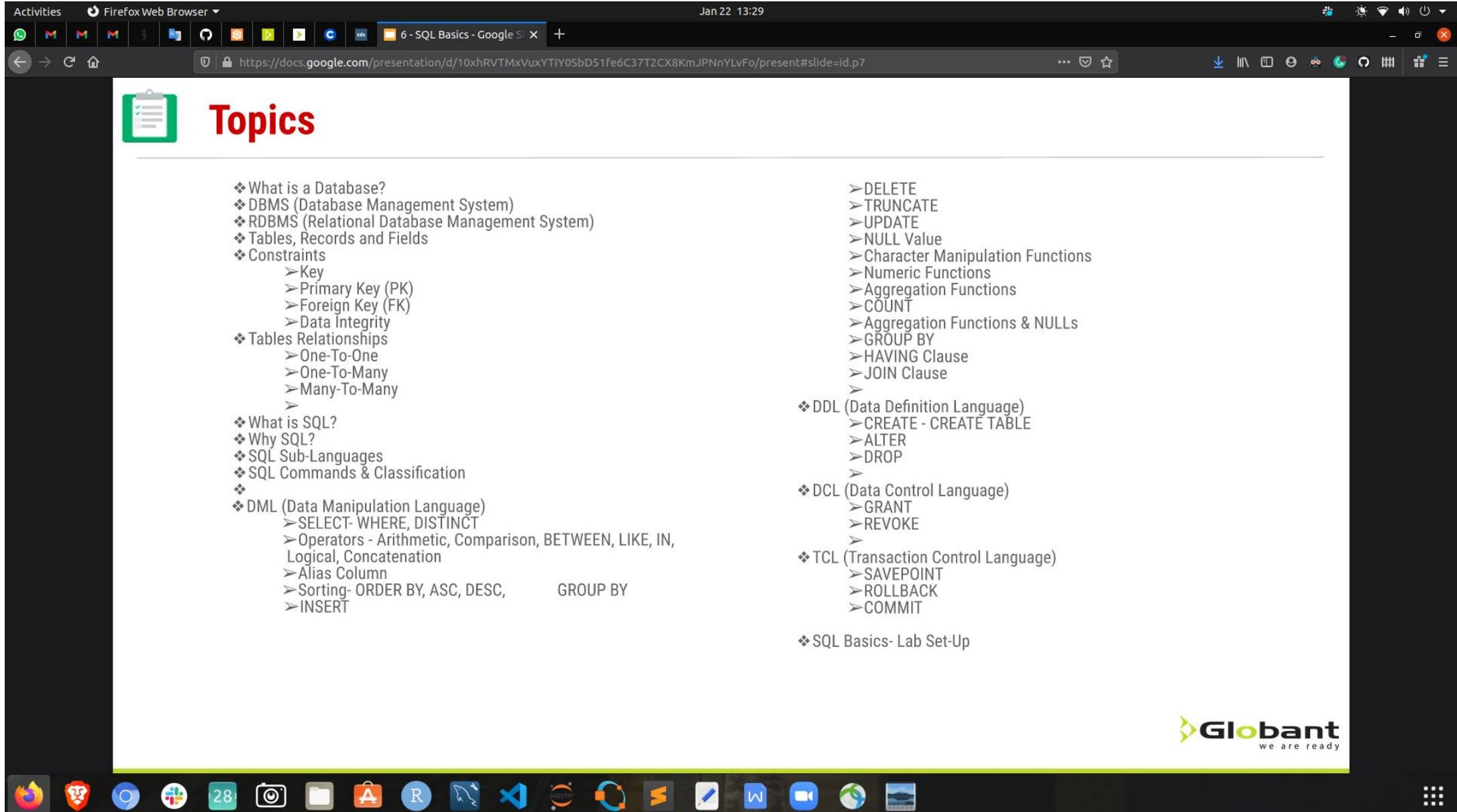




Topics

- ❖ What is a Database?
 - ❖ DBMS (Database Management System)
 - ❖ RDBMS (Relational Database Management System)
 - ❖ Tables, Records and Fields
 - ❖ Constraints
 - > Key
 - > Primary Key (PK)
 - > Foreign Key (FK)
 - > Data Integrity
 - ❖ Tables Relationships
 - > One-To-One
 - > One-To-Many
 - > Many-To-Many
 - >
 - ❖ What is SQL?
 - ❖ Why SQL?
 - ❖ SQL Sub-Languages
 - ❖ SQL Commands & Classification
 - ❖
 - ❖ DML (Data Manipulation Language)
 - > SELECT- WHERE, DISTINCT
 - > Operators - Arithmetic, Comparison, BETWEEN, LIKE, IN, Logical, Concatenation
 - > Alias Column
 - > Sorting- ORDER BY, ASC, DESC,
 - GROUP BY
 - > INSERT
 - > DELETE
 - > TRUNCATE
 - > UPDATE
 - > NULL Value
 - > Character Manipulation Functions
 - > Numeric Functions
 - > Aggregation Functions
 - > COUNT
 - > Aggregation Functions & NULLS
 - > GROUP BY
 - > HAVING Clause
 - > JOIN Clause
 - >
 - ❖ DDL (Data Definition Language)
 - > CREATE - CREATE TABLE
 - > ALTER
 - > DROP
 - >
 - ❖ DCL (Data Control Language)
 - > GRANT
 - > REVOKE
 - >
 - ❖ TCL (Transaction Control Language)
 - > SAVEPOINT
 - > ROLLBACK
 - > COMMIT
 - ❖ SQL Basics- Lab Set-Up



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What is a Database?

A **database** is an organized collection of data.

The data are typically organized to model aspects of reality in a way that supports processes requiring information.

For example, modeling the availability of rooms in hotels in a way that supports finding a hotel with vacancies.



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DBMS (Database Management System)

Database management systems (DBMSs) are computer software applications that interact with the user, other applications, and the database itself to capture and analyze data. A general-purpose DBMS is designed to allow the definition, creation, querying, update, and administration of databases.

Database management systems are often classified according to the database model that they support; the most popular database systems since the 1980s have all supported the relational model as represented by the SQL language. Sometimes a DBMS is loosely referred to as a "database".



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RDBMS (Relational Database Management System)

Unified set of information that will be shared by different users in the organization.

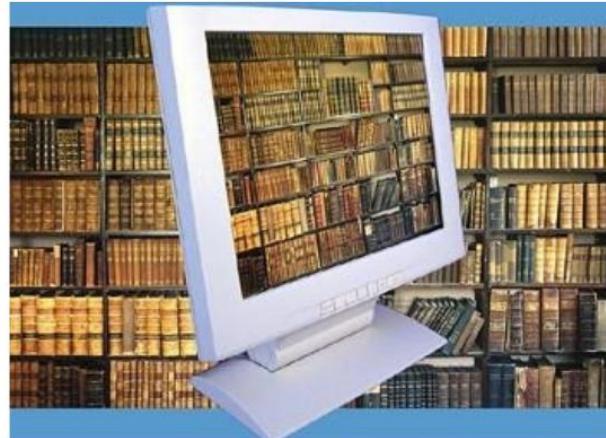
The basic function of a database is to enable information storage and retrieval allowing organization members to make decisions.

All support the standardized version of ANSI SQL.

Each model has extensions and proprietary tools.

They come from different vendors in commercial and free versions.

The most Common are: Oracle, IBM DB2, MS SQL Server, Sybase, MySQL, PostgreSQL.



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Tables, Records and Fields

Relational database is set of tables with defined relations between them

Each table has columns (fields) and rows (records)

Some fields are called primary and foreign keys and define relation

Columns have name and type (number, string, date, image, or other)

EMPLOYEE_ID	FIRST_NAME	LAST_NAME	SALARY	DEPARTMENT_ID
100	Steven	King	24000	80
101	Neenah	Kochhar	17000	50
102	Lex	De Haan	(null)	90
103	Hunold	Alexander	9000	60
104	Ernst	Bruce	6000	90

Columns

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Constraints



Is a condition that restricts the data that may be stored in a column.

Are defined using expressions that result in a Boolean value indicating whether the data satisfy the constraint or not.

Constraint can be user defined, for example, a column that accepts only integer values between 1 and 10.

If entered data do not meet any of the constraint the operation is interrupted with a 'constraint violation' error.

The constraint are used to verify the existence of a corresponding record to a FK in the referenced table.

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Constraints

Constraints are the rules enforced on data columns on a table. These are used to limit the type of data that can go into a table. This ensures the accuracy and reliability of the data in the database.

Constraints can either be column level or table level. Column level constraints are applied only to one column whereas, table level constraints are applied to the entire table.

Following are some of the most commonly used constraints:

- NOT NULL Constraint: Ensures that a column cannot have a NULL value.
- DEFAULT Constraint: Provides a default value for a column when none is specified.
- UNIQUE Constraint: Ensures that all the values in a column are different.
- PRIMARY Key: Uniquely identifies each row/record in a database table.
- FOREIGN Key: Uniquely identifies a row/record in any another database table.
- CHECK Constraint: The CHECK constraint ensures that all values in a column satisfy certain conditions.
- INDEX: Used to create and retrieve data from the database very quickly


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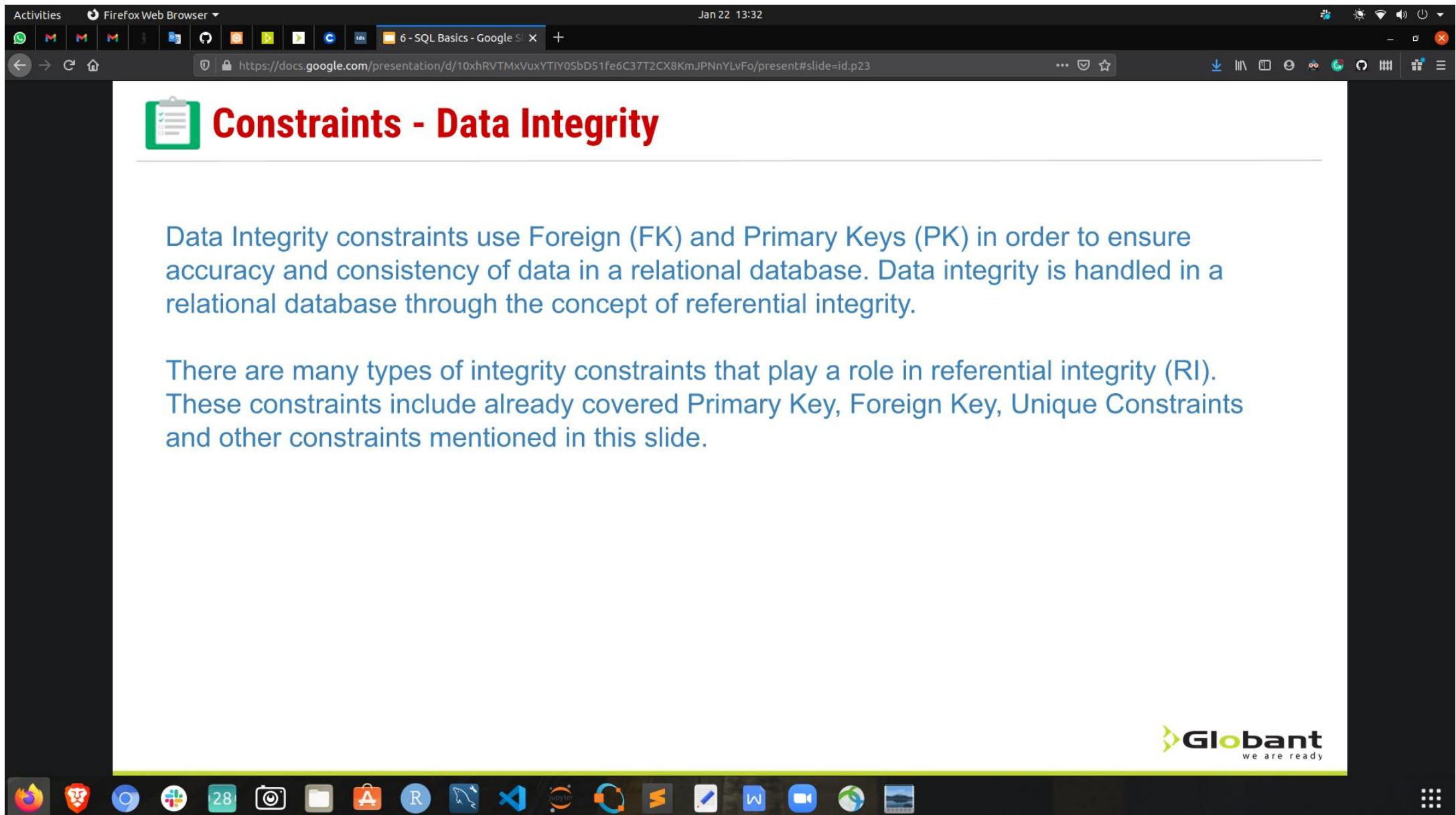
Constraints - Keys



Is one or more fields that holds data which identifies that record from all the other records in a table.

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Constraints - Primary Key (PK)

Primary key is a column of the table that uniquely identifies its rows (usually it is a number)

Two records (rows) are different if and only if their primary keys are different

It can not be null.

The primary key can be composed by several columns (composite primary key)

Id	First Name	Last Name	Employer
1	Svetlin	Nakov	Telerik
2	Stephen	Forte	Telerik
3	Steve	Jobs	Apple

Primary key

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Constraints - Foreign Key (FK)



The foreign key is an identifier of a record located in another table (usually its primary key)

Customer

FirstName	LastName	CustID
Elaine	Stevens	101
Mary	Dittman	102
Skip	Stevenson	103
Drew	Lakeman	104
Eva	Plummer	105

Parent Table Primary Key

Contact

CustID	ContactInformation	ContactType
101	555-2653	Work
101	555-0057	Cell
102	555-8816	Work
104	555-0949	Work
103	555-0650	Work
101	555-8855	Home
105	Plummer@akcomms.com	Email
101	Stevens@akcomms.com	Email
101	555-5787	Fax
103	Stevenson@akcomms.com	Email
105	555-5675	Work
102	Dittman@akcomms.com	Email

One to Many Relationship
Foreign Key Child Table

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Table Relationships

By using constraints we create relationships in which we avoid repeating data in the database

Relationships have multiplicity:

- One-to-one – e.g. human/student
- One-to-many – e.g. country / towns
- Many-to-many – e.g. student / course

```
graph LR; H[HUMAN] -- "One-to-One" --> S[STUDENT]; C[COUNTRY] -- "One-to-Many" --> T[TOWNS]; S -- "Many-to-Many" --> CO[COURSES]
```

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Table Relationships - One-To-One

Relationship one-to-one

- A single record in a table corresponds to a single record in the other table
- Used to model inheritance between tables

Primary key

Primary & foreign key in the same time

Persons

Id	Name	Age
1	Ivan Daddy	72
2	Goiko Dude	26
3	Grand Mara	24

Professors

Id	Title
1	Ph.D.

Students

Id	Specialty
2	Computer Science
3	Chemistry

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Table Relationships - One-To-Many

Relationship one-to-many

- A single record in the first table has many corresponding records in the second table
- Used very often

Towns

Id	Name	CountryId
1	Sofia	1
2	Plovdiv	1
3	Munich	2
4	Berlin	2
5	Moscow	3

Countries

Id	Name
1	Bulgaria
2	Germany
3	Russia

```
graph LR; T1[1] --> C1[1]; T1[1] --> C2[2]; T2[2] --> C1[1]; T3[3] --> C3[3]; T4[4] --> C2[2]; T5[5] --> C3[3];
```

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Table Relationships - Many-To-Many

Relationship many-to-many

- Records in the first table have many corresponding records in the second one and vice versa
- Implemented through additional table

Students

Id	Name
1	Pesho
2	Minka
3	Gosho
4	Penka

StudentsCourses

StudentId	CourseId
1	1
1	2
3	2
3	3
4	2

Courses

Id	Name
1	.NET
2	Java
3	PHP

The diagram illustrates a many-to-many relationship between three tables: Students, StudentsCourses, and Courses. The Students table has four rows: Pesho, Minka, Gosho, and Penka. The Courses table has three rows: .NET, Java, and PHP. The StudentsCourses table acts as a junction table, containing eight rows that map students to courses. Arrows point from each student in the Students table to their corresponding entries in the StudentsCourses table, and another set of arrows points from the StudentsCourses table to the Courses table, showing the many-to-many mapping.

Students

Id	Name
1	Pesho
2	Minka
3	Gosho
4	Penka

StudentsCourses

StudentId	CourseId
1	1
1	2
3	2
3	3
4	2

Courses

Id	Name
1	.NET
2	Java
3	PHP

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What is SQL?

SQL is a database computer language designed for the retrieval and management of data in relational database. SQL stands for Structured Query Language.

SQL is the standard language for Relation Database System. All relational database management systems like MySQL, MS Access, Oracle, Sybase, Informix, postgres and SQL Server use SQL as standard database language.

Also, they are using different dialects, such as:

- MS SQL Server using T-SQL,
- Oracle using PL/SQL,
- MS Access version of SQL is called JET SQL (native format) etc.

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Why SQL?

Allows users to access data in relational database management systems.

Allows users to describe the data.

Allows users to define the data in database and manipulate that data.

Allows to embed within other languages using SQL modules, libraries & pre-compilers.

Allows users to create and drop databases and tables.

Allows users to create view, stored procedure, functions in a database.

Allows users to set permissions on tables, procedures, and views

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SQL Sub-Languages

```
graph TD; SQL[SQL Commands] --> DDL[DDL]; SQL --> DML[DML]; SQL --> DCL[DCL]; SQL --> TCL[TCL]; DDL --> Create[Create]; DDL --> Alter[Alter]; DDL --> Truncate[Truncate]; DDL --> Drop[Drop]; DDL --> Describe[Describe]; DDL --> Rename[Rename]; DML --> Insert[Insert]; DML --> Update[Update]; DML --> Delete[Delete]; DML --> Select[Select]; DCL --> Grant[Grant]; DCL --> Revoke[Revoke]; TCL --> Savepoint[Savepoint]; TCL --> Rollback[Rollback]; TCL --> Commit[Commit]
```

DDL – Data Definition Language: Provides commands to define tables, delete tables, create indexes and modify tables.

DML – Data Manipulation Language: Allows for changes to data via insert, updates, deletion and select commands.

DCL - Data Control Language:
Provides permission relates commands such as grant and revoke.

TCL - Transaction Control Language:
Used to manage transactions in database.

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SQL Commands & Classification

The standard SQL commands to interact with relational databases are CREATE, SELECT, INSERT, UPDATE, DELETE and DROP. These commands can be classified into groups based on their nature:

DDL - Data Definition Language:

CREATE - Creates a new table, a view of a table, or other object in database.

ALTER - Modifies an existing database object, such as a table.

DROP - Deletes an entire table, a view of a table or other object in the database.

DML - Data Manipulation Language:

SELECT - Retrieves certain records from one or more tables.

INSERT - Creates a record.

UPDATE - Modifies records.

DELETE - Deletes records.

DCL - Data Control Language:

GRANT - Gives a privilege to user.

REVOKE - Takes back privileges granted from user.

TCL - Transaction Control Language:

SAVEPOINT - Used to temporarily save a transaction so you can later rollback to that point.

ROLLBACK - Restores the database to last committed state.

COMMIT - Permanently saves any transaction into database.



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DML (Data Manipulation Language)

Allows access to the information contained in the database for querying and updating, through its four verbs of manipulation.

Select	Insert	Update	Delete

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DML (Data Manipulation Language) - SELECT



Projection

Choosing set of columns

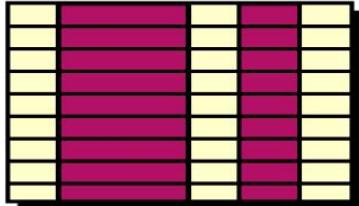


Table 1

Filtering

Choosing set of rows

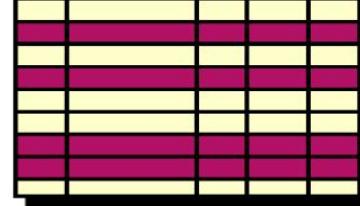


Table 1

Joining

Combining data from two or more tables

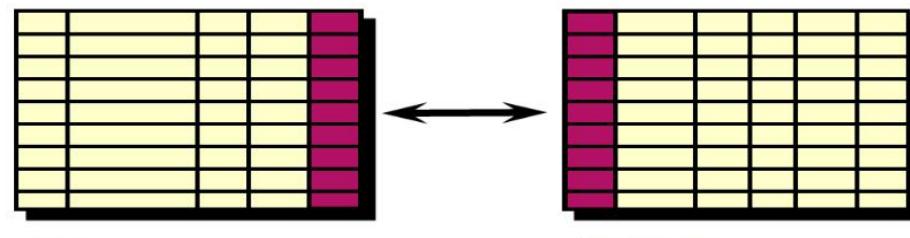
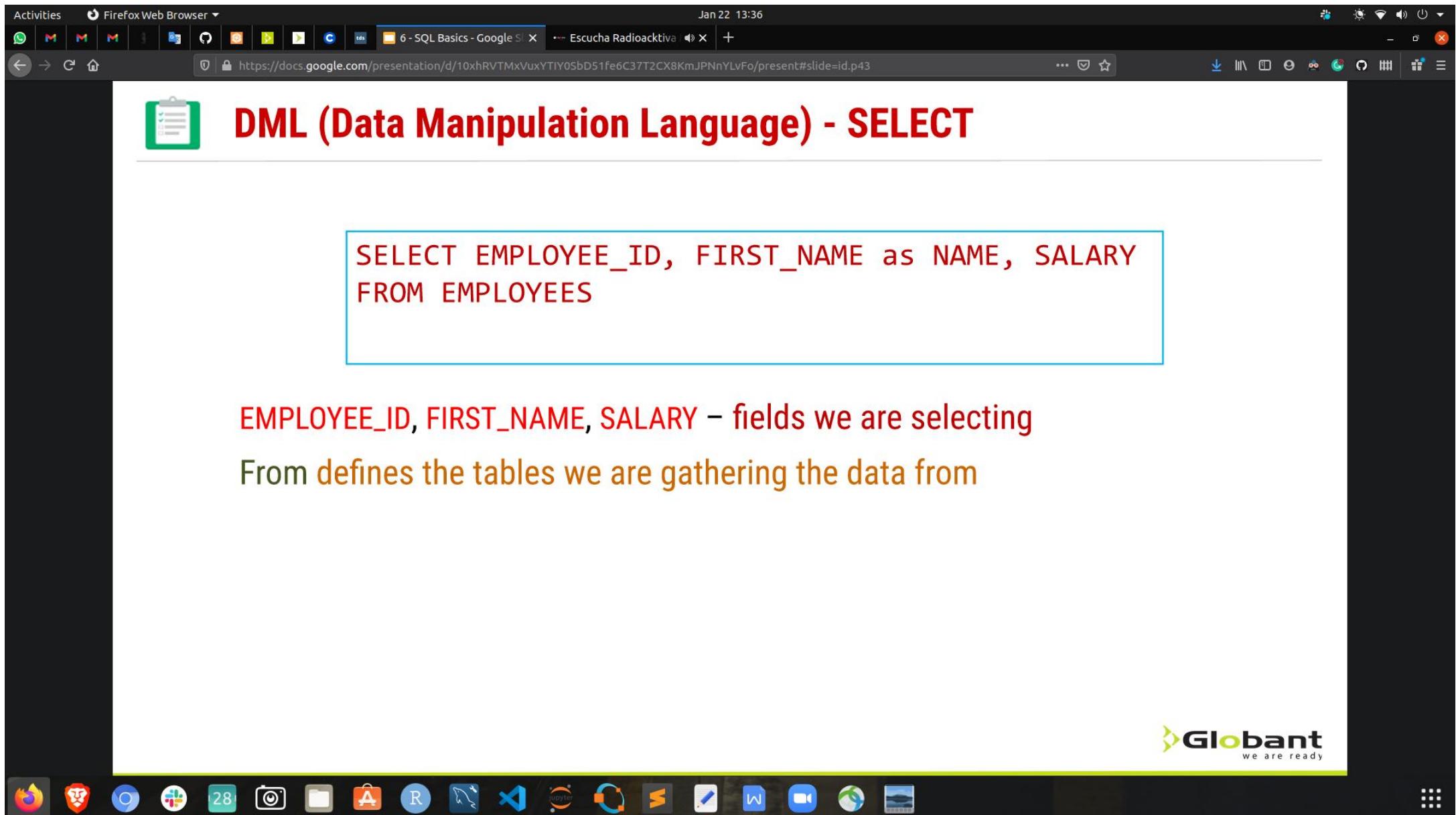


Table 1

Table 2

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DML (Data Manipulation Language) - SELECT

Instead of list of fields to select * can be used to specify all fields

EMPL_ID	FIRST_NAME	LAST_NAME	SALARY
10	Larry	King	900
20	John	Kochhar	800
30	Papa	De Haan	850
50	Mimi	Tochkova	1200

`SELECT * FROM EMPLOYEES`

Is similar to query:

`SELECT EMPLOYEE_ID, FIRST_NAME, LAST_NAME,
salary FROM EMPLOYEES`

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DML (Data Manipulation Language) - WHERE

Where: `SELECT * FROM <table_name> WHERE <column_name> = <value>;`

The WHERE clause is used to specify that only certain rows of the table need to be displayed.



A circular callout points from the text below to the children holding presents.

`SELECT * FROM PRESENTS WHERE CONTENTS ARE Toys or Chocolates`

WHERE clause is used with relational operators such as greater than, less than or equal to. Learn more about these relational operators.

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DML (Data Manipulation Language) - WHERE

To select from the employees table all employees with salary less than 1000:

```
SELECT FIRST_NAME, LAST_NAME, SALARY  
FROM EMPLOYEES  
WHERE SALARY < 1000
```

Produces result:

LAST_NAME	FIRST_NAME	SALARY
King	Larry	900
Kochhar	John	800
De Haan	Papa	850

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DML (Data Manipulation Language) - Distinct

The default display of queries is all rows, including duplicate rows

```
SELECT DepartmentID  
FROM Employees
```

DepartmentID

DepartmentID
7
7
2
...

Eliminate duplicate rows by using the DISTINCT keyword in the SELECT clause

```
SELECT  
    DISTINCT DepartmentID  
FROM Employees
```

DepartmentID

DepartmentID
7
2
...

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DML (Data Manipulation Language) - Arithmetic Operators

Example using in select query:

```
SELECT LAST_NAME, SALARY, SALARY + 300,  
2*(SALARY + 300) AS BIG_SALARY  
FROM EMPLOYEES WHERE SALARY < 1000
```

LAST_NAME	SALARY	SALARY + 300	BIG_SALARY
King	900	1200	2400
Kochhar	800	1100	2200
De Haan	850	1150	2300

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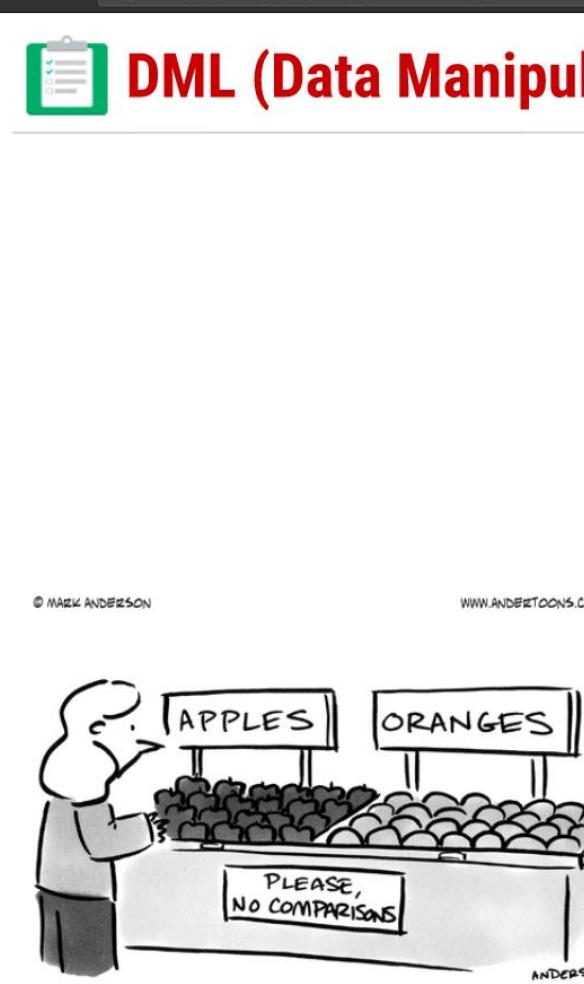
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DML (Data Manipulation Language) - Comparison Operators



< (o <=)	Less (Less than or equal to)
> (o >=)	Greater (Greater than or equal to)
<> o !=	Not equal
=	equal
BETWEEN	Check whether a value is within a range of values
LIKE	Used for comparing a model
IN	Check whether a value is within a set of values

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DML (Data Manipulation Language) - BETWEEN Operators

You can display rows based on a range of values using the **BETWEEN** range condition. The range that you specify contains a lower limit and an upper limit.

Values specified with the **BETWEEN** condition are inclusive. You must specify the lower limit first.



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DML (Data Manipulation Language) - BETWEEN Operators

It is used to check if a certain value is within a given range.

```
SELECT Materia, Carrera FROM 'main'.'Materias' WHERE CantidadAlumnos >= 15 AND CantidadAlumnos <= 25;
```

Using a BETWEEN operator!

```
SELECT Materia, Carrera FROM 'main'.'Materias' WHERE CantidadAlumnos BETWEEN 15 AND 25;
```

The SELECT statement on the slide returns rows from the Employees table for any employee whose base rate is between 40 and 50.

```
SELECT LastName, Salary FROM Employees WHERE Salary BETWEEN 20000 AND 22000
```

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DML (Data Manipulation Language) - LIKE Operators

You may not always know the exact value to search for.

You can select rows that match a character pattern by using the **LIKE** condition.

The character pattern-matching operation is referred to as a *wildcard* search.

Two symbols can be used to construct the search string.

Search conditions can contain either literal characters or numbers:

- % denotes zero or many characters.
- _ denotes one character.

```
SELECT FirstName FROM Employees  
WHERE FirstName LIKE 'S%'
```

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DML (Data Manipulation Language) - IN Operator



It is used to make comparisons with a list of values.

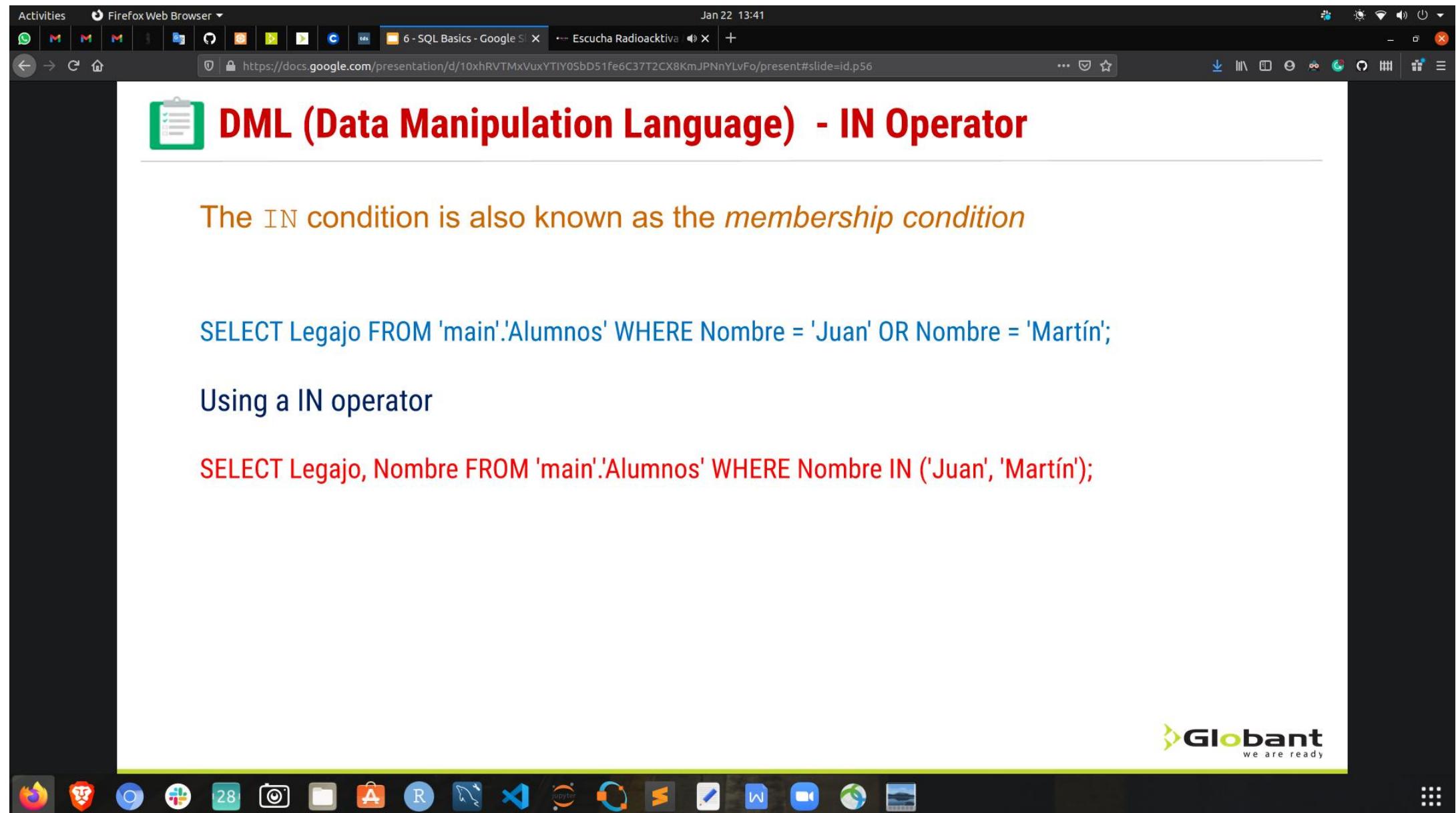
Check if the condition satisfies any of the values are in parentheses.

Using **IN / NOT IN** to specify a set of values

```
SELECT FirstName, LastName, ManagerID FROM Employees  
WHERE ManagerID IN (109, 3, 16)
```

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DML (Data Manipulation Language) - Logical Operators

AND	Evaluates two conditions and returns true only if both are true.
OR	Evaluates two conditions and returns true if at least one of them are true.
NOT	Returns the contrary value of the expression.



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DML (Data Manipulation Language) - Logical Operators

Using NOT, OR and AND operators and brackets:

```
SELECT FirstName, LastName FROM Employees  
WHERE Salary >= 20000 AND LastName LIKE 'C%'
```

```
SELECT LastName FROM Employees  
WHERE ManagerID IS NOT NULL OR LastName LIKE '%so_'
```

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DML (Data Manipulation Language) - Logical Operators

Using NOT, OR and AND operators and brackets:

```
SELECT LastName FROM Employees  
WHERE NOT (ManagerID = 3 OR ManagerID = 4)
```

```
SELECT FirstName, LastName FROM Employees  
WHERE  
    (ManagerID = 3 OR ManagerID = 4) AND  
    (Salary >= 20000 OR ManagerID IS NULL)
```

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DML (Data Manipulation Language) - Concatenation Operator

Concatenates columns or character strings to other columns
Is represented by sign “||”
Creates a resultant column that is a character expression

```
SELECT FirstName || ' ' || LastName AS [Full Name],  
EmployeeID as [No.] FROM Employees
```

Full Name	No.
Guy Gilbert	1
Kevin Brown	2
Federico Green	3

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DML (Data Manipulation Language) - Alias Column

When displaying the result of a query, *SQL Query Analyzer* normally uses the name of the selected column as the column heading.

For calculations the value usually is “(No column name)”. This heading is not descriptive and hence may be difficult to understand. You can change a column heading by using a column alias.

Specify the alias after the column in the SELECT list using a space as a separator. If the alias contains spaces or special characters (such as # or \$), enclose the alias in double quotation marks ("").



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DML (Data Manipulation Language) - Alias Column

Aliases rename a column heading

Useful with calculations

Immediately follows the column name

There is an optional AS keyword

```
SELECT FirstName, LastName, Salary,  
Salary*0.2 AS Bonus FROM Employees
```

FirstName	LastName	Salary	Bonus
Guy	Gilbert	12500,00	2500
Kevin	Brown	13500,00	2700

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DML (Data Manipulation Language) - SORTING



The **order of rows** returned in a query result is undefined.

The **ORDER BY clause** can be used to sort the rows. If you use the ORDER BY clause, it must be the last clause of the SQL statement.

You can specify an expression, or an alias, or column position as the sort condition.

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DML (Data Manipulation Language) - SORTING

Sort rows with the ORDER BY clause

ASC: ascending order, default

DESC: descending order

```
SELECT LastName, HireDate  
FROM Employees ORDER BY  
HireDate
```

```
SELECT LastName, HireDate  
FROM Employees ORDER BY  
HireDate DESC
```

LastName	HireDate
Gilbert	1998-07-31
Brown	1999-02-26
Green	1999-12-12

LastName	HireDate
Green	1999-12-12
Brown	1999-02-26
Gilbert	1998-07-31

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DML (Data Manipulation Language) - INSERT



The insert query has multiple forms
Insert into <table> values (<values>)

```
INSERT INTO COUNTRIES
VALUES ('BG', 'Bulgaria', '1')

INSERT INTO COUNTRIES
(COUNTRY_ID,COUNTRY_NAME,REGION_ID)
VALUES ('BG', 'Bulgaria', '1')
```

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DML (Data Manipulation Language) - INSERT

`INSERT INTO Alumnos ('Legajo', 'Nombre', 'Apellido', 'Añolngreso', 'Carrera') VALUES (1334, 'Natalia', 'Fernández', 2003, 'Electrónica');`

If column names are not listed in an INSERT statement, the VALUES clause must contain values for all columns in the same order in which the columns are listed in the table.

`INSERT INTO Alumnos VALUES (1334, 'Natalia', 'Fernández', 2003, 'Electrónica');`
The rest of the values of the remaining fields inserted with null values.

Legajo	Nombre	Apellido	Añolngreso	Carrera
1334	Natalia	Fernández	2003	Electrónica

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DML (Data Manipulation Language) - DELETE

The delete query deletes single or multiple rows from a table

Syntax is

```
delete from <table> where <condition>
```



```
DELETE FROM EMPLOYEES WHERE EMPLOYEE_ID = 1  
DELETE FROM EMPLOYEES WHERE FIRST_NAME LIKE  
'S%'
```

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DML (Data Manipulation Language) - DELETE

DELETE FROM 'main'.'Alumnos' WHERE Legajo = 1334;

In the DELETE command, the condition is optional, if not specified, all rows are deleted. Otherwise, only the rows that satisfy the condition will be deleted.

Legajo	Nombre	Apellido	AñoIngreso	Carrera
1334	Natalia	Fernández	2003	Electrónica
1333	Gabriela	Panizzi	2001	Sistemas
7555	Jimena	Mesa	2002	Química

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DML (Data Manipulation Language) - TRUNCATE

The `truncate` query empties table



```
TRUNCATE TABLE EMPLOYEES
```

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DML (Data Manipulation Language) - UPDATE

The update query modifies single or multiple rows in a table

The syntax is

```
update <table> set  
<column>=<value>, ...  
where <condition>
```



```
UPDATE EMPLOYEES SET  
    FIRST_NAME = 'Updated Name',  
    DEPARTMENT_ID = 90  
WHERE EMPLOYEE_ID = 100
```

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DML (Data Manipulation Language) - UPDATE

UPDATE 'main'.'Students' SET 'LastName' = 'Pampa' WHERE 'ID' = 3862;

Modified the Student with PK 'ID' = 3862 updated field LastName' with 'Pampa' value.



ID	Name	LastName	Year	Course
3862	María	Pampa	2003	Electronics

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NULL Value

A **NULL** is a value that is unavailable, unassigned, unknown, or inappropriate

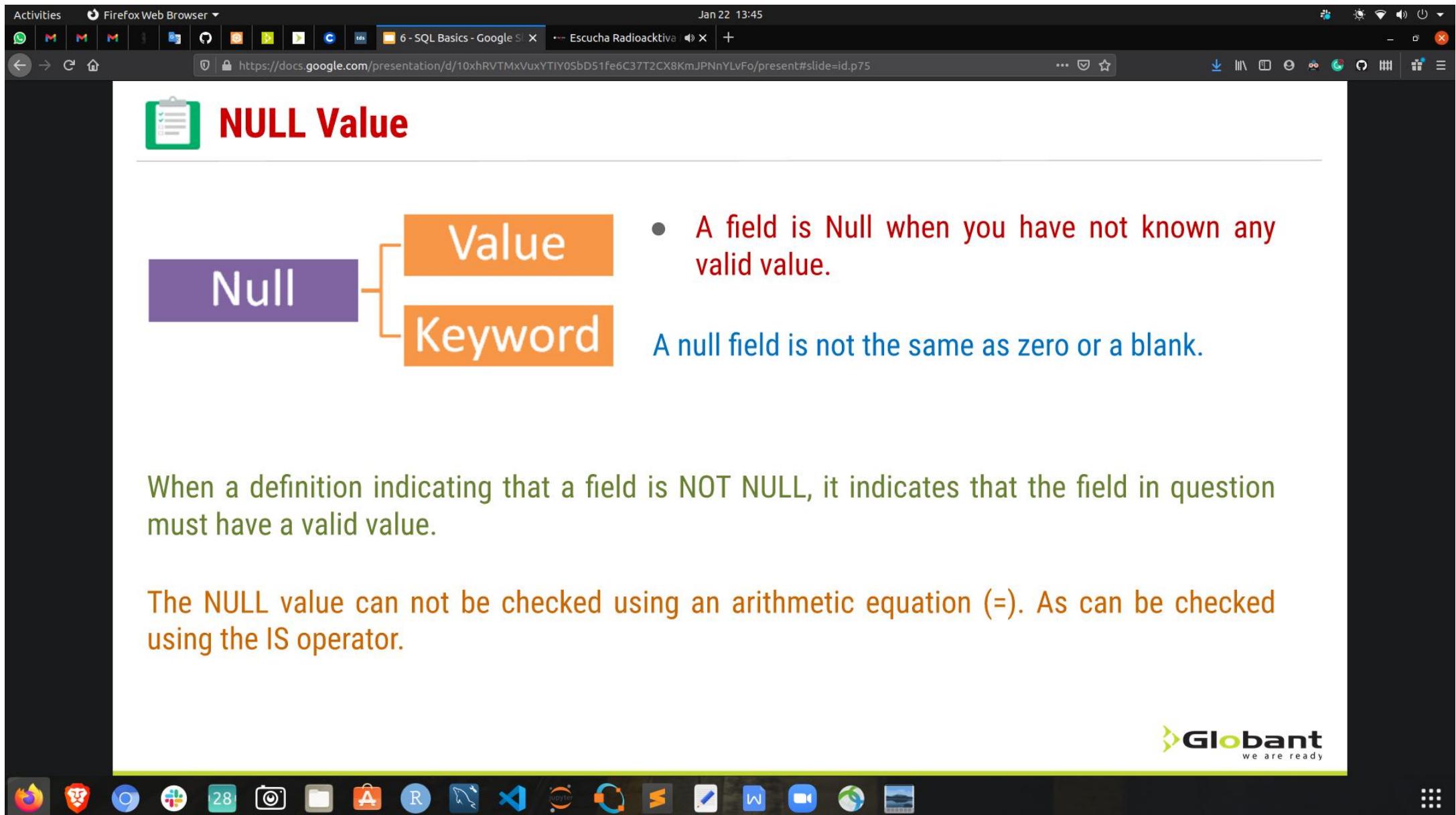
- Not the same as zero or a blank space

Arithmetic expressions containing a **NULL** value are evaluated to **NULL**

LastName	ManagerID
Sánchez	NULL
Duffy	300
Wang	1

NULL is displayed as empty
space or as NULL

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Character Manipulation Functions

The diagram illustrates various character manipulation functions in SQL:

('Hello' 'World')	HelloWorld
SUBSTR('HelloWorld', 1,5)	Hello
LENGTH('HelloWorld')	10
INSTR('HelloWorld', 'W')	6
LPAD(salary, 10, '*')	*****24000
RPAD(salary, 10, '*')	24000*****
TRIM('H' FROM 'HelloWorld')	elloWorld
QUOTE(Juan)	'Juan'
REPLACE(Apellido, 'García', 'López')	

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Numeric Functions

ROUND(45.926, 2) → 45.93
TRUNC(45.926, 2) → 45.92
MOD(1600, 300) → 100
LPAD(salary, 10, '*') → *****24000
RPAD(salary, 10, '*') → 24000*****

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Aggregation Functions

Lets get aggregated values, in a single value that summarizes information from multiple rows.

Average (AVG)	SELECT AVG(CantidadAlumnos) FROM Materias;
Sum ((SUM))	SELECT SUM(CantidadAlumnos) FROM Materias;
Minimum (MIN)	SELECT MIN(CantidadAlumnos) FROM Materias;
Maximum (MAX)	SELECT MAX(CantidadAlumnos) FROM Materias;
Amount (COUNT)	SELECT COUNT(Nombre) FROM Alumnos;

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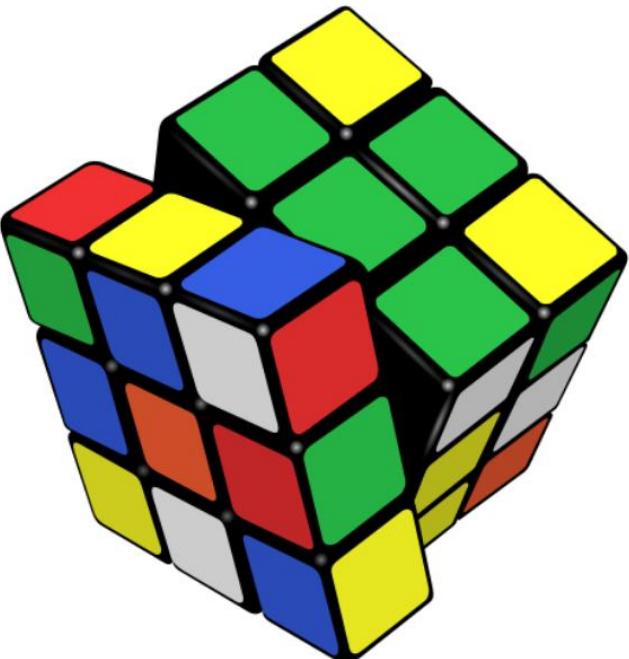
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Aggregation Functions

Lets get aggregated values, in a single value that summarizes information from multiple rows.



Average (AVG)	<code>SELECT AVG(CantidadAlumnos) FROM Materias;</code>
Sum ((SUM))	<code>SELECT SUM(CantidadAlumnos) FROM Materias;</code>
Minimum (MIN)	<code>SELECT MIN(CantidadAlumnos) FROM Materias;</code>
Maximum (MAX)	<code>SELECT MAX(CantidadAlumnos) FROM Materias;</code>
Amount (COUNT)	<code>SELECT COUNT(Nombre) FROM Alumnos;</code>

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Aggregation Functions

Aggregation functions operate over sets of rows to give one single result

EmployeeID	Salary
1	12500,00
2	13500,00
3	43300,00
4	29800,00
5	25000,00
...	...

MAX(Salary)
125500,00

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Aggregation Functions

SELECT

```
AVG(Salary) AS AverageSalary,  
MAX(Salary) AS MaxSalary,  
MIN(Salary) AS MinSalary,  
SUM(Salary) AS SalarySum
```

FROM Employees

```
WHERE JobTitle = 'Design Engineer'
```

You can use `AVG()` and `SUM()` only for numeric data types

AverageSalary	MaxSalary	MinSalary	SalarySum
32700.00	32700.00	32700.00	98100.00

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The COUNT Statement

COUNT(*) returns the number of rows in a table that satisfy the criteria of the SELECT statement, including duplicate rows and rows containing null values in any of the columns.

If a WHERE clause is included in the SELECT statement, COUNT(*) returns the number of rows that satisfies the condition in the WHERE clause.

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The COUNT Statement

COUNT(*) returns the number of rows in the result record set

Cnt
18

```
SELECT COUNT(*) Cnt FROM Employees WHERE DepartmentID = 3
```

COUNT(expr) returns the number of rows with non-null values for the expr

MgrCount	AllCount
1	2

```
SELECT COUNT(ManagerID) AS MgrCount, COUNT(*) AS AllCount
FROM Employees
WHERE DepartmentID = 16
```

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Aggregation Functions and NULLs

Group functions ignore **NULL** values in the target column

Avg	AvgAll
108	106

```
SELECT AVG(ManagerID) AS Avg,  
       SUM(ManagerID) / COUNT(*) AS AvgAll  
FROM Employees
```

If each **NULL** value in the **ManagerID** column were considered as 0 in the calculation, the result would be 106

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The GROUP BY Statement

We can divide rows in a table into smaller groups by using the **GROUP BY** clause

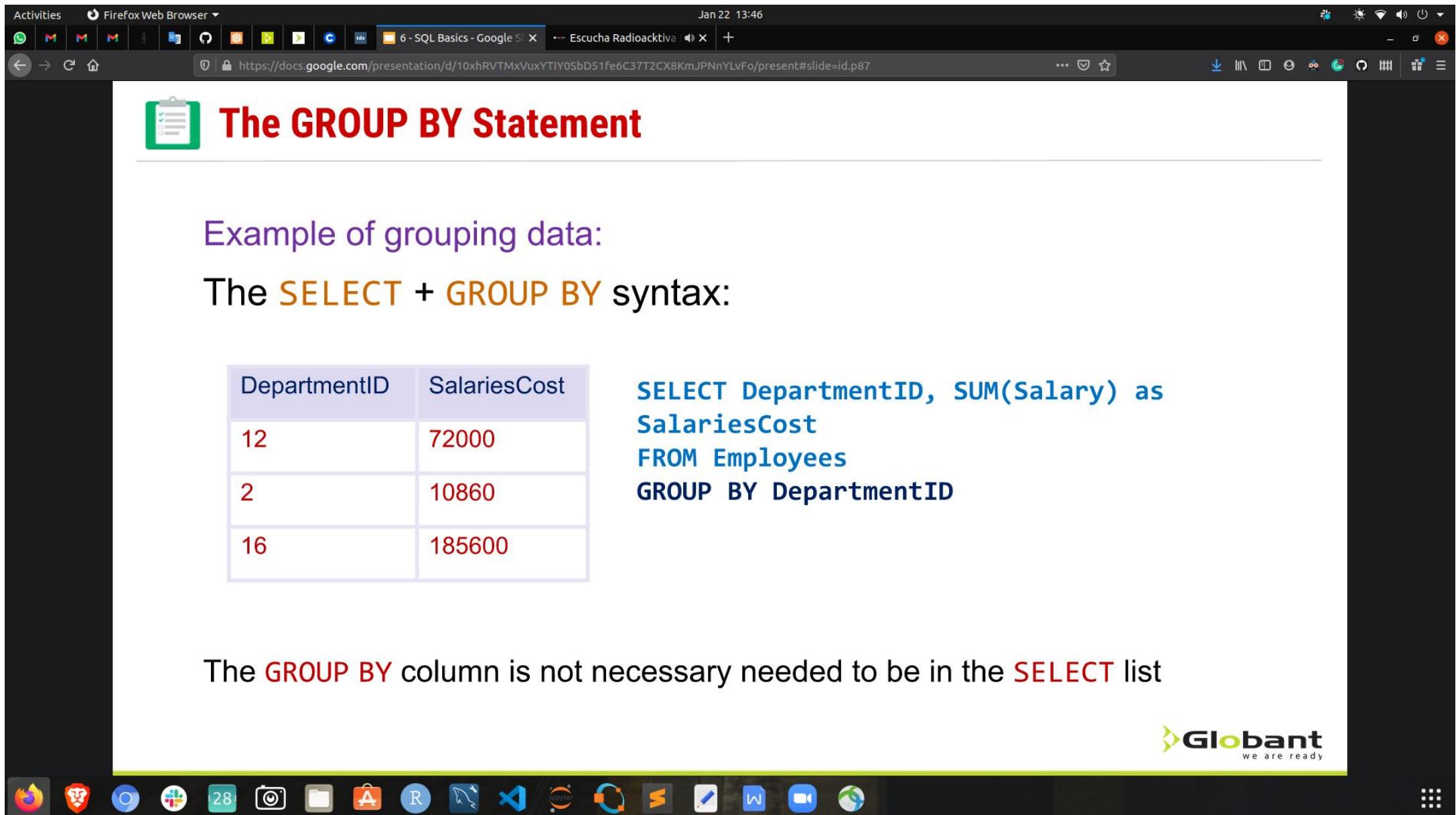
The **SELECT + GROUP BY** syntax:

```
SELECT <columns>, <group_function(column)>
FROM   <table>
[WHERE <condition>]
[GROUP BY <group_by_expression> ]
[HAVING  <filtering_expression>]
[ORDER BY <columns>]
```

The **<group_by_expression>** is a list of columns

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The GROUP BY Statement

SELECT DepartmentID, JobTitle,
SUM(Salary) as Salary FROM Employees
GROUP BY DepartmentID, JobTitle

DepartmentID	JobTitle	Salary
11	Network Manager	39700
11	Network Administrator	32500
11	Network Administrator	32500
11	Database Administrator	38500
11	Database Administrator	38500
10	Accountant	26400
10	Accountant	26400
10	Finance Manager	43300
...

39700
65000
77000
52800
43300

77000

52800

43300

DepartmentID	JobTitle	Salary
11	Network Manager	39700
11	Network Administrator	65000
11	Database Administrator	77000
10	Accountant	52800
10	Finance Manager	43300
...

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The GROUP BY Statement

When using groups we can select only columns listed in the GROUP BY and grouping functions over the other columns

```
SELECT DepartmentID, JobTitle,  
       SUM(Salary) AS Cost, MIN(HireDate) as  
          StartDate  
     FROM Employees  
    GROUP BY DepartmentID, JobTitle
```

Can not select columns not listed in the GROUP BY clause
It is allowed to apply group functions over the columns in the GROUP BY clause, but has no sense

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The HAVING Clause

HAVING works like WHERE but is used for the grouping functions

```
SELECT DepartmentID, COUNT(EmployeeID) as Count, AVG(Salary) as AverageSalary
FROM Employees
GROUP BY DepartmentID
HAVING COUNT(EmployeeID) BETWEEN 3 AND 5
```

DepartmentID	Count	AverageSalary
2	4	27150
12	5	14400

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 **JOIN Clause**

A SQL join clause combines columns from one or more tables in a relational database. It creates a set that can be saved as a table or used as it is. A JOIN is a means for combining columns from one (self-table) or more tables by using values common to each.

There are different types of joins available in SQL –

INNER JOIN	returns rows when there is a match in both tables.
LEFT JOIN	returns all rows from the left table, even if there are no matches in the right table.
RIGHT JOIN	returns all rows from the right table, even if there are no matches in the left table.
FULL JOIN	returns rows when there is a match in one of the tables.
SELF JOIN	is used to join a table to itself as if the table were two tables, temporarily renaming at least one table in the SQL statement.
CARTESIAN JOIN	returns the Cartesian product of the sets of records from the two or more joined tables.


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DDL (Data Definition Language) - CREATE - CREATE TABLE

The CREATE command is used to establish a new database, table, index, stored procedure and other objects based on a given RDBMS.

A commonly used CREATE command is the CREATE TABLE command. The typical usage is:

```
CREATE TABLE [table name] ( [column definitions]
) [table parameters]
```



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DDL (Data Definition Language) - ALTER

The ALTER statement modifies an existing database object.

An ALTER statement in SQL changes the properties of an object inside of a relational database management system (RDBMS). The types of objects that can be altered depends on which RDBMS is being used.

ALTER objecttype objectname parameters.



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DDL (Data Definition Language) - DROP

The DROP statement destroys an existing database, table, index, or view.

A DROP statement in SQL removes a component from a relational database management system (RDBMS). The types of objects that can be dropped depends on which RDBMS is being used, but most support the dropping of tables, users, and databases.

DROP objecttype objectname.



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DCL (Data Control Language) - GRANT

GRANT authorizes one or more users to perform an operation or a set of operations on an object.

```
GRANT SELECT, UPDATE  
ON example  
TO some_user, another_user;
```

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Firefox, LibreOffice, 28, Camera, File Manager, R, Python, VS Code, Jupyter, S, Microsoft Word, Microsoft PowerPoint, Microsoft Excel

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DCL (Data Control Language) - REVOKE

REVOKE eliminates a grant, which may be the default grant.

```
REVOKE SELECT, UPDATE  
ON example  
FROM some_user, another_user;
```

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TCL (Transaction Control Language) - SAVEPOINT

A SAVEPOINT is a point in a transaction when you can roll the transaction back to a certain point without rolling back the entire transaction.

The syntax for a SAVEPOINT command is as shown below.

```
SAVEPOINT SAVEPOINT_NAME;
```

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TCL (Transaction Control Language) - ROLLBACK

The ROLLBACK command is used to undo a group of transactions.

The syntax for ROLLBACK to a SAVEPOINT is as shown below.

```
ROLLBACK TO SAVEPOINT_NAME;
```

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TCL (Transaction Control Language) - COMMIT

The COMMIT command is the transactional command used to save changes invoked by a transaction to the database.

The COMMIT command is the transactional command used to save changes invoked by a transaction to the database. The COMMIT command saves all the transactions to the database since the last COMMIT or ROLLBACK command.

```
COMMIT;
```

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SQL BASICS - LAB SET UP

SQLite Manager Add-On

QUALITY ENGINEERING

The screenshot captures a Linux desktop environment with a dark theme. At the top, a horizontal bar displays the system tray with icons for battery, signal strength, and volume. Below this is the Firefox browser window, which has multiple tabs open. The active tab shows a Google Slides presentation slide titled "SQL BASICS - LAB SET UP" with a subtitle "SQLite Manager Add-On". The slide content area is mostly blank. At the bottom right of the slide, there is a logo for "QUALITY ENGINEERING" featuring the word "QUALITY" in bold capital letters next to a yellow square icon containing a checkmark. The bottom of the screen features a dock with icons for various applications, including a terminal, file manager, and several productivity tools like R, Python, and Jupyter. The overall layout is clean and organized, typical of a modern Linux desktop setup.

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SQL Basics - Enable SQLite Manager in Firefox

You can practice all the commands introduced in this training by using SQLite Manager Firefox Add-On and the attached SQL-Training.sqlite file.

Please download the file [here](#) and then follow the next steps.



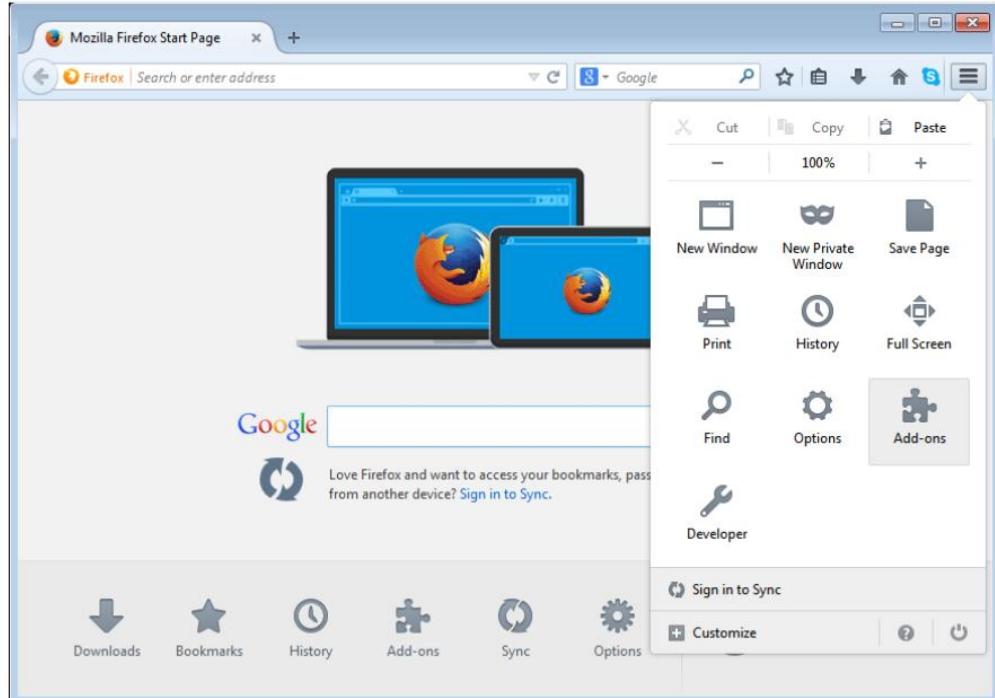
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SQL Basics - Enable SQLite Manager in Firefox



In order to run SQL sentences described in this training you will need to enable SQLite Manager in your Firefox Browser:

Have Firefox installed

Open Menu and click on "Add-Ons"

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SQL Basics - Enable SQLite Manager in Firefox

A new “Add-ons Manager” TAB is opened:

Click on the highlighted Editbox and type “SQLITE Manager”, then click on the Magnifier to Search for this Add On.

When search results are displayed Click on Install Button.

Name	Last Updated	Action
SQLite Manager 0.8.1	Sunday, September 22, 2013	Install
Gmail Manager 0.6.4.1	Thursday, March 24, 2011	Install
LastPass Password Manager 3.1.1	Thursday, March 20, 2014	Install
Download Manager Tweak 1.0.7	Tuesday, July 22, 2014	Install
Cleanest Addon Manager 7.0	Tuesday, January 22, 2013	Install

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SQL Basics - Enable SQLite Manager in Firefox

Click on “Restart Now” link to complete the installation.
This will restart Firefox.

The screenshot shows the Mozilla Firefox Add-ons Manager window. The search bar at the top has "SQLite Manager" typed into it. Below the search bar, there are two tabs: "My Add-ons" (selected) and "Available Add-ons". A list of add-ons is displayed, with the first item being "SQLite Manager 0.8.1". To the right of this item is a green checkmark followed by the text "SQLite Manager will be installed after you restart Firefox". Below this, there are two buttons: "Restart now" (which is highlighted with a red box) and "Undo". Other items in the list include "Gmail Manager 0.6.4.1", "LastPass Password Manager 3.1.1", "Download Manager Tweak 1.0.7", and "Cleanest Addon Manager 7.0". Each item has a small icon, a name, a date, and an "Install" button.

Search: My Add-ons Available Add-ons

SQLite Manager will be installed after you restart Firefox

SQLite Manager 0.8.1

Gmail Manager 0.6.4.1

LastPass Password Manager 3.1.1

Download Manager Tweak 1.0.7

Cleanest Addon Manager 7.0

Restart now Undo

Monday, September 22, 2014

Thursday, March 24, 2011

Thursday, March 20, 2014

Tuesday, July 22, 2014

Tuesday, January 22, 2013

Install

Install

Install

Install

Slide 93 Q & A Notes Pointer Tips

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SQL Basics - Enable SQLite Manager in Firefox

In Order to create a Direct Access to this Add-On click on “Open Menu” icon and then on Customize.

The screenshot shows a Firefox window with the title "Add-ons Manager". The address bar says "about:addons". On the left, there's a sidebar with options: Get Add-ons, Extensions (selected), Appearance, Plugins, Dictionaries, and Services. In the main pane, two add-ons are listed: "Skype Click to Call 7.3.1654" and "SQLite Manager 0.8.1". A context menu is open on the right side of the screen, with its top-left corner pointing towards the "Customize" button in the Add-ons Manager. The context menu has several items: Cut, Copy, Paste, New Window, New Private Window, Save Page, Print, History, Full Screen, Find, Options, and Add-ons. The "Customize" button at the bottom of the context menu is highlighted with a red box. The Firefox toolbar at the bottom includes icons for various applications like a browser, file manager, and media players.

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SQL Basics - Enable SQLite Manager in Firefox

Right click on SQLite Icon and select Add to toolbar.

The screenshot shows a Linux desktop environment with a dark theme. A Firefox window is open, displaying a presentation slide titled "SQL Basics - Enable SQLite Manager in Firefox". Below the slide, a red text overlay reads "Right click on SQLite Icon and select Add to toolbar.". The Firefox interface includes a top bar with activity icons and tabs, a toolbar with various icons, and a bottom dock with application icons. A "Customize Firefox" window is overlaid on the browser, specifically the "Additional Tools and Features" section. This section lists several icons: Open File, Sidebars, Subscribe, Character Encoding, Email Link, Sync, Tab Groups, and SQLite Manager. The SQLite Manager icon is highlighted with a red box. To the right of the list is a toolbar with standard browser controls like Cut, Copy, Paste, New Window, New Private Window, Save Page, Print, History, Full Screen, Find, Options, and Add-ons. At the bottom of the customization window are buttons for "Title Bar", "Show / Hide Toolbars", and "Restore Defaults". A green button at the bottom right says "Exit Customize".

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SQL Basics - Enable SQLite Manager in Firefox

SQLite Icon should appear in your toolbar.
Click on Exit Customize to Finish the operation.

Mozilla Firefox Start Page Add-ons Manager Customize Firefox

Additional Tools and Features

- Open File
- Sidebars
- Subscribe
- Character Encoding
- Email Link
- Sync
- Tab Groups

Cut Copy Paste
New Window New Private Window Save Page
Print History Full Screen
Find Options Add-ons

Sign in to Sync

Exit Customize

Globant we are ready

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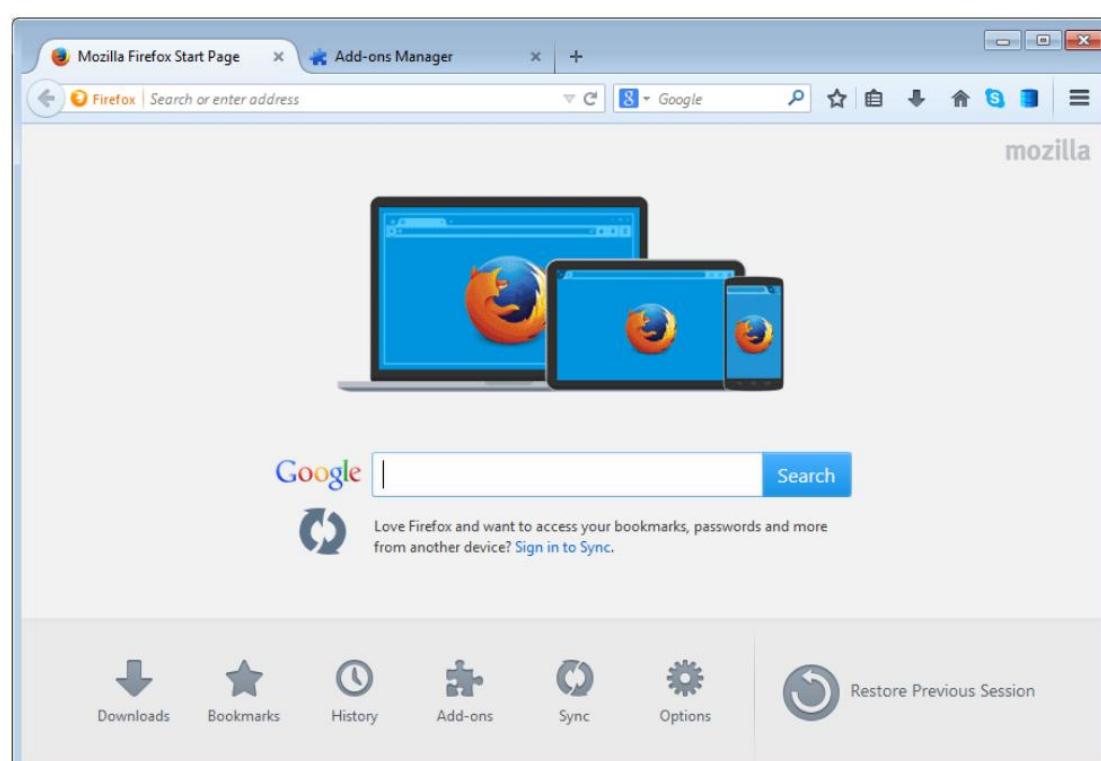
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SQL Basics - Working with SQLite Manager in Firefox

To start SQLite Manager application click on SQLite Icon.

A new window named SQLite Manager should appear.



mozilla

Firefox | Search or enter address

Google Search

Sync

Downloads Bookmarks History Add-ons Sync Options Restore Previous Session

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To Open the training Database click on Database and then select Connect Database.

A select file popup window should appear. There select the file you downloaded for this training and click on Open.

The image shows a screenshot of a Linux desktop environment with a dark theme. At the top, there's a dock with various application icons. The main window is a Firefox browser displaying a presentation slide titled "SQL Basics - Working with SQLite Manager in Firefox". On the left side of the slide, there's an orange icon of a document with a pencil. The text on the slide provides instructions for opening a database using the SQLite Manager extension in Firefox. It says to click on the "Database" menu, select "Connect Database", and then choose the downloaded database file ("SQL-Training.sqlite") from a file selection dialog. The "SQLite Manager" extension interface is shown, with its menu bar and a "Select SQLite Database" dialog box overlaid. The dialog box shows a file tree and a file name input field set to "SQL-Training.sqlite". The Globant logo is in the bottom right corner of the slide area.

