a table or view in SQL Server 2019. There are many variations to **UPDATE**.

```
--UPDATE table_name  
--SET column1 = value1, column2 = value2, ...  
--WHERE condition;  
UPDATE Employee  
SET TITLE = 'Tech Lead'  
Where FirstName = 'Nick';
```

```
USE AdventureWorks2012;  
GO
```

```
UPDATE Sales.SalesPerson  
SET Bonus = 6000, CommissionPct = .10, SalesQuota = NULL;  
GO
```

```
USE AdventureWorks2012;  
GO  
UPDATE Person.Address  
SET ModifiedDate = GETDATE();
```

UPDATE multiple rows simultaneously.

SQL – INSERT into a table

<https://docs.microsoft.com/en-us/sql/t-sql/statements/insert-transact-sql?view=sql-server-ver15#BasicSyntax>
<https://docs.microsoft.com/en-us/sql/t-sql/statements/insert-transact-sql?view=sql-server-ver15#BasicSyntax>

INSERT adds one or more rows to a table or a view in SQL Server.

```
--INSERT INTO table_name (column1, column2, column3, ...)
--VALUES (value1, value2, value3, ...);
SELECT * FROM Employee;

INSERT INTO Employee (LastName, EmployeeId, FirstName, Title)
VALUES ('Escalona', (SELECT MAX(EmployeeId) FROM Employee) + 1, 'Nick', 'Master');

SELECT * FROM Employee
WHERE EmployeeId = 102;
```

SQL – DELETE from a table

<https://docs.microsoft.com/en-us/sql/t-sql/statements/delete-transact-sql?view=sql-server-ver15>

<https://docs.microsoft.com/en-us/sql/t-sql/statements/delete-transact-sql?view=sql-server-ver15#BasicSyntax>

DELETE removes one or more rows from a table or view in SQL Server.

```
--DELETE FROM table_name WHERE condition;  
UPDATE Employee  
SET ReportsTo = 1  
Where EmployeeId = 102;  
  
DELETE FROM Employee  
WHERE FirstName LIKE 'N_C%' AND ReportsTo = 102;
```

SQL – Queries

https://www.ibm.com/support/knowledgecenter/SSGU8G_12.1.0/com.ibm.dbdk.doc/ids_dbdk_028.htm

SQL Queries have a specific syntax and structure.

1. Start the query with the **SELECT** keyword,
2. State the names of the columns you want in the result,
3. State **FROM** which table to get the data,
4. Followed by conditions.

This query returns the TerritoryID and Name columns from the Sales.SalesDirectory table and orders the result by TerritoryID. Default order is ascending.

```
SELECT TerritoryID, Name  
FROM Sales.SalesTerritory  
ORDER BY TerritoryID ;
```

SQL - Queries

Queries are used to insert, retrieve, modify, and delete data in a SQL Database.

```
SELECT TerritoryID, Name
FROM Sales.SalesTerritory
ORDER BY TerritoryID ;
```

```
SELECT e.BusinessEntityID, d.Name AS Department
FROM HumanResources.Employee AS e
CROSS JOIN HumanResources.Department AS d
ORDER BY e.BusinessEntityID, d.Name ;
```

```
SELECT DepartmentNumber,
       DepartmentName,
       ManagerID,
       ParentDepartmentNumber
FROM DEPARTMENT
FOR SYSTEM_TIME AS OF '2014-01-01'
WHERE ManagerID = 5;
```

Query Examples

This query SELECTs the EmployeeKey and LastName columns from the DimEmployee table, but only if the last name is “Smith”

```
SELECT EmployeeKey, LastName  
FROM DimEmployee  
WHERE LastName = 'Smith' ;
```

This query SELECTs all the columns from the Production.Product table and orders the result by the Name column in ascending order.

```
SELECT *  
FROM Production.Product  
ORDER BY Name ASC;
```


Query Examples – Aggregate Functions

This query returns the amount of items in the Quantity column from the table OrderDetails.

```
SELECT SUM(Quantity)  
FROM OrderDetails;
```

This query returns the average of all the numbers in the Price column from the Products table.

```
SELECT AVG(Price)  
FROM Products;
```

Query Examples – Aggregate Functions

This query returns the CustomerID and Country columns from the Customers table. It will GROUP all the like countries and tell how many customers from each country there are.

```
SELECT COUNT(CustomerID), Country  
FROM Customers  
GROUP BY Country;
```

This query returns the CustomerID and Country columns from the Customers table. It will GROUP all the like countries and tell how many customers from each country there are if the count total is over 5.

```
SELECT COUNT(CustomerID), Country  
FROM Customers  
GROUP BY Country  
HAVING COUNT(CustomerID) > 5;
```

DML Activity

- basic exercises in groups of 3 (Chinook database)
- 1. List all customers (full names, customer ID, and country) who are not in the US
- 2. List all customers from brazil
- 3. List all sales agents
- 4. Show a list of all countries in billing addresses on invoices.
- 5. How many invoices were there in 2009, and what was the sales total for that year?
- 6. How many line items were there for invoice #37?
- 7. How many invoices per country?
- 8. Show total sales per country, ordered by highest sales first.

Chinook DB Seeder Code

https://raw.githubusercontent.com/2002-feb24-net/trainer-code/master/2-sql/Chinook_SqlServer.sql

Above ^^^

Download and set up SQL Server Management Studio – <https://aka.ms/ssmsfullsetup>

SQL Server Express - <https://www.microsoft.com/en-us/download/details.aspx?id=55994>

Download & Install SQL Server Express

To download SQL Server Express, click on the following link:

<https://www.microsoft.com/en-us/download/details.aspx?id=42299>

Click the orange "Download" button

Select one of the following downloads depending on your computer:

32-bit: ExpressAndTools 32BIT\SQLEXPRWT_x86_ENU.exe

64-bit: ExpressAndTools 64BIT\SQLEXPRWT_x64_ENU.exe

Run the .exe file

Select New SQL Server stand-alone installation or add features to an existing installation (unless you already have SQL Server installed)

Follow through the installation wizard, you do not need to change any of the default settings.

Once your installation is complete, you can run SQL Server Management Studio in order to create databases!

DML Activity - Answers

```
SELECT * FROM Customer;
```

- 1. list all customers (full names, customer ID, and country) who are not in the US

```
SELECT CustomerId, FirstName, LastName, Country  
FROM Customer
```

```
WHERE Country != 'USA';
```

- 2. list all customers from brazil

- 3. list all sales agents

```
SELECT *  
FROM Employee
```

```
WHERE Title LIKE '%Sales%Agen?%';
```

- pattern matching with the LIKE operator

- % - 0 to many of any character

- [abc] - one of a, b, or c

- _ - one of any character

- 4. show a list of all countries in billing addresses on invoices.

```
SELECT DISTINCT BillingCountry
```

```
FROM Invoice;
```

```
ESC, BillingCountry;
```

- SELECT DISTINCT means, after you get all the result rows, remove duplicate rows (where ALL column values match)

- 5. how many invoices were there in 2009, and what was the sales total for that year? (extra challenge: find the invoice count sales total for every year, using one query)

```
SELECT SUM(Total) AS TotalAmount, COUNT(InvoiceId) AS  
InvoicesIn2009
```

```
FROM Invoice
```

```
WHERE InvoiceDate BETWEEN '2009-01-01' AND '2010-01-01';
```

```
WHERE YEAR(InvoiceDate) = 2009;
```

```
SELECT YEAR(InvoiceDate) AS Year, SUM(Total) AS  
TotalAmount, COUNT(InvoiceId) AS Invoices
```

```
FROM Invoice
```

```
GROUP BY YEAR(InvoiceDate);
```

- 6. how many line items were there for invoice #37?

- 7. how many invoices per country?

- 8. show total sales per country, ordered by highest sales first.

```
SELECT BillingCountry, SUM(Total)
```

```
FROM Invoice
```

```
GROUP BY BillingCountry
```

```
ORDER BY SUM(Total)
```