Relational Database Management System, DML

.NET

Software 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.

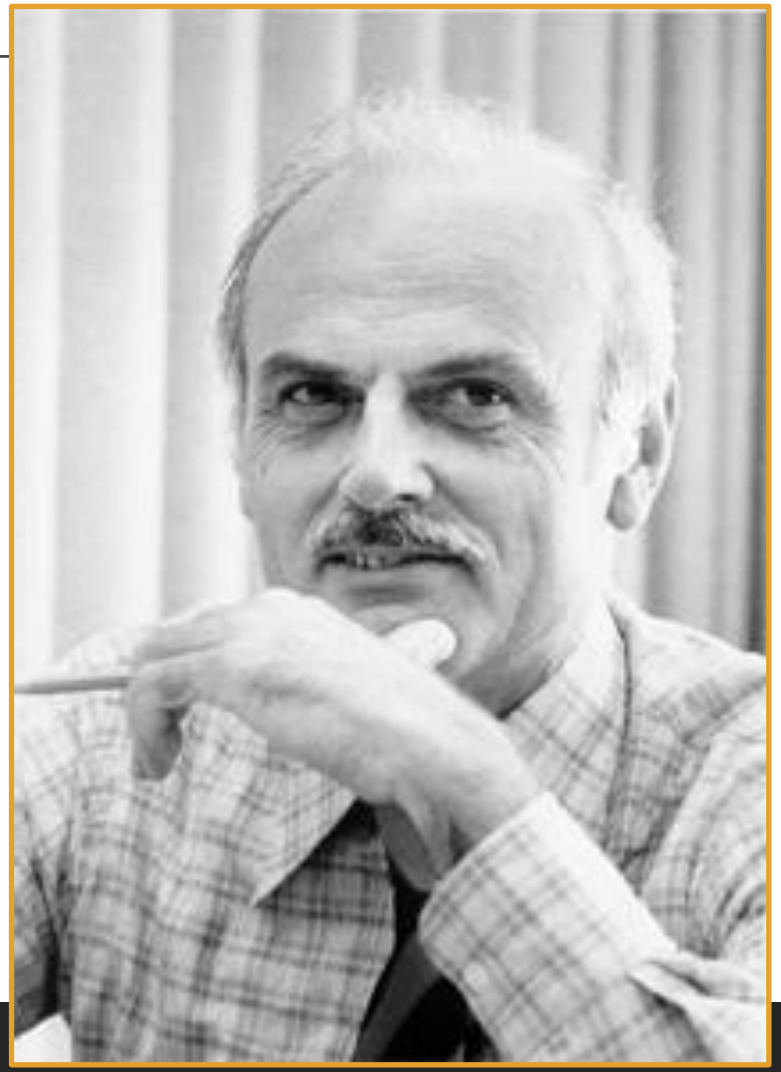
HTTPS://DOCS.MICROSOFT.COM/EN-US/SQL/T-SQL/LANGUAGE-REFERENCE?

(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.



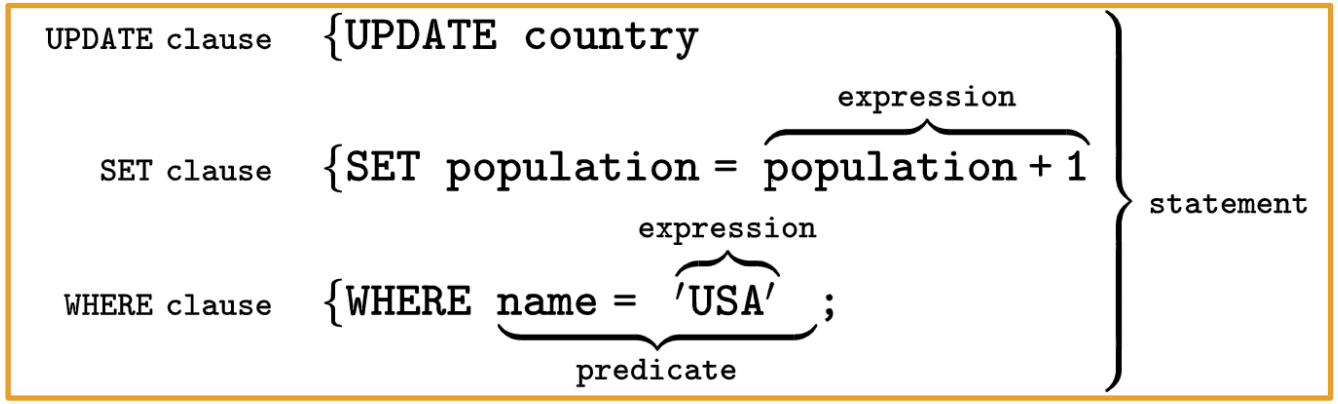
SQL (Structured Query Language)

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).



Microsoft and T-SQL

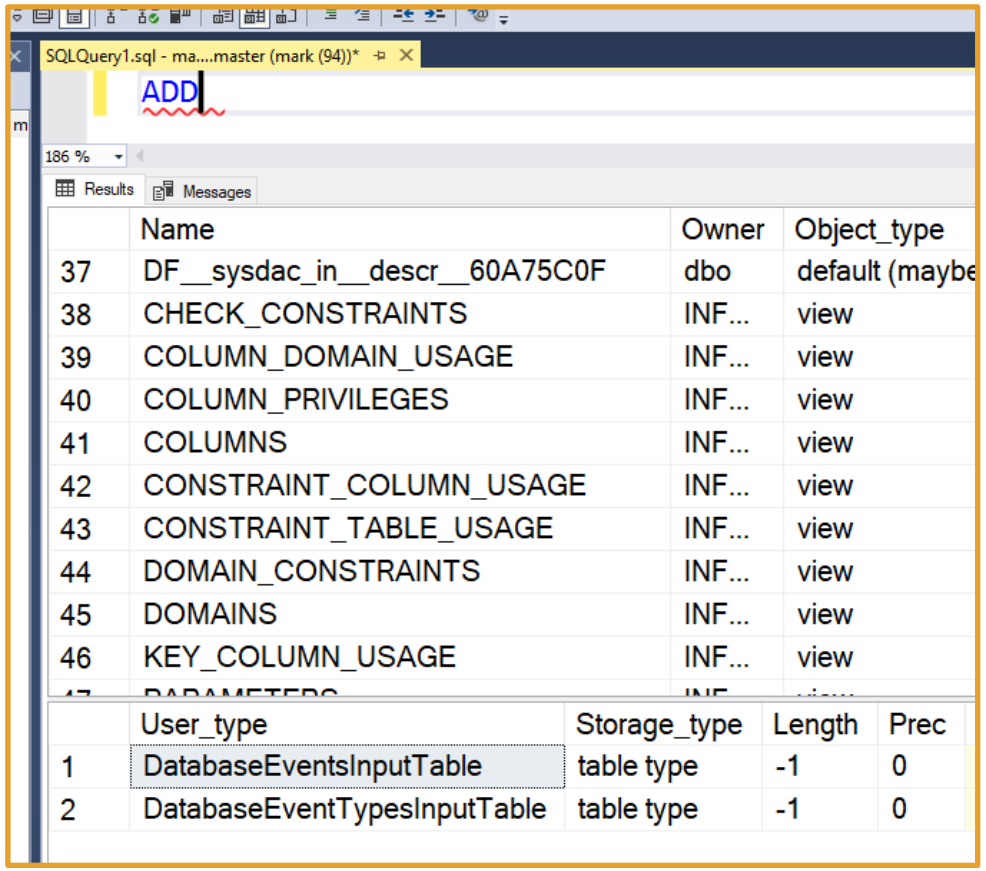
https://docs.microsoft.com/en-us/sql/t-sql/language-reference?view=sql-server-ver15#tools-that-use-t-sql

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

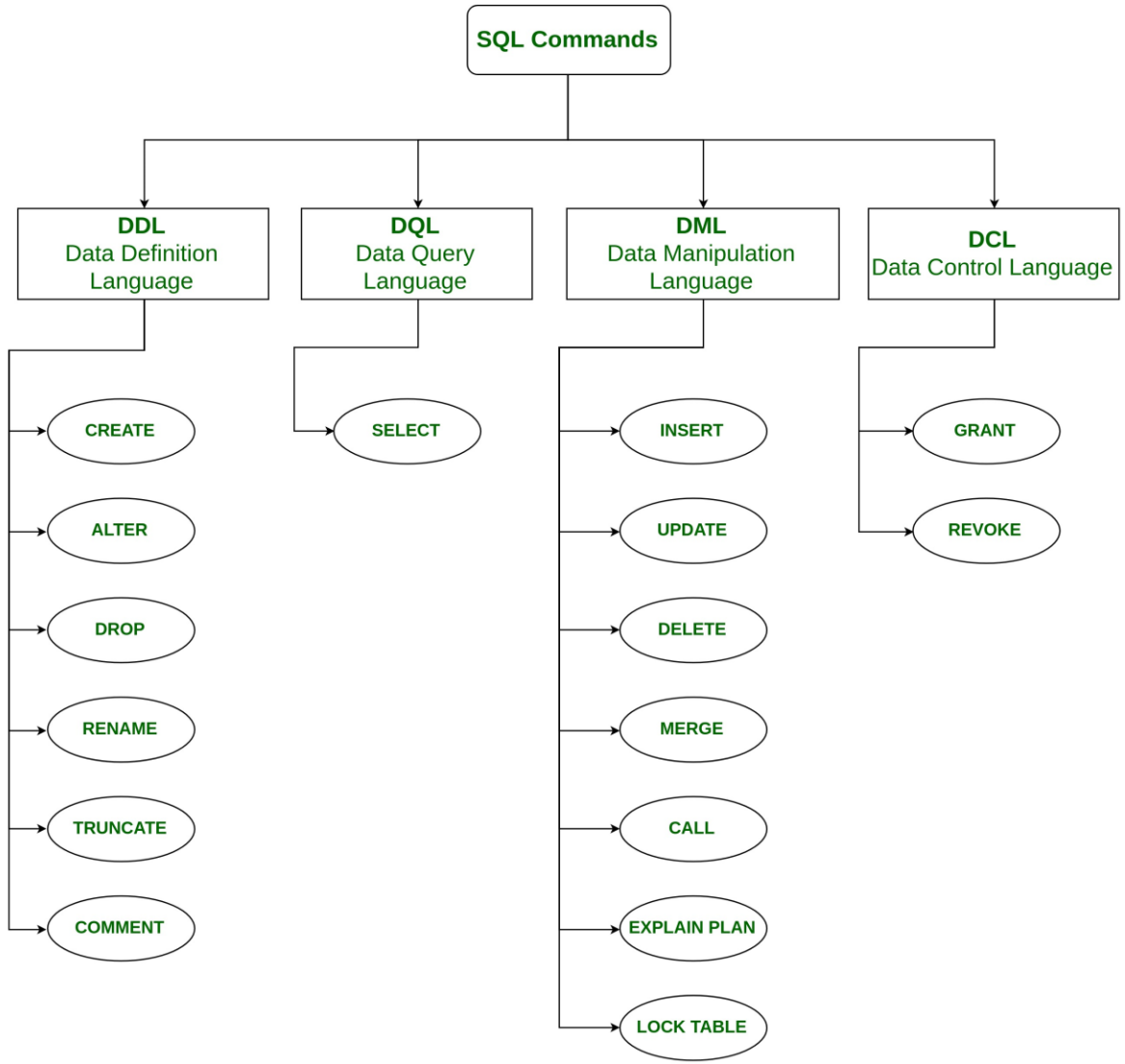
*You can type a T-SQL keyword in the SSMS Query Editor window and press F1 to get data about any T-SQL Keyword.



	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

	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 (DML)

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

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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 query the rows in the database and:

- 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

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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 – 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;
```

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. 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 Person.Address
SET ModifiedDate = GETDATE();
```

```
USE AdventureWorks2012;
GO
UPDATE Sales.SalesPerson
SET Bonus = 6000, CommissionPct = .10, SalesQuota = NULL;
GO
```

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

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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

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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;
```

ROW_NUMBER

https://docs.microsoft.com/en-us/sql/t-sql/functions/row-number-transact-sql?view=sql-server-ver15

- Assign a row number to every tuple. Then you can search based of the row number

```
SELECT
  ROW_NUMBER() OVER(ORDER BY name ASC) AS Row#,
  name, recovery_model_desc
FROM sys.databases
WHERE database_id < 5;
```

CASE Statements

https://www.w3schools.com/sql/sql_case.asp

```
SELECT OrderID, Quantity,
CASE
    WHEN Quantity > 30 THEN 'The quantity is greater than 30'
    WHEN Quantity = 30 THEN 'The quantity is 30'
    ELSE 'The quantity is under 30'
END AS QuantityText
FROM OrderDetails;
```

IN(), NOT IN()

Select * from Customers where name IN (‘Moore’, ‘Smith’, ‘Hunter’);

Between

- BETWEEN is inclusive of the two bounding values.

Select productid from orders where productid BETWEEN 5 and 10;

Select productid from orders where productName BETWEEN ‘B’ and ‘L’;

LIKE

- _ means a single char.
- % means any number of chars.

Select productName from orders where productName LIKE ‘Comp%’;

Select productPrice from orders where productPrice LIKE ‘3.%’;

Ordering Data

Select * from orders where productName LIKE ‘Comp%’ order by price ASC;

Select * from orders where productName LIKE ‘Comp%’ order by price DESC;

Distinct

- Select DISTINCT productName from orders
- where productName LIKE ‘Comp%’;

- Select DISTINCT productName, productId from orders
- where productName LIKE ‘Comp%’;

(this gives distinct productName but the productid can be the same.)

LIMIT and OFFSET

Select productName from orders where productName LIKE ‘Comp%’ LIMIT 5;

- Returns only the first 5.

Select productName from orders where productName LIKE ‘Comp%’ LIMIT 5 OFFSET 6;

- Returns 5 but starting with the… 7th …so… 7th, 8th, 9th, 10th, and 11th, etc.

Aliases

SELECT productName AS JimmyJohn FROM orders WHERE productName LIKE ‘Comp%’ LIMIT 5;

EXTRACT()

- Extract a subcomponent of a date value. Like the YEAR, MONTH, DAY, WEEK, QUARTER

EXTRACT(YEAR FROM <dateColumn>);

AGE()

Calculates and returns the current age of a given timestamp.

ROUND()

```
SELECT ROUND(rental_rate/replacement_cost,2) FROM film;
```

Math functions

```
SELECT * FROM film;

SELECT rental_rate/replacement_cost FROM film;

SELECT film_id*10 AS "multiplied!" FROM film;
```

String functions

https://www.postgresql.org/docs/current/functions-string.html

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You can concatenate columns or data to a string for custom output!

COALESCE()

SELECT item,(price – COALESCE(discount,0) AS final FROM tableName

COALESCE() replaces a null value with the given value. It is valuable when doing calculations on a column that might have null values.

CAST()

To cast one data type to another type.

```
SELECT CAST('5' AS INTEGER)

SELECT CAST(dateColumn AS TIMESTAMP)
```

You can cast an integer as a string to coundt how many digits it is.

```
SELECT CHAR_LENGTH(CAST(inventory_id AS VARCHAR)) FROM rental
```

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NULLIF()

NULLIF(arg1, arg2) takes 2 args and returns null if they are equal. Otherwise, returns the first arg.

NULLIF(1,2) returns 1.

NULLIF(2,2) returns null.

Chinook DB Seeder Code

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

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

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=101064

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.

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'; (also acceptable "Country NOT 'USA';")
2. list all customers from brazil
3. list all sales agents
SELECT * FROM Employee WHERE Title LIKE '%Sales%Agent%';
-- pattern matching with the LIKE operator
-- % - 0 to n number of any characters
-- [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;
-- also
SELECT BillingCountry FROM Invoice GROUP BY BillingCountry;
```

DML Activity - Answers

-- 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,

```
SELECT count(InvoiceDate) FROM Invoice;
```

6. What was the sales total for 2009?

(extra challenge: find the invoice count sales total for every year, using one query)

```
SELECT SUM(Total) AS TotalAmount, COUNT(InvoiceId) AS “Invoices in 2009” FROM Invoice
WHERE InvoiceDate BETWEEN '2009-01-01' AND '2010-01-01’; WHERE YEAR(InvoiceDate) = 2009;
--also
SELECT YEAR(InvoiceDate) AS Year, SUM(Total) AS TotalAmount, COUNT(InvoiceId) AS Invoices FROM Invoice
GROUP BY YEAR(InvoiceDate);
```

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

```
SELECT Count(Quantity) As TotalItems FROM InvoiceLine WHERE InvoiceId = ‘37’;
```

8. How many invoices per country?

```
SELECT BillingCountry, count(BillingCountry) as “Number of Orders” FROM dbo.Invoice GROUP BY BillingCountry
```

9. Show total sales per country, ordered by highest sales first.

```
SELECT BillingCountry, SUM(Total) FROM Invoice GROUP BY BillingCountry ORDER BY SUM(Total) DESC;
```