1. 1 point

Activity overview

You've come a long way in working with relational databases and SQL. Now, you'll gain practice writing queries that join multiple tables together.
In this activity, you'll work with the World Bank's International Education Dataset. By mastering JOIN statements, you'll be able to fully harness the power of relational databases by combining data from tables linked by keys.

Load and examine the dataset

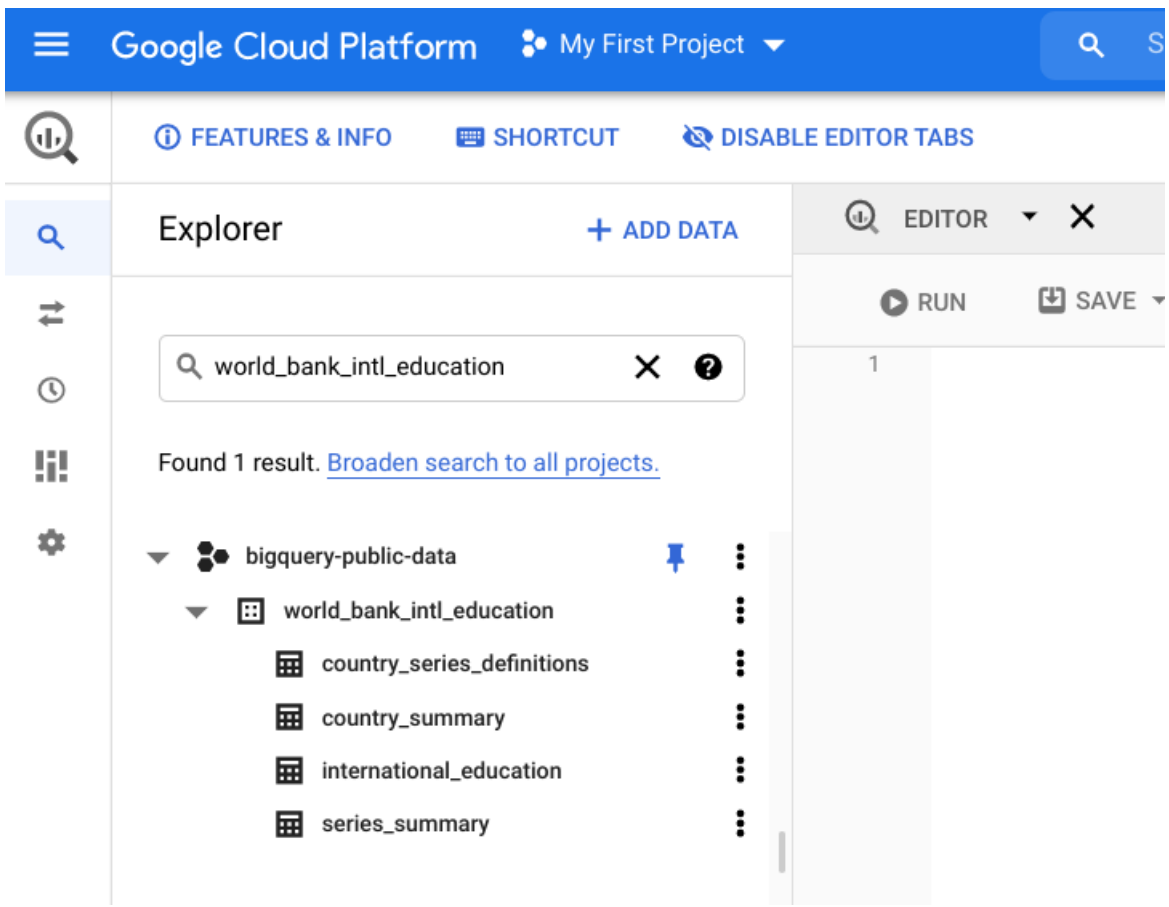
1. Log in to BigQuery Sandbox. If you have a free trial version of BigQuery, you can use that instead. On the BigQuery page, click the Go to BigQuery button.

- Note: BigQuery Sandbox frequently updates its user interface. The latest changes may not be reflected in the screenshots presented in this activity, but the principles remain the same. Adapting to changes in software updates is an essential skill for data analysts, and it's helpful for you to practice troubleshooting. You can also reach out to your community of learners on the discussion forum for help.

2. If you have never created a BigQuery project before, click CREATE PROJECT on the right side of the screen. If you have created a project before, you can use an existing one or create a new one by clicking the project dropdown in the blue header bar and selecting NEW PROJECT.
3. Name your project something that will help you identify it later. You can give it a unique project ID or use an auto-generated one. Don't worry about selecting an organization if you don't know what to put.
4. Now, you'll see the Editor interface. In the middle of the screen is a window where you can type code, and to the left is the Explorer menu where you can search for datasets.
Before you begin joining two tables together, you'll first need to figure out which tables to join together. Recall that two tables must be connected in order to join them. Two tables can be joined if the primary key for one table is included in the other table as a foreign key.
To determine what information the tables contain and identify keys you can join them on, review the schema of the tables. To access the schema:
5. Click + ADD at the top right of the Explorer menu, then click on the Public Datasets option from the resulting dropdown list.
6. In the Search Marketplace search bar, type international education.
7. Click the first result, The World Bank's International Education dataset.
8. Click View Dataset. This will bring you back to the BigQuery Sandbox interface in a new tab.

- Note: You may want to star the bigquery-public-data dropdown to the Explorer menu. You can use this to browse datasets and tables without navigating to the data marketplace in the future.

9. In the Explorer menu, search for world_bank_intl_education. Click the dropdown arrow to expand the dataset. You may also need to click on the SHOW MORE button for the additional subsets to appear.

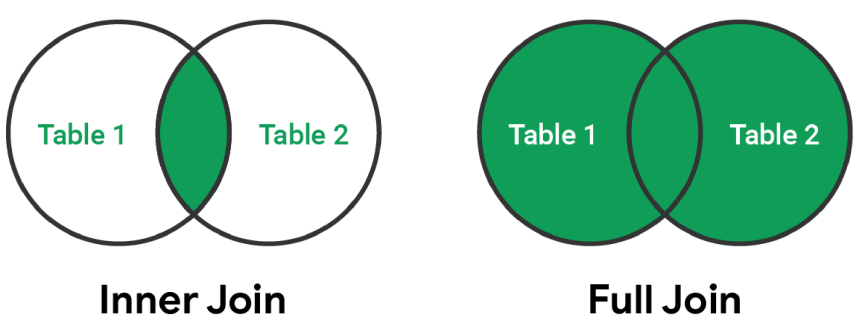


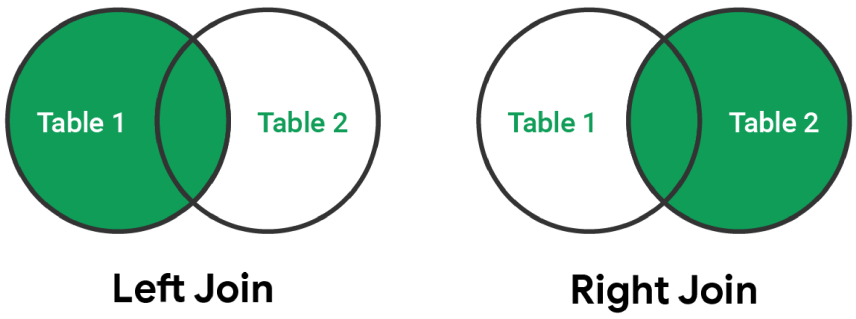
10. Click the international_education table. This will bring up the table's schema. If the schema doesn't appear, click on the Schema tab in the table viewer.
11. Next, select the country_summary table and examine its schema. You'll find that the country_code column appears in both the table schemas.

- Note: Foreign keys don't always have the same names across tables. If you're ever unsure if the columns are the same, you can always double-check. You can click the Details tab from each table and confirm that they contain the same kinds of information.

Review JOINs

Before you join the two tables with queries, take a moment to review the various kinds of JOIN statements.





The two most common kinds of JOIN statements are INNER JOINs and OUTER LEFT JOINs (also known simply as LEFT JOINs). As a review:

- INNER JOIN: Returns only the rows where the target appears in both tables.
- LEFT JOIN: Returns every row from the left table, as well as any rows from the right table with matching keys found in the left table.

Note the difference between the INNER JOIN and LEFT JOIN and the implications for when each should be used. Consider the following queries:

```
-- Let's say table_1 has 100 rows and table_2 has 10 rows.
-- They share 10 keys in common.

-- Using INNER JOIN --> We get 10 rows in our results.
SELECT
    COUNT(*)
FROM
    table_1
INNER JOIN
    table_2
ON table_1.key = table_2.key;

-- Using LEFT JOIN --> We get 100 rows in our results.
SELECT
    COUNT(*)
FROM
    table_1
LEFT JOIN
    table_2
ON table_1.key = table_2.key;
```

The takeaway here is that the sort of JOIN you use matters. When writing a query, you can draw out a Venn diagram like the example graphic above to help you decide which sort of JOIN you need.

Queries with JOINS and aliases

Now, it's time to actually query the dataset. As a starting point, try a query that pulls information from both the international_education and country_summary tables. Copy, paste, and run the following query:

```
SELECT
    `bigquery-public-data.world_bank_intl_education.international_education`.country_name,
    `bigquery-public-data.world_bank_intl_education.country_summary`.country_code,
    `bigquery-public-data.world_bank_intl_education.international_education`.value
FROM
    `bigquery-public-data.world_bank_intl_education.international_education`
INNER JOIN
    `bigquery-public-data.world_bank_intl_education.country_summary`
ON `bigquery-public-data.world_bank_intl_education.country_summary`.country_code = `bigquery-public-data.w
```

This basic query joins the tables on the country_code foreign key, and returns the country name, country code, and value column. This is quite a long, unwieldy query for such a basic result! The length of each table name (which must include the full address for each table for BigQuery to know where to pull the data from) makes this hard to read and work with.
However, you can solve this by setting an alias for each table.

Use descriptive aliases

Try using descriptive aliases that tell you what they represent. This next query is the same query as the previous one, but with aliases to improve readability. Copy, paste, and run the following query:

```
SELECT
    edu.country_name,
    summary.country_code,
    edu.value
FROM
    bigquery-public-data.world_bank_intl_education.international_education AS edu
INNER JOIN
    bigquery-public-data.world_bank_intl_education.country_summary AS summary
ON edu.country_code = summary.country_code
```

This query is much easier to read and understand. Recall that you can set aliases for tables by specifying the alias for the table after the table's name in FROM and/or JOIN statements.
For this example, the international_education table was renamed as edu, and the country_summary table as summary. Using descriptive aliases is a best practice and will help you keep your queries clean, readable, and easy to work with.

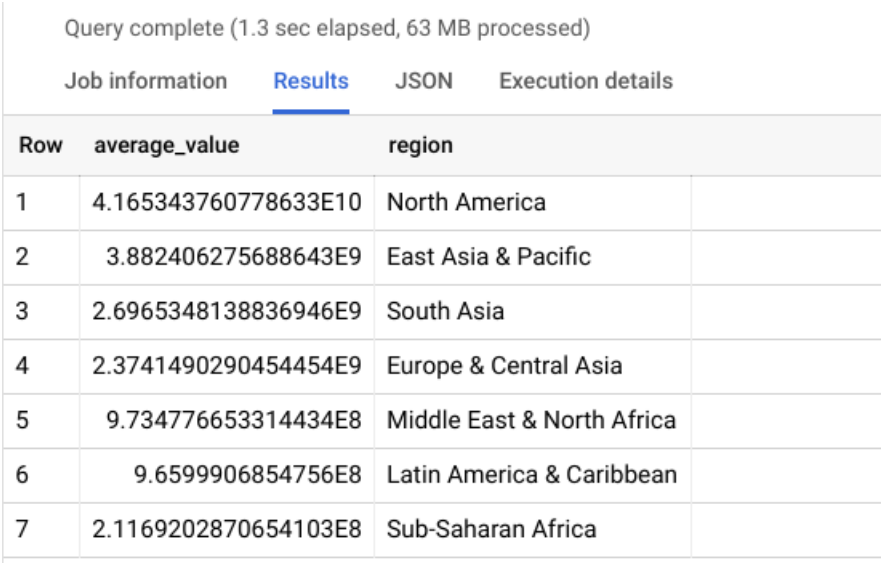
Use a JOIN to answer a question

Now that you've confirmed that the JOIN statement works, try to answer an actual data question using this dataset. What is the average amount of money spent per region on education? Copy, paste, and run the following query:

```
SELECT
    AVG(edu.value) average_value, summary.region
FROM
```

```
4       `bigquery-public-data.world_bank_intl_education.international_education` AS edu
5   INNER JOIN
6       `bigquery-public-data.world_bank_intl_education.country_summary` AS summary
7   ON edu.country_code = summary.country_code
8   WHERE summary.region IS NOT null
9   GROUP BY summary.region
10  ORDER BY average_value DESC
```

Your results should appear like this:



Query complete (1.3 sec elapsed, 63 MB processed)

Job information | Results | JSON | Execution details

Row	average_value	region
1	4.165343760778633E10	North America
2	3.882406275688643E9	East Asia & Pacific
3	2.6965348138836946E9	South Asia
4	2.3741490290454454E9	Europe & Central Asia
5	9.734776653314434E8	Middle East & North Africa
6	9.6599906854756E8	Latin America & Caribbean
7	2.1169202870654103E8	Sub-Saharan Africa

Notice how in this query, an alias is also set to give the AVG(edu.value) a more descriptive name for the temporary table the query returns.

Also note that the WHERE statement excludes rows with any null information. This is necessary to present the data succinctly and display only seven rows for the seven regions represented in the data. However, this WHERE statement means that the results will return the same regardless of which JOIN you use. In the next section, you'll explore a situation where you need to use a specific kind of join in your query...

INNER JOINs versus OUTER JOINs

In the last query, you used an INNER JOIN to find the average amount of money spent per region on education. Because of the WHERE statement in this query, using any kind of JOIN produces the same result.
Now, you will write a LEFT JOIN, a type of OUTER JOIN, for a situation where the type of query you use will change the result you return.

Consider this scenario:

You have been tasked to provide data for a feature sports article on Michael Jordan's basketball career. The writer wants to include a funny twist and asks you to find out if Michael Jordan played better at schools with animal mascots.
To analyze his early career, you start with the years he played basketball in college. You need to examine National Collegiate Athletic Association (NCAA) college basketball stats from 1984.
You'll need a list of all NCAA Division I colleges and universities; their mascots, if applicable; and their number of wins and losses. You can find this information by typing ncaa_basketball in the Explorer tab dataset search bar on BigQuery.
Next, you will start a new query tab by clicking on the blue + button. Your query should join the season statistics from one table with the mascot information from another. You need to use a LEFT JOIN instead of an INNER JOIN because not all teams have mascots. If you use an INNER JOIN, you would exclude teams with no mascot.
To demonstrate this, copy, paste, and run the following query:

```
1   SELECT
2    seasons.market AS university,
3    seasons.name AS team_name,
4    seasons.wins,
5    seasons.losses,
6    seasons.ties,
7    mascots.mascot AS team_mascot
8   FROM
9    `bigquery-public-data.ncaa_basketball.mbb_historical_teams_seasons` AS seasons
10  LEFT JOIN
11   `bigquery-public-data.ncaa_basketball.mascots` AS mascots
12  ON
13   seasons.team_id = mascots.id
14  WHERE
15   seasons.season = 1984
16   AND seasons.division = 1
17  ORDER BY
18   seasons.market
```

This is an example of when a LEFT JOIN is more helpful than an INNER JOIN. With this query, you can look at college basketball statistics to get a better sense of Michael Jordan's early career, find out more information about which teams had mascots, and answer your business question.

Confirmation and reflection

In the last query, you use a LEFT JOIN instead of an INNER JOIN to find the correct information. Beneath the query results, you'll find that the number of rows in your joined table is 281. If you rerun the query with an INNER JOIN instead of a LEFT JOIN, how many rows would it return?

- ○ 274
- ○ 281
- ○ 301
- ○ 324

2. In this activity, you used JOIN statements to combine data from multiple tables. In the text box below, write 2-3 sentences (40-60 words) in response to each of the following questions.
   - Why do you think JOIN statements are important for working with databases?
   - How do you distinguish INNER JOINS from OUTER JOINS?