FOUNDATIONS OF SQL

Learning Objectives

1. Introduction to SQL
2. Retrieving Data with SELECT
3. Using WHERE to Filter data
4. GROUP BY and ORDER BY
5. CASE expressions
6. JOIN operators

Introduction to SQL

- What is SQL? Why and Where is SQL used? Why should you learn it?
- What are Databases and Relational Databases? And How the tables in a relational database are related?
- How to run SQL? And different types of RDBMS and Database management tools

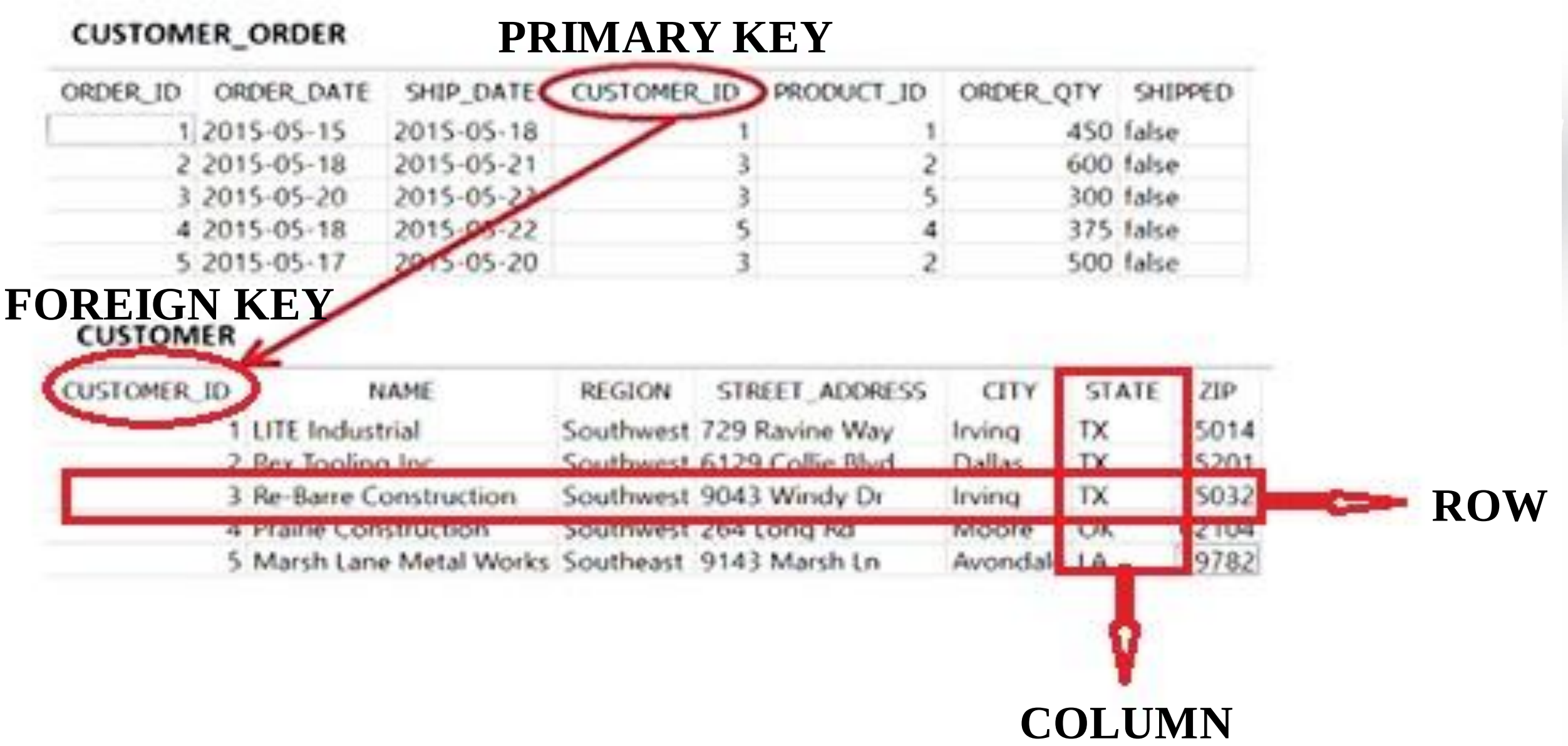
- SQL stands for Structured Query Language.
- It was developed in the 1970s by IBM researchers **Raymond Boyce** and **Donald Chamberlin**.
- SQL is a standard language for **storing**, **manipulating** and **retrieving** data in databases.
- SQL is designed to interact with databases by **defining**, **querying**, **updating**, and **managing** the data within them.
- SQL is used in **Data Analytics**, **Healthcare**, **Marketing**, **Business**, **Government** and **Public services,** E-**commerce**, **Finance** etc.

Why should you learn SQL?

- SQL is a lucrative skill that helps in handling large databases and **making informed decisions using data analysis**.
- It can be utilized to open up many career paths in both businesses and IT.
- In **Businesses** it helps in performing **analysis**, **research**, making strategies and managerial decisions.
- In Technology it helps in data analysis, **database management**, **software management** and **Project management** etc.
- It's a time saving skill that helps in **problem solving** and **data processing**.

What are Databases and Relational databases?

- Databases are collections of **structured information** that are stored and accessed electronically.
- They make it easy for companies to extract, update, and analyze internal data, often by using SQL or similar languages.
- In relational databases, the data is stored in **one or more tables** and each table can be viewed as a two-dimensional matrix consisting of rows and columns.
- **rows and columns** of the relational database are more referred to as **records and fields.** The value stored at the intersection of each row and column is sometimes called a **Cell**.


CUSTOMER_ORDER
PRIMARY KEY
ORDER_ID ORDER_DATE SHIP_DATE CUSTOMER_ID PRODUCT_ID ORDER_QTY SHIPPED
1 2015-05-15 2015-05-18 1 1 450 false
2 2015-05-18 2015-05-21 3 2 600 false
3 2015-05-20 2015-05-23 3 5 300 false
4 2015-05-18 2015-05-22 5 4 375 false
5 2015-05-17 2015-05-20 3 2 500 false
FOREIGN KEY
CUSTOMER
CUSTOMER_ID NAME REGION STREET_ADDRESS CITY STATE ZIP
1 LITE Industrial Southwest 729 Ravine Way Irving TX 5014
3 Re-Barre Construction Southwest 9043 Windy Dr Irving TX 5032
5 Marsh Lane Metal Works Southeast 9143 Marsh Ln Avondal LA 9782
ROW
COLUMN

CUSTOMER

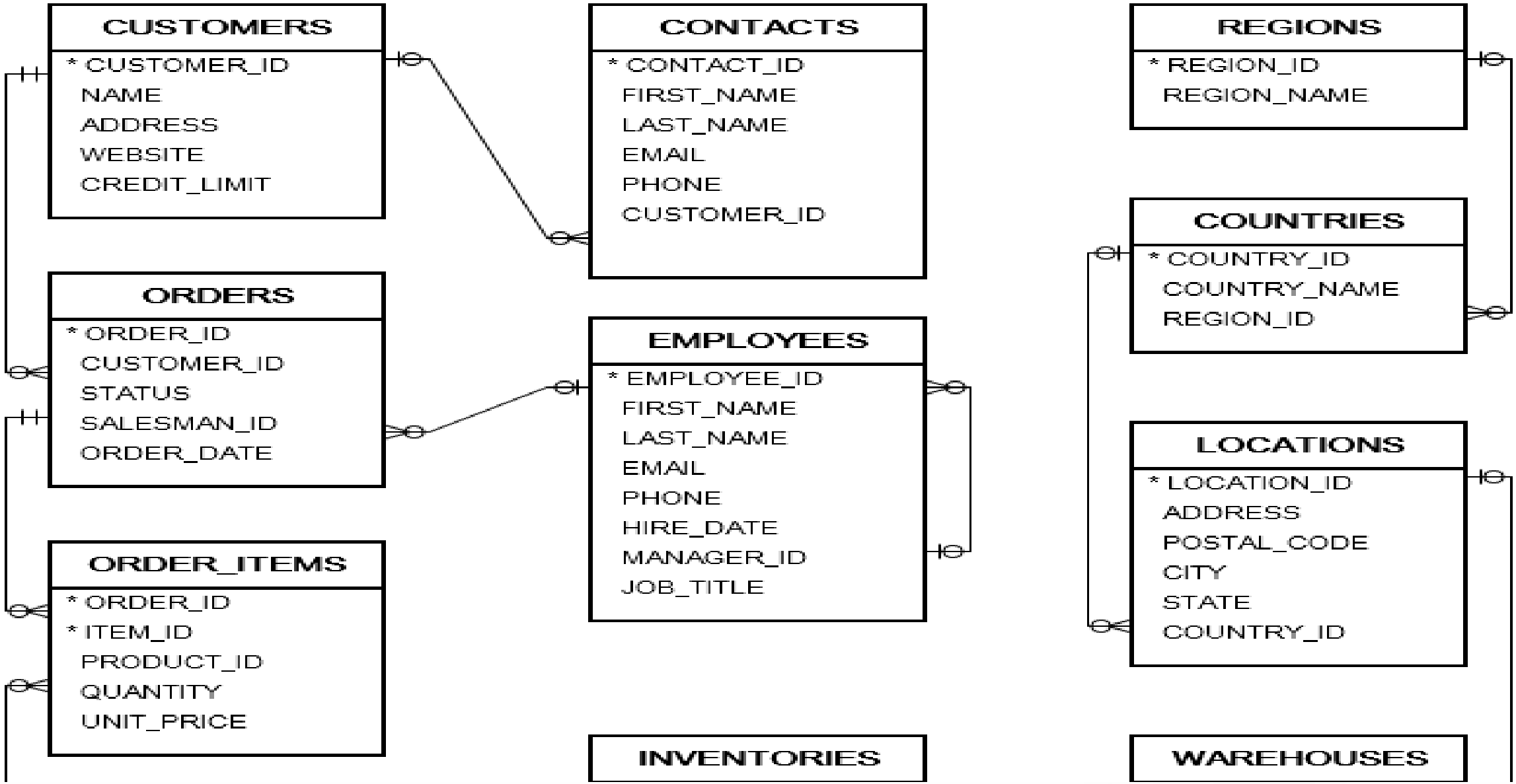
CUSTOMER ID	NAME	REGION	STREET ADDRESS	CITY	STATE	ZIP
1	LITE Industrial	Southwest	729 Ravine Way	Irving	TX	75014
2	Rex Tooling Inc	Southwest	6129 Collie Blvd	Dallas	TX	75201
3	Re-Barre Construction	Southwest	9043 Windy Dr	Irving	TX	75032
4	Prairie Construction	Southwest	264 Long Rd	Moore	OK	62104
5	Lane Metal Works	Southeast	9143 Marsh Ln	Avondale	LA	79782

Primary Key

CUSTOMER_ORDER

	ORDER_ID	ORDER_DATE	SHIP_DATE	CUSTOMER_ID	PRODUCT_ID	ORDER_QTY	SHIPPED
1	3	2015-04-20	2015-04-[illegible]	3	5	300	false
2	4	2015-04-18	2015-04-22	5	4	375	false
3	1	2015-04-15	2015-04-18	1	1	450	false
4	5	2015-04-17	2015-04-20	3	2	500	false
5	2	2015-04-18	2015-04-21	3	2	600	false

Foreign Key


CUSTOMERS
* CUSTOMER_ID
NAME
ADDRESS
WEBSITE
CREDIT_LIMIT
CONTACTS
* CONTACT_ID
FIRST_NAME
LAST_NAME
EMAIL
PHONE
CUSTOMER_ID
REGIONS
* REGION_ID
REGION_NAME
ORDERS
* ORDER_ID
CUSTOMER_ID
STATUS
SALESMAN_ID
ORDER_DATE
EMPLOYEES
* EMPLOYEE_ID
FIRST_NAME
LAST_NAME
EMAIL
PHONE
HIRE_DATE
MANAGER_ID
JOB_TITLE
COUNTRIES
* COUNTRY_ID
COUNTRY_NAME
REGION_ID
LOCATIONS
* LOCATION_ID
ADDRESS
POSTAL_CODE
CITY
STATE
COUNTRY_ID
ORDER_ITEMS
* ORDER_ID
* ITEM_ID
PRODUCT_ID
QUANTITY
UNIT_PRICE
INVENTORIES
WAREHOUSES

How the tables in a relational database are related?

- The tables in a relational database can be related to other tables by **values** in specific columns.
- For eg., a row in a primary table can be related to a column in another table.
- If in case each row in primary table is related to one or more rows in the second table, then it is called **one to many relationship**.
- Typically, relationships exist between **primary key** in one table and the **foreign key** in another table.
- The **foreign key** is simply one or more columns in a table that refer to a primary key in another table.
- Many to many relationship can be broken down into two one to many relationships.

Different types of RDBMS

1. Microsoft SQL Server

It is a relational database management system. As a database server that stores and retrieves data as requested by other software applications on the same computer or a remote computer using the client-server model. It is used for **small to medium** sized systems

MySQL

MySQL is one of the most popular, widely used open-source relational database management systems in **modern app development**. Unlike SQL, **MySQL is a piece of software, not a language.** MySQL uses SQL as its query language, which allows users to define, manipulate, and retrieve data from the database using standardized syntax. It is owned by **Oracle**.

SQLite

SQLite is an embedded, server-less relational database management system. It is an in-memory open-source library with zero configuration and does not require any installation. Also, it is very convenient as it's **less than 500kb in size**, which is significantly lesser than other database management systems. It operates as a **library** that applications can directly link to and use.

Postgre SQL

PostgreSQL is a **powerful, open-source** object-relational database system that uses and extends the SQL language combined with many features that safely store and scale the most **complicated data workloads**.

Oracle DB

Oracle Database, simply referred to as Oracle DB, is a widely used relational database management system (RDBMS) developed by the Oracle corporation. It is one of the most popular and powerful database systems in the world, known for its **scalability, security and reliability**.

In this course we are using the SQLite as our Database management System. SQLite is a lightweight database and can be found on all our day-to-day appliances like different Smartphones, Smartwatches, Smart TVs, Car infotainment systems, Digital cameras, home security systems and ATMs. It is also great for training SQL because we don't have the need to set up a server and do the configuration process

Basic Math Operators in SQL

S.no	Operator	Operation	Example
1	+	Adds two numbers	LAB1_POINTS + LAB2_POINTS
2	-	Subtracts two number	TOTAL_POINTS – GRADED_POINTS
3	*	Multiplies two numbers	PRICE* TAX
4	/	Divides two numbers	GRADED-POINTS/ TOTAL_POINTS
5	%	Divides two numbers but returns the remainders	GRADED_POINTS% TOTAL_POINTS

Github Codespaces

A codespace is a development environment that's hosted in the cloud. You can customize your project for GitHub Codespaces by committing configuration files to your repository (often known as Configuration-as-Code), which creates a repeatable codespace configuration for all users of your project.

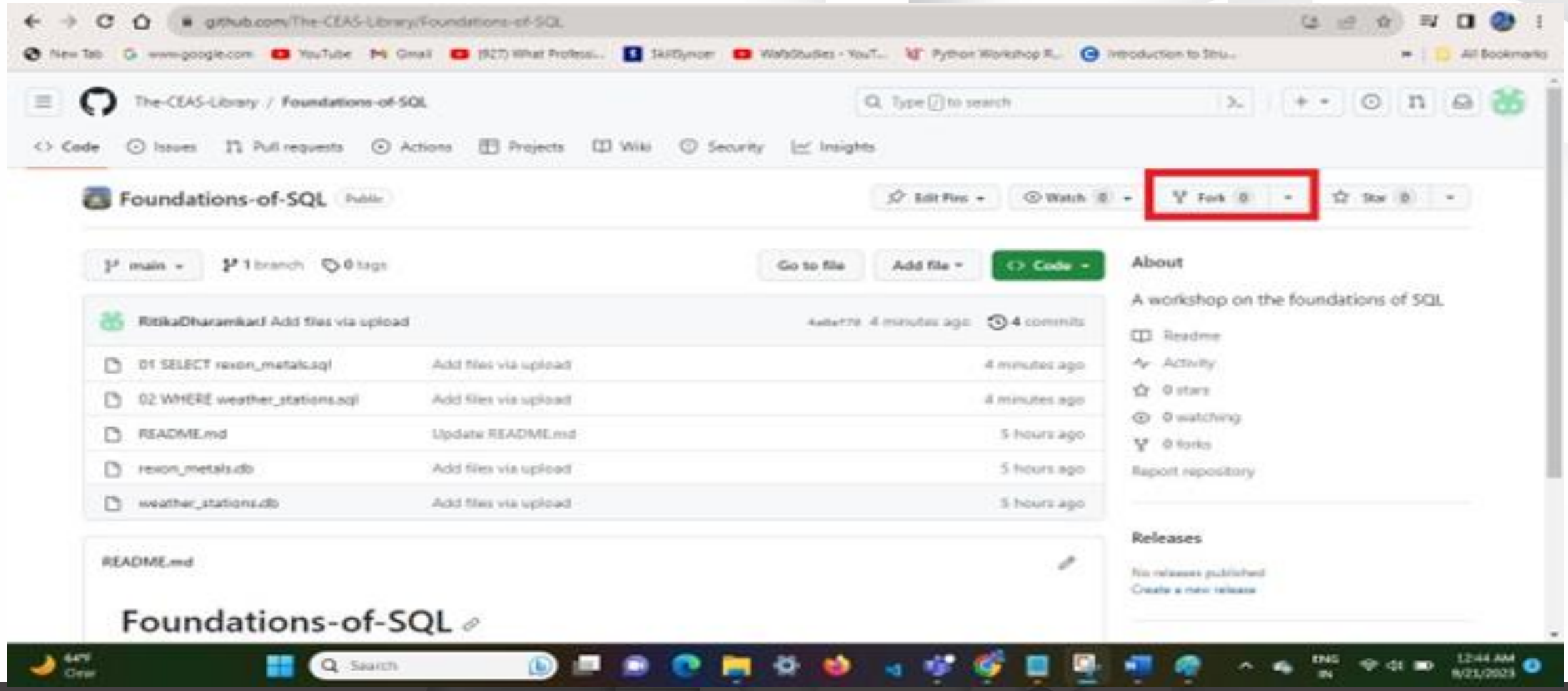
Instructions for the workshop

- Please ensure you have a working email to create a free account with Github at https://github.com/signup

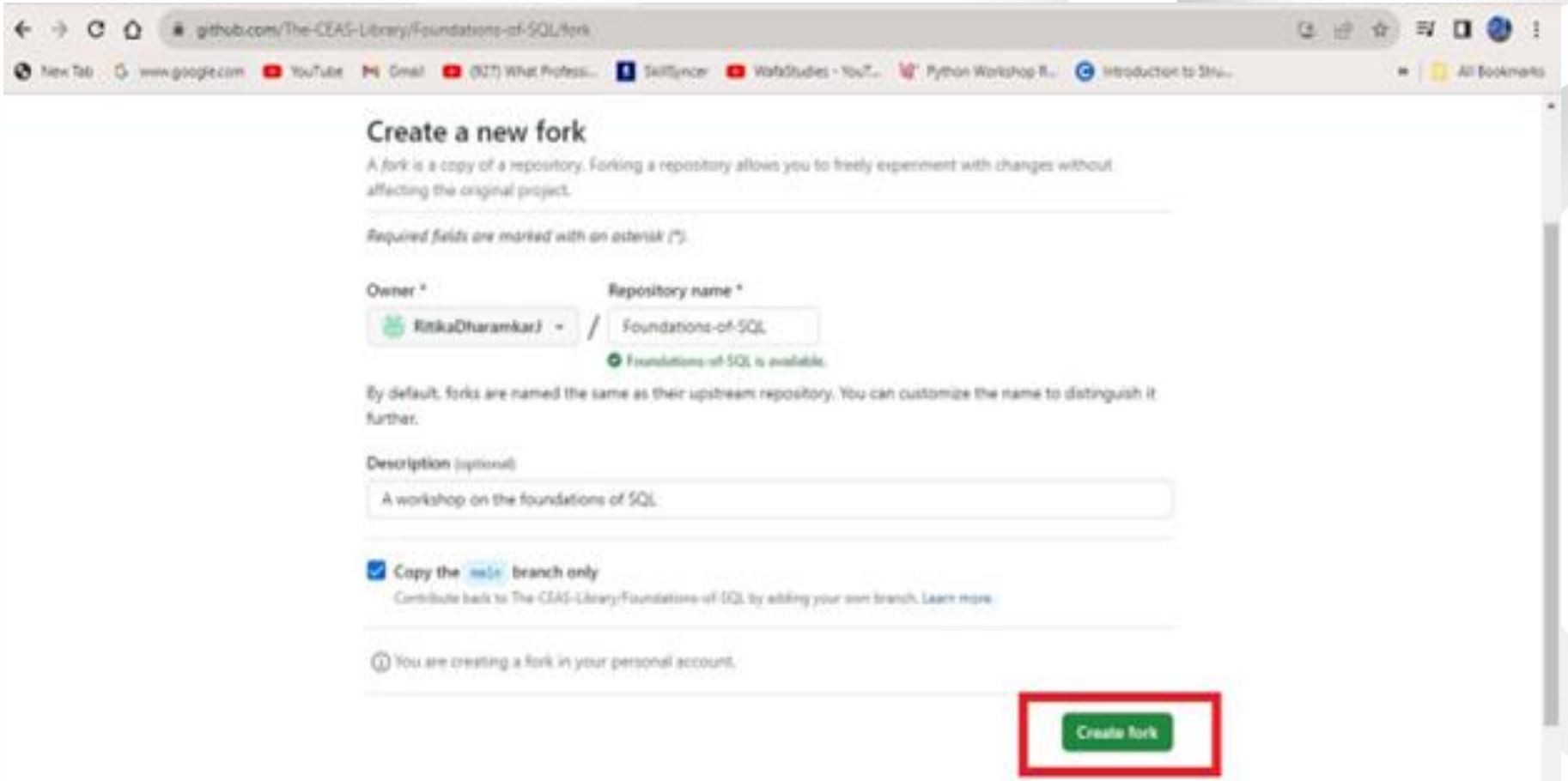
- Now ensure you click on the link

https://github.com/The-CEAS-Library/Foundations-of-SQL

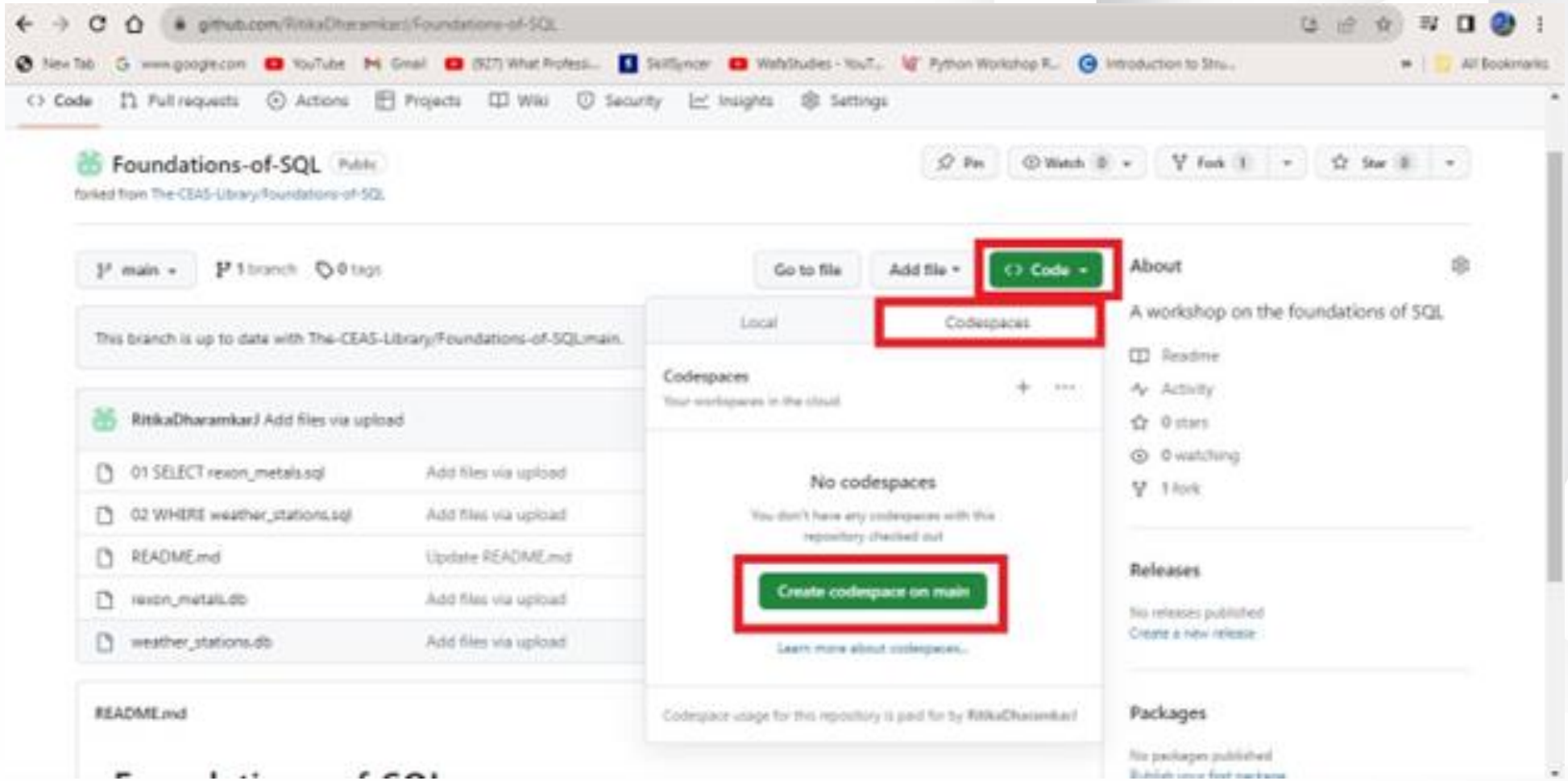
- You will be redirected to this page. Where you need to click on fork.



In the next page, click on create fork. [You can also edit the repository name to your liking]



You will be taken to this page below where you need to click on Code << Codespaces << Create codespaces on main



Post creating the codespaces on main. The codespaces will be created. Post the creation of the new page. Ensure that you click on the extensions tab on the extreme left as shown in the picture below. [This icon has four boxes symbol]

In the search bar that pops up. You can search for sqlite term. And click on install for the two extensions – SQLite by alexcvzz and SQLite Viewer by Florian Klampfer, just like in the screenshot below. That's all and you are good to go.

- Now you can go ahead navigate through the entire codespace environment.
- On top left side you will have documents section where all files will be present.
- You can open any files inside, you will be prompted to choose SQLite viewer by Florain Klampfer to view the files.
- There are two databases that we have, You can choose to view these databases in the text editor on the right-hand side.
- To run the code, open any of the two files that have code in them, select the code which you want to run. Now left click the code and choose "Run selected Query" option. It will prompt you to select which database you want to choose at first. You can select the relevant database. The output shows on the left side text editor.