Data Analysis Fundamentals : SQL

Global Engineering Challenge - Vaccine Distribution Plan

UNIVERSITY OF TORONTO

Slide by Sarah.L

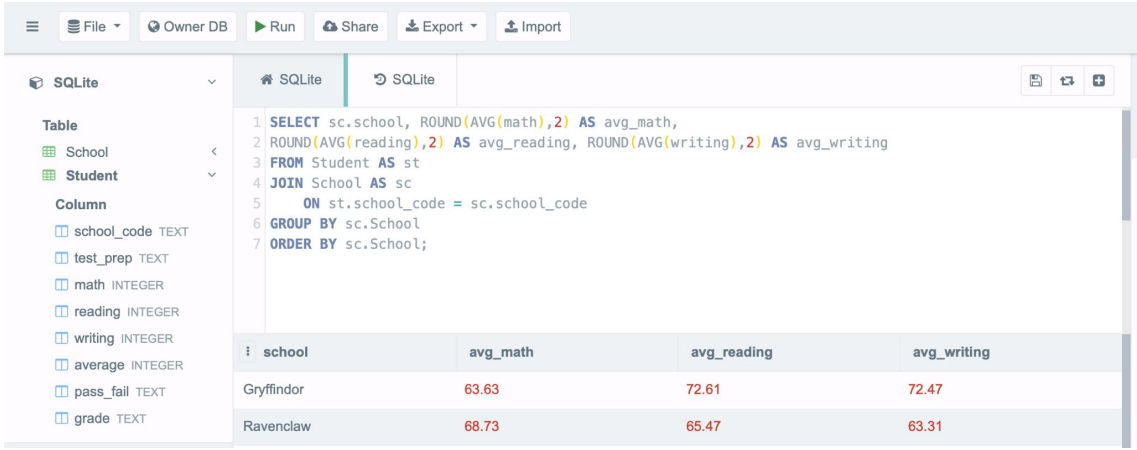
What is SQL?

- **S**tructured **Q**uery **L**anguage, **SQL**, is the standard and most widely **used** programming language for relational databases. It is **used** to manage and organize data in all sorts of systems in which various data relationships exist.

BigQuery

Basic Commands in SQL

- **SQL commands** are the instructions used to communicate with a database to perform tasks, functions, and queries with data
- Basic functions:
  - SELECT
  - FROM
  - WHERE
  - JOIN
  - GROUP BY
  - ORDER BY



SQL Order Of Operations

ORDER	CLAUSE	FUNCTION
1	from	Choose and join tables to get base data.
2	where	Filters the base data.
3	group by	Aggregates the base data.
4	having	Filters the aggregated data.
5	select	Returns the final data.
6	order by	Sorts the final data.
7	limit	Limits the returned data to a row count.

https://www.sisense.com/blog/sql-query-order-of-operations/

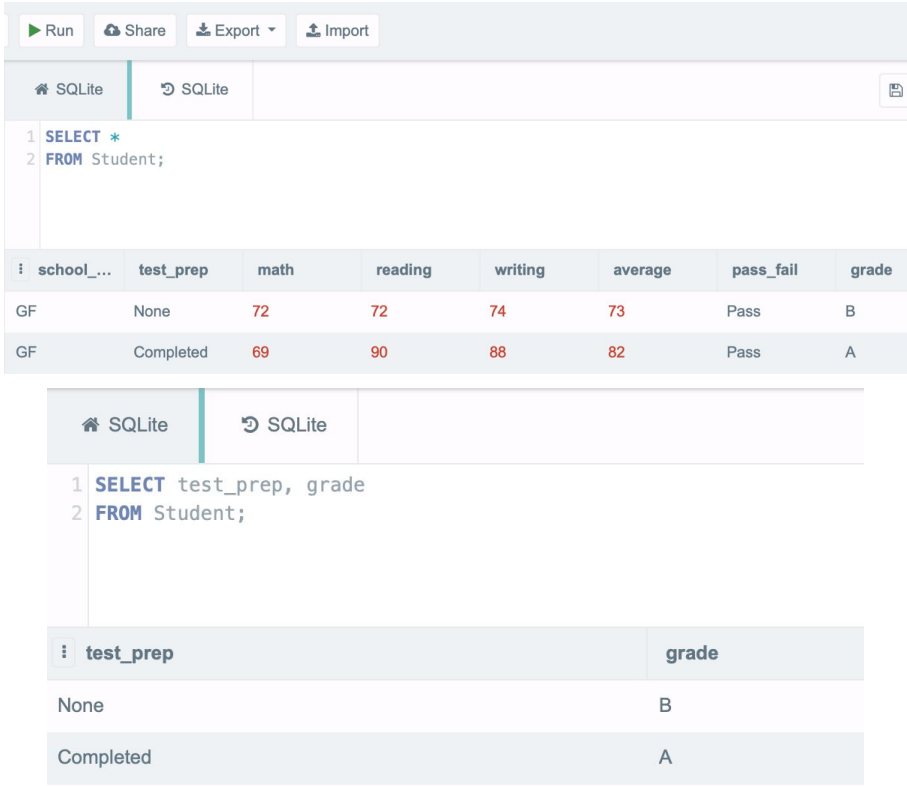
SELECT

The **SELECT** statement is used to select data from a database.

Example:

SELECT *

SELECT test_prep, grade

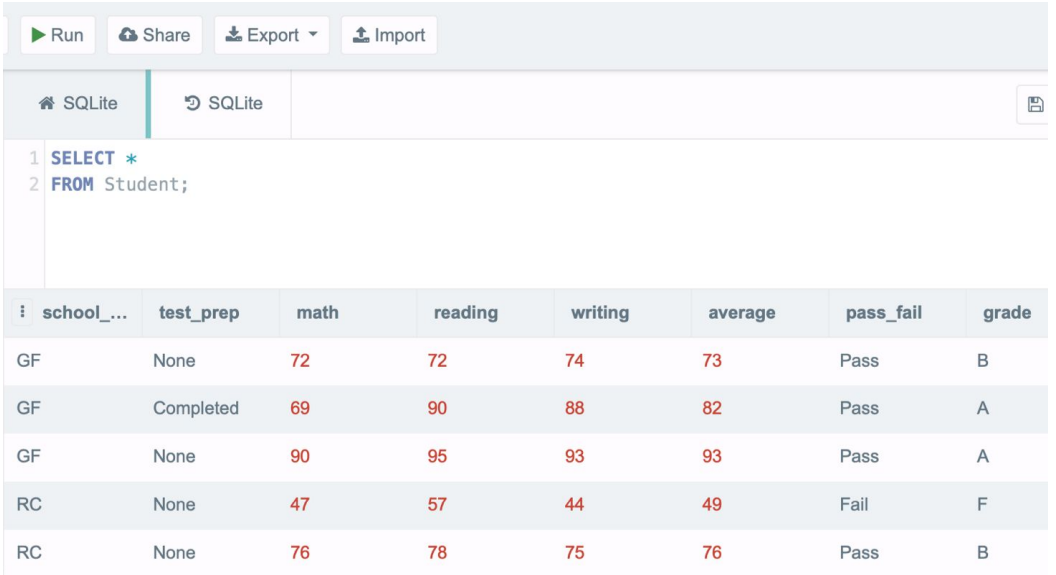


FROM

The **FROM** command is used to specify which table to select or delete data from

Example:

```
SELECT *
FROM Student;
```



school_...	test_prep	math	reading	writing	average	pass_fail	grade
GF	None	72	72	74	73	Pass	B
GF	Completed	69	90	88	82	Pass	A
GF	None	90	95	93	93	Pass	A
RC	None	47	57	44	49	Fail	F
RC	None	76	78	75	76	Pass	B

WHERE

The **WHERE** clause is used to filter records

Example:

```
SELECT *
FROM Student
WHERE school_code = “GF”
```

SQLite | SQLite

```
1 SELECT *
2 FROM Student
3 WHERE school_code = "GF"
```

school_...	test_prep	math	reading
GF	None	72	72
GF	Completed	69	90
GF	None	90	95
GF	None	71	83

ORDER BY

The **ORDER BY** keyword is used to sort the result-set in ascending or descending order

Example:

```
SELECT school_code,
pass_fail, grade
FROM Student
WHERE grade;
```

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```
1 SELECT school_code, pass_fail, grade
2 FROM Student
3 ORDER BY grade;
```

school_code	pass_fail	grade
GF	Pass	A
GF	Pass	A
GF	Pass	A
RC	Pass	A
RC	Pass	A

GROUP BY

The **GROUP BY** statement groups rows that have the same values into summary rows

The **GROUP BY** statement is often used with aggregate functions (COUNT, MAX, MIN, SUM, AVG) to group the result-set by one or more columns

Example:

```
SELECT school_code,
ROUND(AVG(math),2) as avg_math,
ROUND(AVG(reading),2) as avg_reading
ROUND(AVG(writing),2) as avg_writing
FROM Student
GROUP BY school_code;
```

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```
1 SELECT school_code, ROUND(AVG(math),2) AS avg_math,
2 ROUND(AVG(reading),2) AS avg_reading, ROUND(AVG(writing),2) AS avg_writing
3 FROM Student
4 GROUP BY school_code;
```

school_code	avg_math	avg_reading	avg_writing
GF	63.63	72.61	72.47
RC	68.73	65.47	63.31

JOIN

A **JOIN** clause is used to combine rows from two or more tables, based on a related column between them

Example:

```
SELECT sc.school, st.grade
FROM Student AS st
JOIN School AS sc
ON st.school_code = sc.school_code
WHERE school_code = “GF”
```

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```
1 SELECT sc.school, st.grade
2 FROM Student AS st
3 JOIN School AS sc
4 ON st.school_code = sc.school_code
5 WHERE st.school_code = "GF"
```

school	grade
Gryffindor	B
Gryffindor	A
Gryffindor	A
Gryffindor	B

JOIN

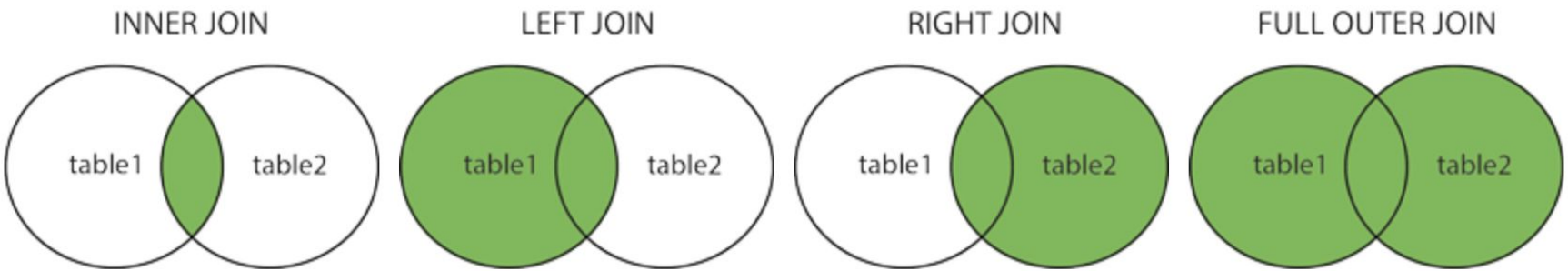
Different types of the JOINs in SQL:

(INNER) JOIN

Returns records that have matching values in both tables

FULL (OUTER) JOIN

Returns all records when there is a match in either left or right



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

JOIN

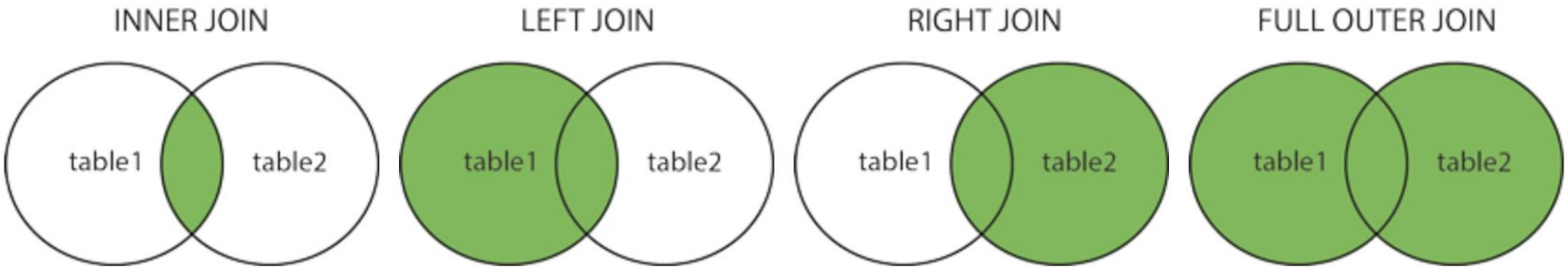
Different types of the JOINs in SQL:

LEFT (OUTER) JOIN:

Returns all records from the left table, and the matched records from the right table

RIGHT (OUTER) JOIN:

Returns all records from the right table, and the matched records from the left table



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SQL Exercise

Download SQL Exercise Data
https://docs.google.com/spreadsheets/d/1ZVKyKP-xmVeXDzbRzprdKfE5g2c6XrSrscbUqYuXPoI/edit?usp=sharing

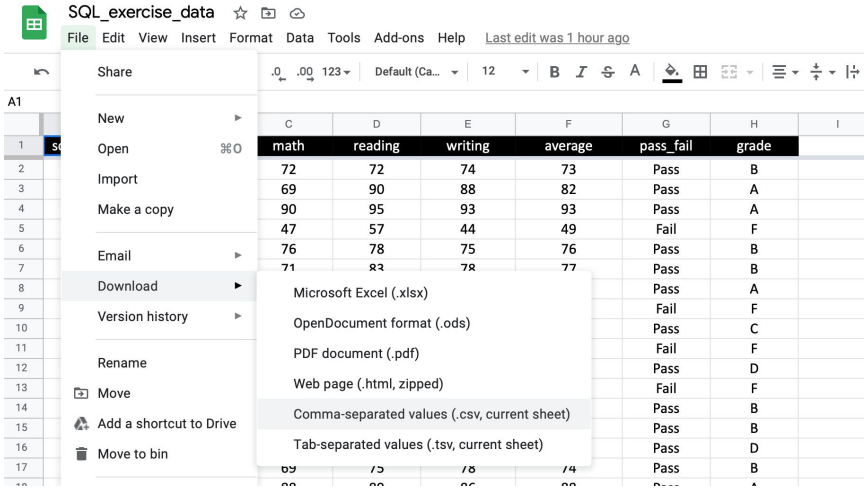
Download both Student and School Data as .csv file and import them on https://sqliteonline.com

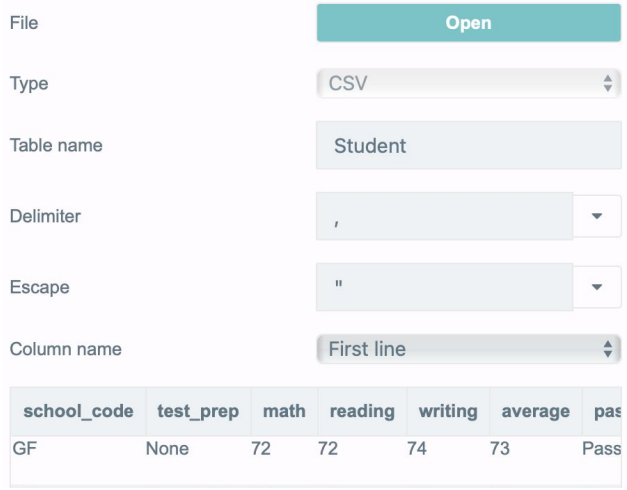
Sheet1: Student

- Contains detailed grade data for each student

Sheet2: School

- Contains data for school code and matching school name





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SQL Exercise

1. Write a statement that will select the grade column from Student table
2. Select all records from Student table where school_code column has the value “GF”
3. Select all records from Student table and sort result alphabetically by column pass_fail
4. List school code, average math, average reading and average writing score group by school code from Student table
5. Select all records from Student table order by grades (A, B, C, D, F)
6. Write a statement that will select school name, average math, average reading and average writing score from Student table and group by school name from School table