Working with JSON, Arrays, and Structs in BigQuery

GSP416

Google Cloud Self-Paced Labs

- BigQuery is Google's fully managed, serverless analytics database for querying massive datasets with SQL under a pay-as-you-go model, without infrastructure overhead.
- This lab dives deep into handling semi-structured data like JSON and arrays directly within BigQuery tables.
- You'll denormalize schemas into single tables using nested and repeated fields for better query performance.
- Practice loading, querying, troubleshooting, and unnesting complex semi-structured datasets effectively.
- Master the tricky SQL syntax required for array operations and nested field manipulations.

Lab setup instructions and requirements

End Lab 01:52:07 Time limit

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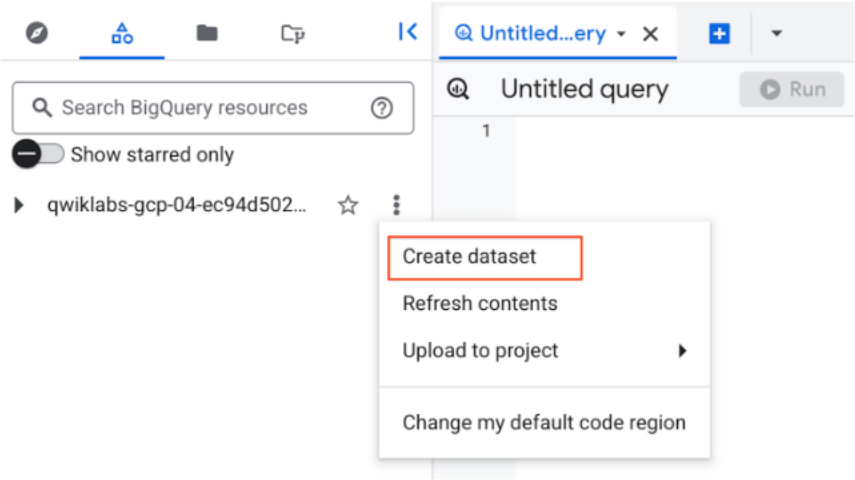
Username
student-02-7be6421b583d

Password
vXCkUvp8ZJ01

Project ID
qwiklabs-gcp-01-d0a9af8

Task 1. Create a new dataset to store the tables

1. In your BigQuery, click the three dots next to your Project ID and select **Create dataset**:



2. Set the **Dataset ID** to `fruit_store`. Leave the other options at their default values (Data Location, Default Expiration).

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Task 6. Practice with STRUCTs and arrays
Task 7. Lab question: STRUCT()

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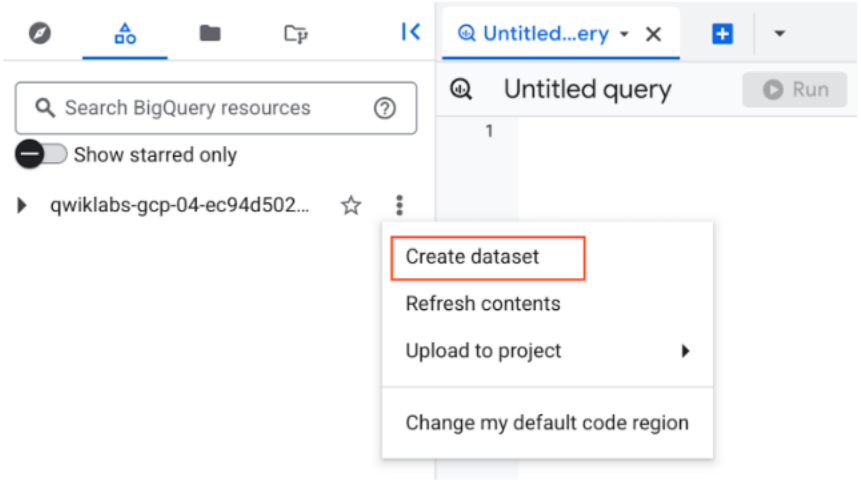
dataset:



2. Set the **Dataset ID** to `fruit_store`. Leave the other options at their default values (Data Location, Default Expiration).

3. Click **Create dataset**.

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Welcome to BigQuery in the Cloud Console

New to the BigQuery UI?

The BigQuery UI helps you complete tasks like running queries, loading data, and even creating and training ML models. Check out the BigQuery quickstart guide to learn how to start performing data analysis on Google Cloud.

Learn about new features

New improvements and updates are constantly on the way. We recommend periodically checking our release notes to stay up to date on what's new.

Done

Organize and share code assets Preview

The new **Files** explorer provides a dedicated view to organize your BigQuery assets (saved queries, notebooks, and more) into folders.

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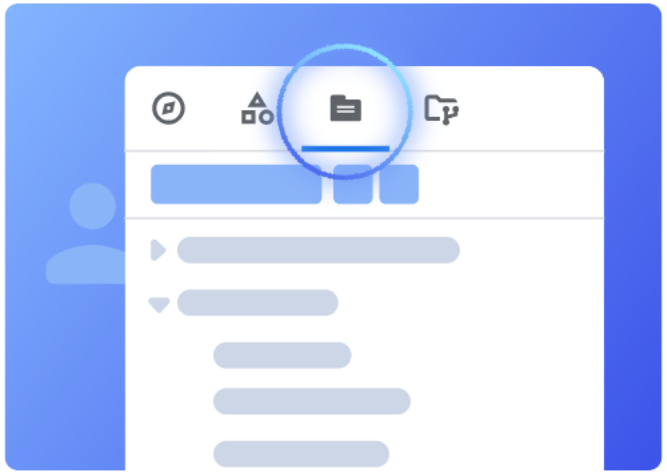
- Upload to project
- Change my default code region

Notebook gallery

Check out what's new in Studio



Organize and share code assets Preview

The new **Files** explorer provides a dedicated view to organize your BigQuery assets (saved queries, notebooks, and more) into folders.

To get started with better project management and easier collaboration, click the Files icon at the top of

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Create dataset – BigQuery – qwi

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- Files explorer
- Gemini in queries
- Apache Spark
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- Notebook gallery

Organize and share

The new Files explorer pr
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Create dataset

Project ID *
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Dataset ID *
fruit_store

Letters, numbers, and underscores allowed

Some locations have been restricted due to a policy set by your organization. Learn more about restricting locations.

Data location

Tags

Advanced options

Create dataset | Cancel

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Task 2. Practice working with arrays in SQL

Normally in SQL you will have a single value for each row like this list of fruits below:

Row	Fruit
1	raspberry
2	blackberry
3	strawberry
4	cherry

What if you wanted a list of fruit items for each person at the store? It could look something like this:

Row	Fruit	Person
1	raspberry	sally
2	blackberry	sally
3	strawberry	sally
4	cherry	sally

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End Lab 01:46:24 Time limit

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People. That process is called normalization (going from one table to many). This is a common approach for transactional databases like mySQL.

For data warehousing, data analysts often go the reverse direction (denormalization) and bring many separate tables into one large reporting table.

What are some potential issues if you stored all your data in one giant table?

- The table row size could be too large for traditional reporting databases
- Any changes to a value (like customer email) could impact many other rows (like all their orders)
- Data at differing levels of granularity could lead to reporting issues because less granular fields would be repeated.
- ✓ All of the above

Submit

Now, you're going to learn a different approach that stores data at different levels of

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Submit

Now, you're going to learn a different approach that stores data at different levels of granularity all in one table using repeated fields:

Row	Fruit (array)	Person
1	raspberry	sally
	blackberry	
	strawberry	
	cherry	
2	orange	frederick
	apple	

What looks strange about the previous table?

- It's only two rows.
- There are multiple field values for Fruit in a single row.
- The people are associated with all of the field values.

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2	orange	frederick
	apple	

What looks strange about the previous table?

- It's only two rows.
- There are multiple field values for Fruit in a single row.
- The people are associated with all of the field values.

What the key insight? The `array` data type!

An easier way to interpret the Fruit array:

Row	Fruit (array)	Person
1	[raspberry, blackberry, strawberry, cherry]	sally
2	[orange, apple]	frederick

Both of these tables are exactly the same. There are two key learnings here:

- An array is simply a list of items in brackets [ ]
- BigQuery visually displays arrays as *flattened*. It simply lists the value in the array vertically (note that all of those values still belong to a single row)

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- An array is simply a list of items in brackets [ ]
- BigQuery visually displays arrays as *flattened*. It simply lists the value in the array vertically (note that all of those values still belong to a single row)

Try it yourself.

1. Enter the following in the BigQuery Query Editor:

```
#standardSQL
SELECT
['raspberry', 'blackberry', 'strawberry', 'cherry'] AS
fruit_array
```

2. Click **Run**.

3. Now try executing this one:

```
#standardSQL
SELECT
['raspberry', 'blackberry', 'strawberry', 'cherry', 1234567] AS
fruit_array
```

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End Lab 01:45:26 Time limit

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Project ID
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```

2. Click **Run**.

3. Now try executing this one:

```
#standardSQL
SELECT
['raspberry', 'blackberry', 'strawberry', 'cherry', 1234567] AS
fruit_array
```

You should get an error that looks like the following:

Error: `Array elements of types {INT64, STRING} do not have a common supertype at [3:1]`

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fruit_store

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Untitled query | Run | Save | Download | Share | Schedule | Open in

```
#standardSQL
SELECT
['raspberry', 'blackberry', 'strawberry', 'cherry'] AS fruit_array
```

Query completed

Query results | Save results | Open in

Job information | Results | Visualization | JSON | Execution details | Execution graph

Row	fruit_array
1	raspberry
	blackberry
	strawberry
	cherry

Results per page: 50 | 1 – 1 of 1

Job history | Show

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```
#standardSQL
SELECT
['raspberry', 'blackberry', 'strawberry', 'cherry', 1234567] AS fruit_array
```

Query completed with errors

Query results | Save results | Open in

Job information | Results | Execution details | Execution graph

Array elements of types {INT64, STRING} do not have a common supertype at [3:1]

Job history | Show

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You should get an error that looks like the following:

Error: `Array elements of types {INT64, STRING} do not have a common supertype at [3:1]`

Why did you get this error?

- Data in an array must only be strings
- ✓ Data in an array [ ] must all be the same type
- Data in an array cannot exceed 4 elements

Submit

Arrays can only share one data type (all strings, all numbers).

4. Here's the final table to query against:

```
#standardSQL
SELECT person, fruit_array, total_cost FROM `data-to-
```

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Arrays can only share one data type (all strings, all numbers).

4. Here's the final table to query against:

```
#standardSQL
SELECT person, fruit_array, total_cost FROM `data-to-insights.advanced.fruit_store`;
```

5. Click **Run**.

6. After viewing the results, click the **JSON** tab to view the nested structure of the results.

Query results Save results Open in

Job information | Results | Visualization | JSON | Execution details | Execution graph


```
[{
  "person": ["sally"],
  "fruit_array": ["raspberry", "blackberry", "strawberry", "cherry"],
  "total_cost": ["10.99"]
}, {
  "person": ["frederick"],
  "fruit_array": ["orange", "apple"],
  "total_cost": ["5.55"]
}]
```


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Untitled query | Run | Save | Download | Share | Schedule | Open in

```
#standardSQL
SELECT person, fruit_array, total_cost FROM `data-to-insights.advanced.fruit_store`;
```

Query completed

Using on-demand processing quota

Query results | Save results | Open in

Job information | Results | Visualization | JSON | Execution details | Execution graph

Row	person	fruit_array	total_cost
1	sally	raspberry	10.99
		blackberry	
		strawberry	
		cherry	
2	frederick	orange	5.55
		apple	

Results per page: 50 | 1 – 2 of 2

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Untitled query | Run | Save | Download | Share | Schedule | Open in

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}, {
  "person": ["frederick"],
  "fruit_array": ["orange", "apple"],
  "total_cost": ["5.55"]
}]
```


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Loading semi-structured JSON into BigQuery

What if you had a JSON file that you needed to ingest into BigQuery?

Create a new table `fruit_details` in the dataset.

1. Click on `fruit_store` dataset.

Now you will see the **Create Table** option.

Note: You may have to widen your browser window to see the Create table option.

2. Add the following details for the table:

- **Source**: Choose **Google Cloud Storage** in the **Create table from** dropdown.
- **Select file from Cloud Storage bucket**: `spls/gsp416/data-insights-course/labs/optimizing-for-performance/shopping_cart.json`
- **File format**: JSONL (Newline delimited JSON)

3. Call the new table `fruit_details`.

4. Check the checkbox of **Schema (Auto-detect)**

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- **Source**: Choose **Google Cloud Storage** in the **Create table from** dropdown.
- **Select file from Cloud Storage bucket**: `spls/gsp416/data-insights-course/labs/optimizing-for-performance/shopping_cart.json`
- **File format**: JSONL (Newline delimited JSON)

3. Call the new table `fruit_details`.

4. Check the checkbox of **Schema (Auto detect)**.

5. Click **Create table**.

In the schema, note that `fruit_array` is marked as REPEATED which means it's an

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- Dataform
- Scheduled queries
- Scheduling

Governance

- Sharing (Analytics Hub)
- Policy tags
- Metadata curation

Administration

- Partner Center
- Settings Preview
- Release Notes

Search BigQuery resources

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fruit_store

Show more

Open
Open in
Create table
Create ML model
Share
Copy ID
Refresh contents
Delete

*Untitled...ery | *Untitled...ery | *Untitled...ery

Untitled query | Run | Save | Download | Share | Schedule | Open in

```
#standardSQL
SELECT person, fruit_array, total_cost FROM `data-to-insights.advanced.fruit_store`;
```

Query completed

Using on-demand processing quota

ults | Save results | Open in

tion | Results | Visualization | JSON | Execution details | Execution graph


```
["sally"],
ray": ["raspberry", "blackberry", "strawberry", "cherry"],
st": ["10.99"]

["frederick"],
ray": ["orange", "apple"],
st": ["5.55"]
```


Job history | Show

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Create table – BigQuery – qwikla

https://console.cloud.google.com/bigquery?project=qwiklabs-gcp-01-d0a9af8ff455&ws=!1m5!1m4!1m3!1sqwiklabs-gcp-01-d0a9af8ff455!2sbqu...

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- Repositories
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- Connections
- fruit_store

Create table

Source

Create table from
Google Cloud Storage

Select file from GCS bucket or use a URI pattern *
spls/gsp416/data-insights-course/labs/optimizing-for-performance/shopping_cart.json
Browse

File format
JSONL (Newline delimited JSON)

☐ Source Data Partitioning

Destination

Project *
qwiklabs-gcp-01-d0a9af8ff455
Browse

Dataset *
fruit_store

Table *
fruit_details

Maximum name size is 1,024 UTF-8 bytes. Unicode letters, marks, numbers, connectors, dashes, and spaces are allowed.

Table type
Native table

Create table | Cancel

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Create table – BigQuery – qwikla

https://console.cloud.google.com/bigquery?project=qwiklabs-gcp-01-d0a9af8ff455&ws=!1m5!1m4!1m3!1sqwiklabs-gcp-01-d0a9af8ff455!2sbqu...

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- Repositories
- Queries
- Notebooks
- Data canvases
- Data preparations
- Pipelines
- Connections
- fruit_store

Create table

Destination

Project *
qwiklabs-gcp-01-d0a9af8ff455 Browse

Dataset *
fruit_store

Table *
fruit_details

Maximum name size is 1,024 UTF-8 bytes. Unicode letters, marks, numbers, connectors, dashes, and spaces are allowed.

Table type
Native table

Schema

☑ Auto detect

Schema will be automatically generated.

Partitioning settings

- (●) No partitioning
- ( ) Partition by ingestion time
- ( ) Partition by field
  To partition by field, you must first add fields to the schema above.

Create table | Cancel

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BigQuery – qwiklabs-gcp-01-d0a

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  - Connections
  - fruit_store
    - fruit_details

Show more

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qwiklabs-gcp-01-d0a9af8ff455 / Datasets / fruit_store / Tables / fruit_details

fruit_details

Query | Open in | Share | Copy | Snapshot | Delete | Export | Refresh

Schema | Details | Preview | Table Explorer Preview | Insights | Lineage | Data Profile | Data Quality

Row	total_cost	fruit_array	person
1	10.99	raspberry	sally
		blackberry	
		strawberry	
		cherry	
2	5.55	orange	frederick
		apple	

Results per page: 50 | 1 – 2 of 2

Job history | Show

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Task 3. Create your own arrays with ARRAY_AGG()

Don't have arrays in your tables already? You can create them!

1. **Copy and paste** the below query to explore this public dataset:

```
SELECT
  fullVisitorId,
  date,
  v2ProductName,
  pageTitle
  FROM `data-to-insights.ecommerce.all_sessions`
WHERE visitId = 1501570398
ORDER BY date
```

2. Click **Run** and view the results.

How many rows are returned?

Overview
Setup and requirements
Task 1. Create a new dataset to store the tables
Task 2. Practice working with arrays in SQL
Task 3. Create your own arrays with ARRAY_AGG()
Task 4. Query tables containing arrays
Task 5. Introduction to STRUCTs
Task 6. Practice with STRUCTs and arrays
Task 7. Lab question: STRUCT()

BigQuery – qwiklabs-gcp-01-d0a

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  - Connections
  - fruit_store
    - fruit_details

Show more

Untitled query | Run | Save | Download | Share | Schedule | Open in | More

```
SELECT
  fullVisitorId,
  date,
  v2ProductName,
  pageTitle
  FROM `data-to-insights.ecommerce.all_sessions`
WHERE visitId = 1501570398
ORDER BY date
```

Query completed

Using on-demand processing quota

Query results | Save results | Open in

Job information | Results | Visualization | JSON | Execution details | Execution graph

Row	fullVisitorId	date	v2ProductName	pageTitle
1	5710379250208908569	20170731	Google Snapback Hat Black	Google RFID Journal
2	5710379250208908569	20170731	Google Women's Lightweight Mi...	Google Snapback Hat Black
3	5710379250208908569	20170801	Switch Tone Color Crayon Pen	Office | Google Merchandise St...
4	5710379250208908569	20170801	Micro Wireless Earbud	Electronics | Google Merchandi

Results per page: 50 | 1 – 50 of 111

Job history | Show

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2. Click **Run** and view the results.

How many rows are returned?

- 70
- 2
- ✓ 111
- 100

Submit

Now, use the `ARRAY_AGG()` function to aggregate our string values into an array.

3. **Copy and paste** the below query to explore this public dataset:

```
SELECT
  fullVisitorId,
  date,
  ARRAY_AGG(v2ProductName) AS products_viewed,
```


Overview
Setup and requirements
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Task 4. Query tables containing arrays
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Task 6. Practice with STRUCTs and arrays
Task 7. Lab question: STRUCT()

100

Submit

Now, use the `ARRAY_AGG()` function to aggregate our string values into an array.

3. **Copy and paste** the below query to explore this public dataset:

```
SELECT
  fullVisitorId,
  date,
  ARRAY_AGG(v2ProductName) AS products_viewed,
  ARRAY_AGG(pageTitle) AS pages_viewed
  FROM `data-to-insights.ecommerce.all_sessions`
WHERE visitId = 1501570398
GROUP BY fullVisitorId, date
ORDER BY date
```

4. Click **Run** and view the results

How many rows are returned?

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BigQuery – qwiklabs-gcp-01-d0a

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  - Connections
  - fruit_store
    - fruit_details

Show more

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Untitled query | Run | Save | Download | Share | Schedule | Open in | More

```
SELECT
  fullVisitorId,
  date,
  ARRAY_AGG(v2ProductName) AS products_viewed,
  ARRAY_AGG(pageTitle) AS pages_viewed
  FROM `data-to-insights.ecommerce.all_sessions`
WHERE visitId = 1501570398
GROUP BY fullVisitorId, date
ORDER BY date
```

Query completed

Using on-demand processing quota

Query results

Save results | Open in

Job information | Results | Visualization | JSON | Execution details | Execution graph

Row	fullVisitorId	date	products_viewed	pages_viewed
1	5710379250208908569	20170731	Google Snapback Hat Black	Google RFID Journal
			Google Women's Lightweight Mi...	Google Snapback Hat Black
2	5710379250208908569	20170801	Seat Pack Organizer	Office | Google Merchandise St...
			Keyboard DOT Sticker	Office | Google Merchandise St

Results per page: 50 | 1 – 2 of 2

Job history | Show

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Lab setup instructions and requirements

End Lab 01:35:40 Time limit

Caution: When you are in the console, do not deviate from the lab instructions. Doing so may cause your account to be blocked. Learn more.

Open Google Cloud console

Username
student-02-7be6421b583d

Password
vXCkUvp8ZJO1

Project ID
qwiklabs-gcp-01-d0a9af8

4. Click **Run** and view the results

How many rows are returned?

- ✓ 2 - one for each day
- 100 - one for each day
- 70 - one for each day
- 63 - one for each day

Submit

5. Next, use the `ARRAY_LENGTH()` function to count the number of pages and products that were viewed:

```
SELECT
  fullVisitorId,
  date,
  ARRAY_AGG(v2ProductName) AS products_viewed,
```

20/100
Overview
Setup and requirements
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Task 4. Query tables containing arrays
Task 5. Introduction to STRUCTs
Task 6. Practice with STRUCTs and arrays
Task 7. Lab question: STRUCT()

63 - one for each day

Submit

5. Next, use the `ARRAY_LENGTH()` function to count the number of pages and products that were viewed:

```
SELECT
  fullVisitorId,
  date,
  ARRAY_AGG(v2ProductName) AS products_viewed,
  ARRAY_LENGTH(ARRAY_AGG(v2ProductName)) AS num_products_viewed,
  ARRAY_AGG(pageTitle) AS pages_viewed,
  ARRAY_LENGTH(ARRAY_AGG(pageTitle)) AS num_pages_viewed
  FROM `data-to-insights.ecommerce.all_sessions`
WHERE visitId = 1501570398
GROUP BY fullVisitorId, date
ORDER BY date
```

How many pages were visited by this user on 20170801?

Overview
Setup and requirements
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BigQuery – qwiklabs-gcp-01-d0a

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  - fruit_store
    - fruit_details

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Untitled query | Run | Save | Download | Share | Schedule | Open in | More

```
SELECT
  fullVisitorId,
  date,
  ARRAY_AGG(v2ProductName) AS products_viewed,
  ARRAY_LENGTH(ARRAY_AGG(v2ProductName)) AS num_products_viewed,
  ARRAY_AGG(pageTitle) AS pages_viewed,
  ARRAY_LENGTH(ARRAY_AGG(pageTitle)) AS num_pages_viewed
  FROM `data-to-insights.ecommerce.all_sessions`
WHERE visitId = 1501570398
```

Query completed

Using on-demand processing quota

Query results

Save results | Open in

Job information | Results | Visualization | JSON | Execution details | Execution graph

Row	fullVisitorId	date	products_viewed	num_products_vi...	pages_viewed	num_pages_view...
1	5710379250208908569	20170731	Google Snapback Hat Black	2	Google RFID Journal	2
			Google Women's Lightweight Mi...		Google Snapback Hat Black	
2	5710379250208908569	20170801	Switch Tone Color Crayon Pen	109	Fun | Accessories | Google Mer...	109
			Recycled Mouse Pad		Accessories | Google Merchand	

Results per page: 50 | 1 – 2 of 2

Job history | Show

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  - fruit_store
    - fruit_details

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```
1 SELECT
```

Query completed

Using on-demand processing quota

Query results

Save results | Open in

Job information | Results | Visualization | JSON | Execution details | Execution graph

date	products_viewed	num_products_viewed	pages_viewed	num_pages_viewed
20170731	Google Snapback Hat Black	2	Google RFID Journal	2
	Google Women's Lightweight Mi...		Google Snapback Hat Black	
20170801	Switch Tone Color Crayon Pen	109	Fun | Accessories | Google Mer...	109
	Recycled Mouse Pad		Accessories | Google Merchand...	
	Metal Texture Roller Pen		Writing Instruments | Office | Go...	
	Ballpoint Stylus Pen		Writing Instruments | Office | Go...	
	Android RFID Journal		Office | Google Merchandise St...	
	Google Laptop and Cell Phone ...		Office | Google Merchandise St...	

Results per page: 50 | 1 – 2 of 2

Job history | Show

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Lab setup instructions and requirements

End Lab 01:34:34 Time limit

Caution: When you are in the console, do not deviate from the lab instructions. Doing so may cause your account to be blocked. Learn more.

Open Google Cloud console

Username
student-02-7be6421b583d

Password
vXCkUvp8ZJO1

Project ID
qwiklabs-gcp-01-d0a9af8

```
  ARRAY_AGG(pageTitle) AS pages_viewed,
  ARRAY_LENGTH(ARRAY_AGG(pageTitle)) AS num_pages_viewed
  FROM `data-to-insights.ecommerce.all_sessions`
WHERE visitId = 1501570398
GROUP BY fullVisitorId, date
ORDER BY date
```

How many pages were visited by this user on 20170801?

- 70
- 8
- 101
- ✓ 109

Submit

6. Next, deduplicate the pages and products so you can see how many unique products were viewed by adding `DISTINCT` to `ARRAY_AGG()`:

20/100
Overview
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Task 6. Practice with STRUCTs and arrays
Task 7. Lab question: STRUCT()

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Lab setup instructions and requirements

End Lab 01:33:55 Time limit

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Open Google Cloud console

Username
student-02-7be6421b583d

Password
vXCkUvp8ZJO1

Project ID
qwiklabs-gcp-01-d0a9af8

✓ 109

Submit

6. Next, deduplicate the pages and products so you can see how many unique products were viewed by adding `DISTINCT` to `ARRAY_AGG()`:

```
SELECT
  fullVisitorId,
  date,
  ARRAY_AGG(DISTINCT v2ProductName) AS products_viewed,
  ARRAY_LENGTH(ARRAY_AGG(DISTINCT v2ProductName)) AS
distinct_products_viewed,
  ARRAY_AGG(DISTINCT pageTitle) AS pages_viewed,
  ARRAY_LENGTH(ARRAY_AGG(DISTINCT pageTitle)) AS
distinct_pages_viewed
  FROM `data-to-insights.ecommerce.all_sessions`
WHERE visitId = 1501570398
GROUP BY fullVisitorId, date
ORDER BY date
```

20/100
Overview
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BigQuery – qwiklabs-gcp-01-d0a

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  - fruit_store
    - fruit_details

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```
SELECT
  fullVisitorId,
  date,
  ARRAY_AGG(DISTINCT v2ProductName) AS products_viewed,
  ARRAY_LENGTH(ARRAY_AGG(DISTINCT v2ProductName)) AS distinct_products_viewed,
  ARRAY_AGG(DISTINCT pageTitle) AS pages_viewed,
  ARRAY_LENGTH(ARRAY_AGG(DISTINCT pageTitle)) AS distinct_pages_viewed
  FROM `data-to-insights.ecommerce.all_sessions`
WHERE visitId = 1501570398
```

Query completed

Using on-demand processing quota

Query results

Save results | Open in

Job information | Results | Visualization | JSON | Execution details | Execution graph

Row	fullVisitorId	date	products_viewed	distinct_products...	pages_viewed	distinct_pages_vi...
1	5710379250208908569	20170731	Google Snapback Hat Black	2	Google RFID Journal	2
			Google Women's Lightweight Mi...		Google Snapback Hat Black	
2	5710379250208908569	20170801	Android RFID Journal	61	Office | Google Merchandise St...	8
			8 pc Android Sticker Sheet		Accessories | Google Merchand	

Results per page: 50 | 1 – 2 of 2

Job history | Show

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  - Connections
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Show more

Untitled query | Run | Save | Download | Share | Schedule | Open in | More

```
1 SELECT
2   fullVisitorId
```

Query completed

Using on-demand processing quota

Query results

Save results | Open in

Job information | Results | Visualization | JSON | Execution details | Execution graph

date	products_viewed	distinct_products_viewed	pages_viewed	distinct_pages_viewed
20170731	Google Snapback Hat Black	2	Google RFID Journal	2
	Google Women's Lightweight Mi...		Google Snapback Hat Black	
20170801	Android RFID Journal	61	Office | Google Merchandise St...	8
	8 pc Android Sticker Sheet		Accessories | Google Merchand...	
	Android Wool Heather Cap Heat...		Writing Instruments | Office | Go...	
	Windup Android		Electronics | Google Merchandi...	
	Recycled Mouse Pad		Shop by Brand | Google Mercha...	
	Android Hard Cover Journal		Fun | Accessories | Google Mer...	

Results per page: 50 | 1 – 2 of 2

Job history | Show

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Lab setup instructions and requirements

End Lab 01:32:54 Time limit

Caution: When you are in the console, do not deviate from the lab instructions. Doing so may cause your account to be blocked. Learn more.

Open Google Cloud console

Username
student-02-7be6421b583d

Password
vXCkUvp8ZJO1

Project ID
qwiklabs-gcp-01-d0a9af8

Task 4. Query tables containing arrays

The BigQuery Public Dataset for Google Analytics `bigquery-public-data.google_analytics_sample` has many more fields and rows than our course dataset `data-to-insights.ecommerce.all_sessions`. More importantly, it already stores field values like products, pages, and transactions natively as ARRAYs.

1. **Copy and paste** the below query to explore the available data and see if you can find fields with repeated values (arrays):

```
SELECT
  *
FROM `bigquery-public-data.google_analytics_sample.ga_sessions_20170801`
WHERE visitId = 1501570398
```

2. **Run** the query.

3. **Scroll right** in the results until you see the `hits.product.v2ProductName` field (multiple field aliases are discussed shortly).

20/100
Overview
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Task 6. Practice with STRUCTs and arrays
Task 7. Lab question: STRUCT()

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BigQuery – qwiklabs-gcp-01-d0a

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Sandbox Set up billing to upgrade to the full BigQuery experience. Learn more | Dismiss | Upgrade

Search BigQuery resources

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  - Notebooks
  - Data canvases
  - Data preparations
  - Pipelines
  - Connections
  - fruit_store
    - fruit_details

Show more

Untitled query | Run | Save | Download | Share | Schedule | Open in | More

```
SELECT
  *
FROM `bigquery-public-data.google_analytics_sample.ga_sessions_20170801`
WHERE visitId = 1501570398
```

Query completed

Using on-demand processing quota

Query results

Save results | Open in

Job information | Results | Visualization | JSON | Execution details | Execution graph

Row	visitorId	visitNumber	visitId	visitStartTime	date	totals. visits	totals. hits	totals. pageviews
1	null	1	1501570398	1501570840	20170801	1	11	

Results per page: 50 | 1 – 1 of 1

Job history | Show

Low visibility Now | Search | ENG IN | 10:00 AM 31-12-2025

Lab setup instructions and requirements

End Lab 01:31:37 Time limit

Caution: When you are in the console, do not deviate from the lab instructions. Doing so may cause your account to be blocked. Learn more.

Open Google Cloud console

Username
student-02-7be6421b583d

Password
vXCkUvp8ZJO1

Project ID
qwiklabs-gcp-01-d0a9af8

```
WHERE visitId = 1501570398
```

2. **Run** the query.

3. **Scroll right** in the results until you see the `hits.product.v2ProductName` field (multiple field aliases are discussed shortly).

You'll note a lot of seemingly 'blank' values in the results as you scroll. Why do you think that is?

- BigQuery is still loading the data for those fields
- The dataset is missing data values for those fields
- ✓ The fields that appear to be missing data are actually at a higher level of granularity than other fields

Submit

The amount of fields available in the Google Analytics schema can be overwhelming for analysis.

35/100
Overview
Setup and requirements
Task 1. Create a new dataset to store the tables
Task 2. Practice working with arrays in SQL
Task 3. Create your own arrays with ARRAY_AGG()
Task 4. Query tables containing arrays
Task 5. Introduction to STRUCTs
Task 6. Practice with STRUCTs and arrays
Task 7. Lab question: STRUCT()

11°C Mostly sunny
Search
ENG IN
10:01 AM 31-12-2025

The amount of fields available in the Google Analytics schema can be overwhelming for analysis.

4. Try to query just the visit and page name fields like before:

```
SELECT
  visitId,
  hits.page.pageTitle
FROM `bigquery-public-data.google_analytics_sample.ga_sessions_20170801`
WHERE visitId = 1501570398
```

You will get an error: **Error:** `Cannot access field page on a value with type ARRAY<STRUCT<hitNumber INT64, time INT64, hour INT64, ...>> at [3:8]`

Before you can query REPEATED fields (arrays) normally, you must first break the arrays back into rows.

For example, the array for `hits.page.pageTitle` is stored currently as a single row like:

Overview
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BigQuery – qwiklabs-gcp-01-d0a

https://console.cloud.google.com/bigquery?project=qwiklabs-gcp-01-d0a9af8ff455&ws=!1m15!1m4!1m3!1sqwiklabs-gcp-01-d0a9af8ff455!2sbq...

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  - fruit_store
    - fruit_details

Show more

*Untitled...ery | *Untitled...ery | *Untitled...ery | *Untitled...ery | *Untitled...ery

Untitled query

Run | Save | Download | Share | Schedule | Open in | More

```
SELECT
  visitId,
  hits.page.pageTitle
FROM `bigquery-public-data.google_analytics_sample.ga_sessions_20170801`
WHERE visitId = 1501570398
```

Query completed with errors

Query results

Save results | Open in

Job information | Results | Execution details | Execution graph

Cannot access field page on a value with type ARRAY<STRUCT<hitNumber INT64, time INT64, hour INT64, ...>> at [3:8]

Job history

Show

11°C Mostly sunny

Search

ENG IN

10:01 AM 31-12-2025

```
'product page',
'checkout']
```

How do you do that with SQL?

Answer: Use the UNNEST() function on your array field:

```
SELECT DISTINCT
  visitId,
  h.page.pageTitle
FROM `bigquery-public-
data.google_analytics_sample.ga_sessions_20170801`,
UNNEST(hits) AS h
WHERE visitId = 1501570398
LIMIT 10
```

We'll cover UNNEST() more in detail later but for now just know that:

- You need to UNNEST() arrays to bring the array elements back into rows
- UNNEST() always follows the table name in your FROM clause (think of it conceptually like a pre-joined table)

Overview
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Task 7. Lab question: STRUCT()

BigQuery – qwiklabs-gcp-01-d0a

https://console.cloud.google.com/bigquery?project=qwiklabs-gcp-01-d0a9af8ff455&ws=!1m15!1m4!1m3!1sqwiklabs-gcp-01-d0a9af8ff455!2sbq...

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Google Cloud | qwiklabs-gcp-01-d0a9af8ff455 | Search (/) for resources, docs, products, and more | Search

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Search BigQuery resources

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  - Notebooks
  - Data canvases
  - Data preparations
  - Pipelines
  - Connections
  - fruit_store
    - fruit_details

Show more

*Untitled...ery | *Untitled...ery | *Untitled...ery | *Untitled...ery | *Untitled...ery

Untitled query | Run | Save | Download | Share | Schedule | Open in | More

```
SELECT DISTINCT
  visitId,
  h.page.pageTitle
FROM `bigquery-public-data.google_analytics_sample.ga_sessions_20170801`,
UNNEST(hits) AS h
WHERE visitId = 1501570398
LIMIT 10
```

Query completed

Using on-demand processing quota

Query results | Save results | Open in

Job information | Results | Visualization | JSON | Execution details | Execution graph

Row	visitId	pageTitle
1	1501570398	Fun | Accessories | Google Mer...
2	1501570398	Home
3	1501570398	Shop by Brand | Google Mercha...
4	1501570398	Office | Google Merchandise St...

Results per page: 50 | 1 – 9 of 9

Job history | Show

11°C Mostly sunny | Search | ENG IN | 10:02 AM 31-12-2025

Task 5. Introduction to STRUCTs

You may have wondered why the field alias `hit.page.pageTitle` looks like three fields in one separated by periods. Just as ARRAY values give you the flexibility to *go deep* into the granularity of your fields, another data type allows you to *go wide* in your schema by grouping related fields together. That SQL data type is the STRUCT data type.

The easiest way to think about a STRUCT is to consider it conceptually like a separate table that is already pre-joined into your main table.

A STRUCT can have:

- One or many fields in it
- The same or different data types for each field
- It's own alias

Sounds just like a table right?

Explore a dataset with STRUCTs

1. To open the **bigquery-public-data** dataset, in the **Classic explorer** pane switch to **Explorer** tab, click **+Add Data**.In the left pane, click **Star a project by name**

Overview
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Task 4. Query tables containing arrays
Task 5. Introduction to STRUCTs
Task 6. Practice with STRUCTs and arrays
Task 7. Lab question: STRUCT()

Lab setup instructions and requirements

End Lab 01:29:23 Time limit

Caution: When you are in the console, do not deviate from the lab instructions. Doing so may cause your account to be blocked. Learn more.

Open Google Cloud console

Username
student-02-7be6421b583d

Password
vXCkUvp8ZJO1

Project ID
qwiklabs-gcp-01-d0a9af8

Explore a dataset with STRUCTs

1. To open the **bigquery-public-data** dataset, in the **Classic explorer** pane switch to **Explorer** tab, click **+Add Data**.In the left pane, click **Star a project by name** and enter the name `bigquery-public-data`
2. Click **Star**.

The `bigquery-public-data` project is listed in the Explorer section.

3. Open **bigquery-public-data**.
4. Click **Datasets**.
5. Find and open **google_analytics_sample** dataset.
6. Click the **ga_sessions_20170801** table.
7. Start scrolling through the schema and answer the following question by using the find feature of your browser.

In a BigQuery schema, a STRUCT field is noted as a RECORD Type. Search for RECORD in the Google Analytics schema. How many

50/100
Overview
Setup and requirements
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BigQuery – qwiklabs-gcp-01-d0a

https://console.cloud.google.com/bigquery?project=qwiklabs-gcp-01-d0a9af8ff455

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Explorer | + Add data

Search for resources

- Home
- Starred
- Shared with me
- Job history

qwiklabs-gcp-01-d0a9af8ff455

- Datasets
- Connections
- Queries
- (Classic) Queries
- Notebooks
- Data canvases
- Data preparations
- Pipelines
- Repositories

*Untitled...ery | *Untitled...ery | *Untitled...ery

Untitled query | Run | Save | Download | Share

```
SELECT DISTINCT
  visitId,
  h.page.pageTitle
FROM `bigquery-public-data.google_analytics_sample.ga_sessions_20170801`,
UNNEST(hits) AS h
WHERE visitId = 1501570398
LIMIT 10
```

Query completed

Using on-demand processing quota

Query results | Save results | Open in

Job information | Results | Visualization | JSON | Execution details | Ex

Row	visitId	pageTitle
1	1501570398	Fun | Accessories | Google Mer...
2	1501570398	Home
3	1501570398	Shop by Brand | Google Mercha...
4	1501570398	Office | Google Merchandise St...
5	1501570398	Other | Office | Google Merchan...

Results per page: 50 | 1 – 9 of 9

Job history | Show

11°C Mostly sunny | Search | ENG IN | 10:05 AM 31-12-2025

BigQuery – qwiklabs-gcp-01-d0a

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Explorer

Search for resources

- Home
- Starred
- Shared with me
- Job history
- qwiklabs-gcp-01-d0a9af8ff455
  - Datasets
  - Connections
  - Queries
  - (Classic) Queries
  - Notebooks
  - Data canvases
  - Data preparations
  - Pipelines
  - Repositories

Add data

Filter By

Data Source Type

- Databases (19)
- Marketing (38)
- Business Applications (30)
- Storage/Data Lakes (6)
- Data Warehouses (3)
- Data Streaming (4)

Public Datasets

Sharing (Analytics Hub)

Star a project by name

Search for data sources

Most popular data sources

Google Cloud Storage
Data lake storage and analysis.

Local File
Data ingestion from local files.

Featured data sources

Amazon Redshift
Data warehousing and business intelligence.

Amazon S3
Data lake storage and analysis.

Apache Spark
Unified engine for large-scale data analytics.

Azure Blob Storage
Data lake storage and analysis.

Close

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BigQuery – qwiklabs-gcp-01-d0a

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Explorer | + Add data

Search for resources

- Home
- Starred
- Shared with me
- Job history
- qwiklabs-gcp-01-d0a9af8ff455
  - Datasets
  - Connections
  - Queries
  - (Classic) Queries
  - Notebooks
  - Data canvases
  - Data preparations
  - Pipelines
  - Repositories

Untitled query | Run | Save | Download | Share

```
SELECT DISTINCT
  visitId,
  h.page.pageTitle
FROM `bigquery-public-data.google_analytics_sample.ga_sessions_20170801`,
UNNEST(hits) AS h
WHERE visitId = 1501570398
LIMIT 10
```

Star a project

Project name *
bigquery-public-data

Cancel | Star

Save results | Open in

Job information | Results | Visualization | JSON | Execution details

Row	visitId	pageTitle
1	1501570398	Fun | Accessories | Google Mer...
2	1501570398	Home
3	1501570398	Shop by Brand | Google Mercha...
4	1501570398	Office | Google Merchandise St...

Results per page: 50 | 1 – 9 of 9

Job history | Show

11°C Mostly sunny | Search | ENG IN | 10:06 AM 31-12-2025

BigQuery – qwiklabs-gcp-01-d0a

https://console.cloud.google.com/bigquery?project=qwiklabs-gcp-01-d0a9af8ff455

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Explorer | + Add data

Search for resources

- Home
- Starred
- Shared with me
- Job history
- qwiklabs-gcp-01-d0a9af8ff455
  - Datasets
  - Connections
  - Queries
  - (Classic) Queries
  - Notebooks
  - Data canvases
  - Data preparations
  - Pipelines
  - Repositories

Untitled query | Run | Save | Download | Share

```
SELECT DISTINCT
  visitId,
  h.page.pageTitle
FROM `bigquery-public-data.google_analytics_sample.ga_sessions_20170801`,
UNNEST(hits) AS h
WHERE visitId = 1501570398
LIMIT 10
```

Star a project

Project name *
bigquery-public-data

Cancel | Star

Save results | Open in

Job information | Results | Visualization | JSON | Execution details

Row	visitId	pageTitle
1	1501570398	Fun | Accessories | Google Mer...
2	1501570398	Home
3	1501570398	Shop by Brand | Google Mercha...
4	1501570398	Office | Google Merchandise St...

Results per page: 50 | 1 – 9 of 9

Job history | Show

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BigQuery – qwiklabs-gcp-01-d0a

https://console.cloud.google.com/bigquery?project=qwiklabs-gcp-01-d0a9af8ff455

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Search BigQuery resources

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- qwiklabs-gcp-01-d0a9af8ff455
  - Repositories
  - Queries
  - Notebooks
  - Data canvases
  - Data preparations
  - Pipelines
  - Connections
  - fruit_store
    - fruit_details
- bigquery-public-data

Untitled query | Run | Schedule | Save | Download | Share

```
SELECT DISTINCT
  visitId,
  h.page.pageTitle
FROM `bigquery-public-data.google_analytics_sample.ga_sessions_20170801`,
UNNEST(hits) AS h
WHERE visitId = 1501570398
LIMIT 10
```

Query completed

Using on-demand processing quota

Query results | Save results | Open in

Job information | Results | Visualization | JSON | Execution details | Execution graph

Row	visitId	pageTitle
1	1501570398	Fun | Accessories | Google Mer...
2	1501570398	Home
3	1501570398	Shop by Brand | Google Mercha...
4	1501570398	Office | Google Merchandise St...
5	1501570398	Other | Office | Google Merchan...

Results per page: 50 | 1 – 9 of 9

'bigquery-public-data' was starred.

Show

11°C Mostly sunny | Search | ENG IN | 10:07 AM 31-12-2025

BigQuery – qwiklabs-gcp-01-d0a

https://console.cloud.google.com/bigquery?project=qwiklabs-gcp-01-d0a9af8ff455

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- google_ads_geo_mapping_us_central1
- google_ads_geo_mapping_us_central2
- google_ads_geo_mapping_us_east1
- google_ads_geo_mapping_us_east4
- google_ads_geo_mapping_us_east5
- google_ads_geo_mapping_us_south1
- google_ads_geo_mapping_us_west1
- google_ads_geo_mapping_us_west2
- google_ads_geo_mapping_us_west3
- google_ads_geo_mapping_us_west4
- google_ads_transparency_center
- google_analytics_sample
- google_books_ngrams_2020
- google_cfe
- google_cloud_release_notes
- google_dei

google_analytics_sample
Click to open in current tab
(Ctrl + Click - open in new tab,
Shift + Ctrl + Click - open in split tab)

Untitled query | Run | Schedule | Save | Download | Share

```
SELECT DISTINCT
  visitId,
  h.page.pageTitle
FROM `bigquery-public-data.google_analytics_sample.ga_sessions_20170801`,
UNNEST(hits) AS h
WHERE visitId = 1501570398
LIMIT 10
```

Query completed

Using on-demand processing quota

Query results | Save results | Open in

Job information | Results | Visualization | JSON | Execution details | Execution graph

		pageTitle
	501570398	Fun | Accessories | Google Mer...
	501570398	Home
3	1501570398	Shop by Brand | Google Mercha...
4	1501570398	Office | Google Merchandise St...
5	1501570398	Other | Office | Google Merchan...

Results per page: 50 | 1 – 9 of 9

'bigquery-public-data' was starred.

Show

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Search BigQuery resources

Show starred only

- google_ads_geo_mapping_us_central1
- google_ads_geo_mapping_us_central2
- google_ads_geo_mapping_us_east1
- google_ads_geo_mapping_us_east4
- google_ads_geo_mapping_us_east5
- google_ads_geo_mapping_us_south1
- google_ads_geo_mapping_us_west1
- google_ads_geo_mapping_us_west2
- google_ads_geo_mapping_us_west3
- google_ads_geo_mapping_us_west4
- google_ads_transparency_center
- google_analytics_sample
- google_books_ngrams_2020
- google_cfe
- google_cloud_release_notes
- google_dei

*Untitled...ery | *Untitled...ery | *Untitled...ery | *Untitled...ery

bigquery-public-data / Datasets / google_analytics_sample

google_analytics_sample | Create Table | Share | Copy | Delete | Refresh

Overview | Details

Tables | Models | Routines

Filter: bigquery-public-data:google_analytics_sample.ga_sessions_20170801

Enter property name or value

Table ID	Type	Create time	Expiration t
ga_sessions_20170801	Table	Mar 31, 20...	None

Rows per page: 50 | 1 – 1 of 1

Job history | Show

11°C Mostly sunny | Search | ENG IN | 10:09 AM 31-12-2025

Lab setup instructions and requirements

End Lab 01:17:09 Time limit

Caution: When you are in the console, do not deviate from the lab instructions. Doing so may cause your account to be blocked. Learn more.

Open Google Cloud console

Username
student-02-7be6421b583d

Password
vXCkUvp8ZJO1

Project ID
qwiklabs-gcp-01-d0a9af8

7. Start scrolling through the schema and answer the following question by using the find feature of your browser.

In a BigQuery schema, a STRUCT field is noted as a RECORD Type. Search for RECORD in the Google Analytics schema. How many STRUCTs are present in this dataset?

- 1
- ✗ ~~5~~
- ✗ ~~11~~
- ✓ 32

Submit

What are the names of some of the STRUCT (RECORD Type) fields?

50/100
Overview
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Task 6. Practice with STRUCTs and arrays
Task 7. Lab question: STRUCT()

Lab setup instructions and requirements

End Lab 01:16:58 Time limit

Caution: When you are in the console, do not deviate from the lab instructions. Doing so may cause your account to be blocked. Learn more.

Open Google Cloud console

Username
student-02-7be6421b583d

Password
vXCkUvp8ZJO1

Project ID
qwiklabs-gcp-01-d0a9af8

What are the names of some of the STRUCT (RECORD Type) fields?

- Totals
- TrafficSource
- trafficSource.adwordsClickInfo
- device
- ✓ All of the above

Submit

How can both TrafficSource and trafficSource.adwordsClickInfo both be STRUCTs?

- ✓ A STRUCT can have another STRUCT as one of its fields (you can nest STRUCTs)
- They are not STRUCTs

50/100
Overview
Setup and requirements
Task 1. Create a new dataset to store the tables
Task 2. Practice working with arrays in SQL
Task 3. Create your own arrays with ARRAY_AGG()
Task 4. Query tables containing arrays
Task 5. Introduction to STRUCTs
Task 6. Practice with STRUCTs and arrays
Task 7. Lab question: STRUCT()

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Search
ENG IN 10:15 AM 31-12-2025

Lab setup instructions and requirements

End Lab 01:16:54 Time limit

Caution: When you are in the console, do not deviate from the lab instructions. Doing so may cause your account to be blocked. Learn more.

Open Google Cloud console

Username
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Password
vXCkUvp8ZJO1

Project ID
qwiklabs-gcp-01-d0a9af8

How can both TrafficSource and trafficSource.adwordsClickInfo both be STRUCTs?

- ✓ A STRUCT can have another STRUCT as one of its fields (you can nest STRUCTs)
- They are not STRUCTs
- Because they are all ARRAYs
- This is an invalid data type

Submit

In a BigQuery schema, an ARRAY field is noted as a REPEATED Mode. Search for REPEATED in the Google Analytics schema. How many ARRAYs are present in this dataset?

- 1
- 5

50/100
Overview
Setup and requirements
Task 1. Create a new dataset to store the tables
Task 2. Practice working with arrays in SQL
Task 3. Create your own arrays with ARRAY_AGG()
Task 4. Query tables containing arrays
Task 5. Introduction to STRUCTs
Task 6. Practice with STRUCTs and arrays
Task 7. Lab question: STRUCT()

Lab setup instructions and requirements

End Lab 01:16:49 Time limit

Caution: When you are in the console, do not deviate from the lab instructions. Doing so may cause your account to be blocked. Learn more.

Open Google Cloud console

Username
student-02-7be6421b583d

Password
vXCkUvp8ZJO1

Project ID
qwiklabs-gcp-01-d0a9af8

In a BigQuery schema, an ARRAY field is noted as a REPEATED Mode. Search for REPEATED in the Google Analytics schema. How many ARRAYs are present in this dataset?

- 1
- 5
- ✓ 11
- 32

Submit

As you can imagine, there is an incredible amount of website session data stored for a modern ecommerce website.

The main advantage of having 32 STRUCTs in a single table is it allows you to run queries like this one without having to do any JOINs:

50/100
Overview
Setup and requirements
Task 1. Create a new dataset to store the tables
Task 2. Practice working with arrays in SQL
Task 3. Create your own arrays with ARRAY_AGG()
Task 4. Query tables containing arrays
Task 5. Introduction to STRUCTs
Task 6. Practice with STRUCTs and arrays
Task 7. Lab question: STRUCT()

As you can imagine, there is an incredible amount of website session data stored for a modern ecommerce website.

The main advantage of having 32 STRUCTs in a single table is it allows you to run queries like this one without having to do any JOINs:

Copied!

```
SELECT
  visitId,
  totals.*,
  device.*
FROM `bigquery-public-data.google_analytics_sample.ga_sessions_20170801`
WHERE visitId = 1501570398
LIMIT 10
```

Note: The `.*` syntax tells BigQuery to return all fields for that STRUCT (much like it would if `totals.*` was a separate table we joined against).

Storing your large reporting tables as STRUCTs (pre-joined "tables") and ARRAYs (deep

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```
SELECT
  visitId,
  totals.*,
  device.*
FROM `bigquery-public-data.google_analytics_sample.ga_sessions_20170801`
WHERE visitId = 1501570398
LIMIT 10
```

Query completed

Using on-demand processing quota

Query results

Save results | Open in

Job information | Results | Visualization | JSON | Execution details | Execution graph

Row	visitId	visits	hits	pageviews	timeOnSite	bounces	transactions	transactionReven...	newVisits
1	1501570398	1	11	11	731	null	null	null	

Results per page: 50 | 1 – 1 of 1

Job history | Show

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Build a Data Warehouse with Big
https://partner.skills.google/course_templates/624/labs/597937
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Lab setup instructions and requirements

End Lab 01:16:13 Time limit

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Open Google Cloud console

Username
student-02-7be6421b583d

Password
vXCkUvp8ZJO1

Project ID
qwiklabs-gcp-01-d0a9af8

Task 6. Practice with STRUCTs and arrays

The next dataset will be lap times of runners around the track. Each lap will be called a "split".

1. With this query, try out the STRUCT syntax and note the different field types within the struct container:

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Task 7. Lab question: STRUCT()

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Lab setup instructions and requirements

End Lab 01:16:06 Time limit

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Password
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Project ID
qwiklabs-gcp-01-d0a9af8

1. With this query, try out the STRUCT syntax and note the different field types within the struct container:

```
#standardSQL
SELECT STRUCT("Rudisha" as name, 23.4 as split) as runner
```

Row	runner.name	runner.split
1	Rudisha	23.4

What do you notice about the field aliases? Since there are fields nested within the struct (name and split are a subset of runner) you end up with a dot notation.

What if the runner has multiple split times for a single race (like time per lap)?

How could you have multiple split times within a single record? Hint: the splits all have the same numeric datatype.

- Store each split time as an element in an ARRAY of splits
- Store each split time in a separate table called race_splits

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Overview
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Untitled query | Run | Save | Download | Share | Schedule | Open in | More

```
#standardSQL
SELECT STRUCT("Rudisha" as name, 23.4 as split) as runner
```

Query completed

Query results

Save results | Open in

Job information | Results | Visualization | JSON | Execution details | Execution graph

Row	runner. name	runner. split
1	Rudisha	23.4

Results per page: 50 | 1 – 1 of 1

Job history | Show

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2. Run the below query to confirm:

```
#standardSQL
SELECT STRUCT("Rudisha" as name, [23.4, 26.3, 26.4, 26.1] as
splits) AS runner
```

Row	runner.name	runner.splits
1	Rudisha	23.4
		26.3
		26.4
		26.1

To recap:

- Structs are containers that can have multiple field names and data types nested inside.
- Arrays can be one of the field types inside of a Struct (as shown above with the splits field).

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```
#standardSQL
SELECT STRUCT("Rudisha" as name, [23.4, 26.3, 26.4, 26.1] as splits) AS runner
```

Query completed

Query results

Save results | Open in

Job information | Results | Visualization | JSON | Execution details | Execution graph

Row	runner. name	runner. splits
1	Rudisha	23.4
		26.3
		26.4
		26.1

Results per page: 50 | 1 – 1 of 1

Job history | Show

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Lab setup instructions and requirements

End Lab 01:15:05 Time limit

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Project ID
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Practice ingesting JSON data

1. Create a new dataset titled `racing`.
2. Click on `racing` dataset and click **Create Table**.

Note: You may have to widen your browser window to see the Create table option.

- **Source**: select **Google Cloud Storage** under **Create table from** dropdown.
- **Select file from Cloud Storage bucket**: `spls/gsp416/data-insights-course/labs/optimizing-for-performance/race_results.json`
- **File format**: JSONL (Newline delimited JSON)
- In **Schema**, click on **Edit as text** slider and add the following:

```
[
    {
        "name": "race",
        "type": "STRING",
        "mode": "NULLABLE"
    },
    {
        "name": "participants",
```

50/100
Overview
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Create dataset
Refresh contents
Upload to project
Change my default code region

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```
#standardSQL
SELECT STRUCT("Rudisha" as name, [23.4, 26.3, 26.4, 26.1] as splits) AS runner
```

Query results | Save results | Open in

Job information | Results | Visualization | JSON | Execution details | Execution graph

Row	runner. name	runner. splits
1	Rudisha	23.4
		26.3
		26.4
		26.1

Results per page: 50 | 1 – 1 of 1

Job history | Show

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```
#standardSQL
SELECT STRUCT("Rudisha" as name, [23.4, 26.3, 26.4, 26.1] as splits) AS runner
```

Query completed

Query results

Job information | Results | Visualization | JSON | Execution details | Exe

Row	runner. name	runner. splits
1	Rudisha	23.4
		26.3
		26.4
		26.1

Job history

Create dataset

Project ID *
qwiklabs-gcp-01-d0a9af8ff455 Change

Dataset ID *
racing

Letters, numbers, and underscores allowed

Some locations have been restricted due to a policy set by your organization. Learn more about restricting locations.

Data location

Tags

Advanced options

Create dataset | Cancel

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Open
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Create table
Create ML model
Share
Copy ID
Refresh contents
Delete

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```
rdSQL
STRUCT("Rudisha" as name, [23.4, 26.3, 26.4, 26.1] as splits) AS runner
```

leted

sults | Save results | Open in

tion | Results | Visualization | JSON | Execution details | Execution graph

Row	runner. name	runner. splits
1	Rudisha	23.4
		26.3
		26.4
		26.1

Results per page: 50 | 1 – 1 of 1

"racing" created. Go to dataset

Job history | Show

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Create table

Source

Create table from
Google Cloud Storage

Select file from GCS bucket or use a URI pattern *
spls/gsp416/data-insights-course/labs/optimizing-for-performance/race_results.json
Browse

File format
JSONL (Newline delimited JSON)

☐ Source Data Partitioning

Destination

Project *
qwiklabs-gcp-01-d0a9af8ff455
Browse

Dataset *
racing

Table *
race_results

Maximum name size is 1,024 UTF-8 bytes. Unicode letters, marks, numbers, connectors, dashes, and spaces are allowed.

Table type
Native table

Create table | Cancel

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- bigquery-public-data

Create table

Schema

☐ Auto detect

☑ Edit as text

Press Alt+F1 for Accessibility Options.

```
[
    {
        "name": "race",
        "type": "STRING",
        "mode": "NULLABLE"
    },
    {
        "name": "participants",
        "type": "RECORD",
        "mode": "REPEATED",
        "fields": [
            {
                "name": "name",
                "type": "STRING",
                "mode": "NULLABLE"
            },
            {
                "name": "splits",
                "type": "FLOAT",
                "mode": "REPEATED"
            }
        ]
    }
]
```

Create table | Cancel

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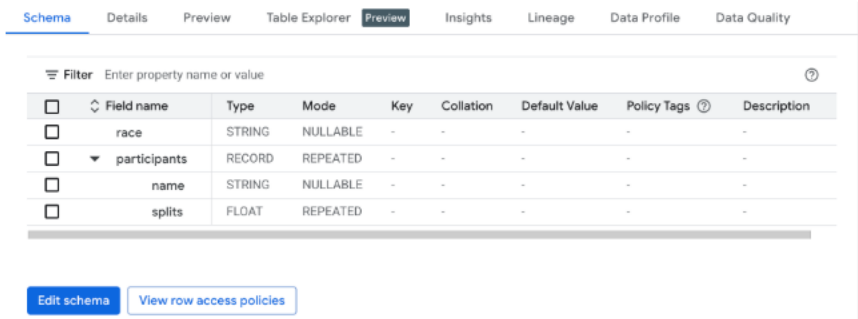
3. Call the new table `race_results`.

4. Click **Create table**.

5. After the load job is successful, preview the schema for the newly created table:



Field name	Type	Mode	Key	Collation	Default Value	Policy Tags	Description
race	STRING	NULLABLE	-	-	-	-	-
participants	RECORD	REPEATED	-	-	-	-	-
name	STRING	NULLABLE	-	-	-	-	-
splits	FLOAT	REPEATED	-	-	-	-	-

Which field is the STRUCT? How do you know?

The **participants** field is the STRUCT because it is of type RECORD.

Which field is the ARRAY?

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4. Click **Create table**.

5. After the load job is successful, preview the schema for the newly created table:

Schema | Details | Preview | Table Explorer Preview | Insights | Lineage | Data Profile | Data Quality

Filter Enter property name or value

Field name	Type	Mode	Key	Collation	Default Value	Policy Tags	Description
race	STRING	NULLABLE	-	-	-	-	-
participants	RECORD	REPEATED	-	-	-	-	-
name	STRING	NULLABLE	-	-	-	-	-
splits	FLOAT	REPEATED	-	-	-	-	-

Edit schema | View row access policies

Which field is the STRUCT? How do you know?

The **participants** field is the STRUCT because it is of type RECORD.

Which field is the ARRAY?

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```
#standardSQL
SELECT * FROM racing.race_results
```

Query completed

Using on-demand processing quota

Query results | Save results | Open in

Job information | Results | Visualization | JSON | Execution details | Execution graph

Row	race	participants. name	participants. splits
1	800M	Rudisha	23.4
			26.3
			26.4
			26.1
		Makhloufi	24.5
			25.4
			26.6
			26.1
		Murphy	23.9

Results per page: 50 | 1 – 1 of 1

Job history | Show

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	Bosse	23.6

What if you wanted to list the name of each runner and the type of race?

2. Run the below schema and see what happens:

```
#standardSQL
SELECT race, participants.name
FROM racing.race_results
```

Error: `Cannot access field name on a value with type ARRAY<STRUCT<name STRING, splits ARRAY<FLOAT64>>>> at [2:27]`

Much like forgetting to GROUP BY when you use aggregation functions, here there are two different levels of granularity. One row for the race and three rows for the participants names. So how do you change this...

Row	race	participants.name
1	800M	Rudisha
2	???	Makhloufi
3	???	Murphy

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  - racing
    - race_results
- bigquery-public-data

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```
#standardSQL
SELECT race, participants.name
FROM racing.race_results
```

Query completed with errors

Query results | Save results | Open in

Job information | Results | Execution details | Execution graph

Cannot access field name on a value with type ARRAY<STRUCT<name STRING, splits ARRAY<FLOAT64>>> at [2:27]

Job history | Show

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3. Now try running this:

```
#standardSQL
SELECT race, participants.name
FROM racing.race_results
CROSS JOIN
participants  # this is the STRUCT (it is like a table within a table)
```

`Table name "participants" missing dataset while no default dataset is set in the request.`

Even though the participants STRUCT is like a table, it is still technically a field in the `racing.race_results` table.

4. Add the dataset name to the query:

```
#standardSQL
SELECT race, participants.name
FROM racing.race_results
CROSS JOIN
```

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    - race_results
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```
#standardSQL
SELECT race, participants.name
FROM racing.race_results
CROSS JOIN
participants  # this is the STRUCT (it is like a table within a table)
```

Query completed with errors

Query results | Save results | Open in

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Table "participants" must be qualified with a dataset (e.g. dataset.table).

Job history | Show

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`racing.race_results` table.

4. Add the dataset name to the query:

```
#standardSQL
SELECT race, participants.name
FROM racing.race_results
CROSS JOIN
race_results.participants # full STRUCT name
```

5. And click **Run**.

Wow! You've successfully listed all of the racers for each race!

Row	race	name
1	800M	Rudisha
2	800M	Makhloufi
3	800M	Murphy
4	800M	Bosse
5	800M	Rotich

Overview
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    - race_results
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```
#standardSQL
SELECT race, participants.name
FROM racing.race_results
CROSS JOIN
race_results.participants # full STRUCT name
```

Query completed

Using on-demand processing quota

Query results

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Row	race	name
1	800M	Rudisha
2	800M	Makhloufi
3	800M	Murphy
4	800M	Bosse
5	800M	Rotich
6	800M	Lewandowski
7	800M	Kipketer

Results per page: 50 | 1 – 8 of 8

Job history | Show

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This will give you the same query result:

```
#standardSQL
SELECT race, participants.name
FROM racing.race_results AS r, r.participants
```

If you have more than one race type (800M, 100M, 200M), wouldn't a CROSS JOIN just associate every racer name with every possible race like a cartesian product?

Answer: No. This is a *correlated* cross join which only unpacks the elements associated with a single row. For a greater discussion, see working with ARRAYs and STRUCTs

Recap of STRUCTs:

- A SQL STRUCT is simply a container of other data fields which can be of different data types. The word struct means data structure. Recall the example from earlier: `STRUCT(``"Rudisha" as name, [23.4, 26.3, 26.4, 26.1] as splits``)`` AS runner`
- STRUCTs are given an alias (like runner above) and can conceptually be thought of as a table inside of your main table.
- STRUCTs (and ARRAYs) must be unpacked before you can operate over their elements. Wrap an UNNEST() around the name of the struct itself or the struct field that is an array in order to unpack and flatten it.

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```
#standardSQL
SELECT race, participants.name
FROM racing.race_results AS r, r.participants
```

Query completed

Using on-demand processing quota

Query results

Save results | Open in

Job information | Results | Visualization | JSON | Execution details | Execution graph

Row	race	name
1	800M	Rudisha
2	800M	Makhloufi
3	800M	Murphy
4	800M	Bosse
5	800M	Rotich
6	800M	Lewandowski
7	800M	Kipketer
8	800M	Berian

Results per page: 50 | 1 – 8 of 8

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Task 7. Lab question: STRUCT()

Answer the below questions using the `racing.race_results` table you created previously.

Task: Write a query to COUNT how many racers were there in total.

- To start, use the below partially written query:

```
#standardSQL
SELECT COUNT(participants.name) AS racer_count
FROM racing.race_results
```

Note: Remember you will need to cross join in your struct name as an additional data source after the `FROM`.

Possible solution:

Task 3. Create your arrays with ARRAY_AGG()
Task 4. Query tables containing arrays
Task 5. Introduction to STRUCTs
Task 6. Practice with STRUCTs and arrays
Task 7. Lab question: STRUCT()
Task 8. Lab question: Unpacking arrays with UNNEST()
Task 9. Filter within array values
Congratulations!

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```
#standardSQL
SELECT COUNT(participants.name) AS racer_count
FROM racing.race_results
```

Query completed with errors

Query results | Save results | Open in

Job information | Results | Execution details | Execution graph

Cannot access field name on a value with type ARRAY<STRUCT<name STRING, splits ARRAY<FLOAT64>>> at [2:27]

Job history | Show

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Lab setup instructions and requirements

End Lab 01:07:52 Time limit

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Password
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Project ID
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Possible solution:

```
#standardSQL
SELECT COUNT(p.name) AS racer_count
FROM racing.race_results AS r, UNNEST(r.participants) AS p
```

Row	racer_count
1	8

Answer: There were 8 racers who ran the race.

Click *Check my progress* to verify the objective.

Execute the query to COUNT how many racers were there in total

Check my progress

Assessment Completed!

Task 3. Create your arrays with ARRAY_AGG()
Task 4. Query tables containing arrays
Task 5. Introduction to STRUCTs
Task 6. Practice with STRUCTs and arrays
Task 7. Lab question: STRUCT()
Task 8. Lab question: Unpacking arrays with UNNEST()
Task 9. Filter within array values
Congratulations!

80/100

Check complete. Points earned: 10. Message: Assessment Completed!

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```
#standardSQL
SELECT COUNT(p.name) AS racer_count
FROM racing.race_results AS r, UNNEST(r.participants) AS p
```

Query completed

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Query results | Save results | Open in

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Row	racer_count
1	8

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Lab setup instructions and requirements

End Lab 01:07:35 Time limit

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Task 8. Lab question: Unpacking arrays with UNNEST( )

Write a query that will list the total race time for racers whose names begin with R. Order the results with the fastest total time first. Use the UNNEST() operator and start with the partially written query below.

- Complete the query:

```
#standardSQL
SELECT
  p.name,
  SUM(split_times) as total_race_time
FROM racing.race_results AS r
, r.participants AS p
, p.splits AS split_times
WHERE
GROUP BY
ORDER BY
;
```

Task 3. Create your arrays with ARRAY_AGG()
Task 4. Query tables containing arrays
Task 5. Introduction to STRUCTs
Task 6. Practice with STRUCTs and arrays
Task 7. Lab question: STRUCT()
Task 8. Lab question: Unpacking arrays with UNNEST( )
Task 9. Filter within array values
Congratulations!

80/100

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```
#standardSQL
SELECT
  p.name,
  SUM(split_times) as total_race_time
FROM racing.race_results AS r
, r.participants AS p
, p.splits AS split_times
WHERE
GROUP BY
ORDER BY
;
```

Query completed with errors

Query results | Save results | Open in

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Syntax error: Unexpected keyword GROUP at [9:1]

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Lab setup instructions and requirements

End Lab 01:06:22 Time limit

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Password
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Possible solution:

```
#standardSQL
SELECT
  p.name,
  SUM(split_times) as total_race_time
FROM racing.race_results AS r
, UNNEST(r.participants) AS p
, UNNEST(p.splits) AS split_times
WHERE p.name LIKE 'R%'
GROUP BY p.name
ORDER BY total_race_time ASC;
```

Row	name	total_race_time
1	Rudisha	102.19999999999999
2	Rotich	103.6

Click *Check my progress* to verify the objective.

Execute the query that will list the total race time for racers whose names

90/100
Task 3. Create your arrays with ARRAY_AGG()
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Task 8. Lab question: Unpacking arrays with UNNEST()
Task 9. Filter within array values
Congratulations!

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```
#standardSQL
SELECT
  p.name,
  SUM(split_times) as total_race_time
FROM racing.race_results AS r
, UNNEST(r.participants) AS p
, UNNEST(p.splits) AS split_times
WHERE p.name LIKE 'R%'
GROUP BY p.name
ORDER BY total_race_time ASC;
```

Query completed

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Query results | Save results | Open in

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Row	name	total_race_time
1	Rudisha	102.1999999999...
2	Rotich	103.6

Results per page: 50 | 1 – 2 of 2

Job history | Show

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Task 9. Filter within array values

You happened to see that the fastest lap time recorded for the 800 M race was 23.2 seconds, but you did not see which runner ran that particular lap. Create a query that returns that result.

- Complete the partially written query:

```
#standardSQL
SELECT
  p.name,
  split_time
FROM racing.race_results AS r
, r.participants AS p
, p.splits AS split_time
WHERE split_time = ;
```

Possible solution:

Task 3. Create your arrays with ARRAY_AGG()
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Task 5. Introduction to STRUCTs
Task 6. Practice with STRUCTs and arrays
Task 7. Lab question: STRUCT()
Task 8. Lab question: Unpacking arrays with UNNEST()
Task 9. Filter within array values
Congratulations!

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```
#standardSQL
SELECT
  p.name,
  split_time
FROM racing.race_results AS r
, r.participants AS p
, p.splits AS split_time
WHERE split_time = ;
```

Query completed with errors

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Syntax error: Unexpected ";" at [8:20]

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Lab setup instructions and requirements

End Lab 01:05:26 Time limit

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Project ID
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```
  p.name,
  split_time
FROM racing.race_results AS r
, r.participants AS p
, p.splits AS split_time
WHERE split_time = ;
```

Possible solution:

```
#standardSQL
SELECT
  p.name,
  split_time
FROM racing.race_results AS r
, UNNEST(r.participants) AS p
, UNNEST(p.splits) AS split_time
WHERE split_time = 23.2;
```

Row	name	split_time
1	Kipketer	23.2

Click *Check my progress* to verify the objective.

Check complete. Points earned: 10. Message: Assessment Completed!

100/100
Task 3. Create you arrays with ARRAY_AGG()
Task 4. Query tables containing arrays
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Task 6. Practice with STRUCTs and arrays
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Task 9. Filter within array values
Congratulations!

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```
#standardSQL
SELECT
  p.name,
  split_time
FROM racing.race_results AS r
, UNNEST(r.participants) AS p
, UNNEST(p.splits) AS split_time
WHERE split_time = 23.2;
```

Query completed

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Row	name	split_time
1	Kipketer	23.2

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