**Project Description**

I examine SQL join queries in this lab. SQL joins are used to merge databases by matching common columns.

**The Machines Table**

```
MariaDB [organization]> select *
    -> from machines;
+--------------+------------------+----------------+--------------+-------------+
| device_id    | operating_system | email_client   | OS_patch_date | employee_id |
+--------------+------------------+----------------+--------------+-------------+
| a184b775c707 | OS 1             | Email Client 1 | 2021-09-01    |        1156 |
| a192b174c940 | OS 2             | Email Client 1 | 2021-06-01    |        1052 |
| a305b818c708 | OS 3             | Email Client 2 | 2021-06-01    |        1182 |
| a317b635c465 | OS 1             | Email Client 2 | 2021-03-01    |        1130 |
| a320b137c219 | OS 2             | Email Client 2 | 2021-03-01    |        1000 |
| a398b471c573 | OS 3             | Email Client 2 | 2021-12-01    |           0 |
| a667b270c984 | OS 1             | Email Client 1 | 2021-03-01    |        1078 |
| a821b452c176 | OS 2             | Email Client 2 | 2021-12-01    |        1104 |
| a998b568c863 | OS 3             | Email Client 1 | 2021-12-01    |        1026 |
```

The machines table lists device_id, installed operating_system and email_client, OS_patch_date and employee_id. Notice one of the employee id column elements is 0.

**The Employees Table**

```
MariaDB [organization]> select *
    -> from employees;
+-------------+--------------+----------+-------------------------+-------------+
| employee_id | device_id    | username | department              | office      |
+-------------+--------------+----------+-------------------------+-------------+
|        1000 | a320b137c219 | elarson  | Marketing               | East-170    |
|        1001 | b239c825d303 | bmoreno  | Marketing               | Central-276 |
|        1002 | c116d593e558 | tshah    | Human Resources         | North-434   |
|        1003 | d394e816f943 | sgilmore | Finance                 | South-153   |
|        1004 | e218f877g788 | eraab    | Human Resources         | South-127   |
|        1005 | f551g340h864 | gesparza | Human Resources         | South-366   |
|        1006 | g329h357i597 | alevitsk | Information Technology  | East-320    |
|        1007 | h174i497j413 | wjaffrey | Finance                 | North-406   |
|        1008 | i858j583k571 | abernard | Finance                 | South-170   |
|        1009 | NULL         | lrodriqu | Sales                   | South-134   |
```

The employees table lists employee_id, device_id, username, department and office. I noticed that some of the device_id entries are null.

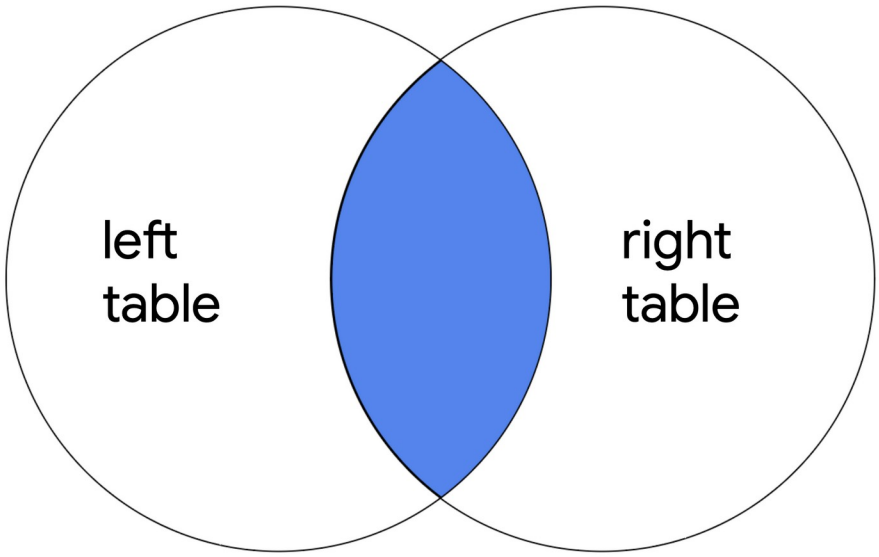
**Inner Join**

```
MariaDB [organization]> SELECT *
    -> FROM employees
    -> INNER JOIN machines ON employees.device_id = machines.device_id;
+-------------+--------------+----------+-----------------------+------------+--------------+-------
----------+----------------+---------------+-------------+
| employee_id | device_id    | username | department            | office     | device_id    | operat
ing_system | email_client   | OS_patch_date | employee_id |
+-------------+--------------+----------+-----------------------+------------+--------------+-------
----------+----------------+---------------+-------------+
|        1000 | a320b137c219 | elarson  | Marketing             | East-170   | a320b137c219 | OS 2
          | Email Client 2 | 2021-03-01    |        1000 |
|        1001 | b239c825d303 | bmoreno  | Marketing             | Central-276 | b239c825d303 | OS 1
          | Email Client 1 | 2021-03-01    |        1001 |
|        1002 | c116d593e558 | tshah    | Human Resources       | North-434  | c116d593e558 | OS 3
          | Email Client 1 | 2021-09-01    |        1002 |
|        1003 | d394e816f943 | sgilmore | Finance               | South-153  | d394e816f943 | OS 3
          | Email Client 2 | 2021-03-01    |        1003 |
|        1004 | e218f877g788 | eraab    | Human Resources       | South-127  | e218f877g788 | OS 2
          | Email Client 1 | 2021-09-01    |        1004 |
|        1005 | f551g340h864 | gesparza | Human Resources       | South-366  | f551g340h864 | OS 3
          | Email Client 2 | 2021-12-01    |        1005 |
|        1006 | g329h357i597 | alevitsk | Information Technology | East-320   | g329h357i597 | OS 1
          | Email Client 2 | 2021-06-01    |        1006 |
```

SELECT *
FROM employees
INNER JOIN machines ON employees.device_id = machines.device_id;

The inner join query returns rows from both tables that match on the common device_id column. Notice that the device_id column is included twice, once from the employees table and another time from the machines table. Each entry lists a matching device_id.

The inner join query returns only rows where the device_id column data matches from both employees and machines tables.



I noticed that there were no 0 employee_id elements from the machines table (see comment in the machines table section above). This is because the corresponding machines table's device_id did not match any of the employee table's device_id entries in these cases.

I also noticed there were no null device_id column entries from the employees table (see comment in the employees table section above). This is because the corresponding employees table's device_id did not match any of the employee table's device_id entries in these cases.

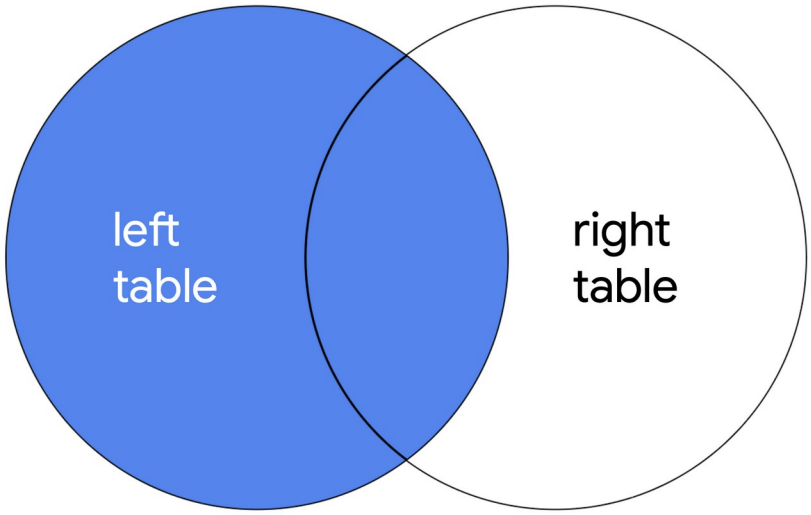
**Left Join**

The left join query returns all rows from the left table and rows from the right table with matching common column data on the joined column.

```
MariaDB [organization]> SELECT *
    -> FROM employees
    -> LEFT JOIN machines ON employees.device_id = machines.device_id
    -> ;
+-------------+--------------+----------+-----------------------+------------+-------------+-------
----------+---------------+--------------+-------------+
| employee_id | device_id    | username | department            | office     | device_id   | operat
ing_system | email_client  | OS_patch_date | employee_id |
+-------------+--------------+----------+-----------------------+------------+-------------+-------
----------+---------------+--------------+-------------+
|        1000 | a320b137c219 | elarson  | Marketing             | East-170   | a320b137c219 | OS 2
          | Email Client 2 | 2021-03-01    |        1000 |
|        1001 | b239c825d303 | bmoreno  | Marketing             | Central-276 | b239c825d303 | OS 1
          | Email Client 1 | 2021-03-01    |        1001 |
|        1002 | c116d593e558 | tshah    | Human Resources       | North-434  | c116d593e558 | OS 3
          | Email Client 1 | 2021-09-01    |        1002 |
|        1003 | d394e816f943 | sgilmore | Finance               | South-153  | d394e816f943 | OS 3
          | Email Client 2 | 2021-03-01    |        1003 |
|        1004 | e218f877g788 | eraab    | Human Resources       | South-127  | e218f877g788 | OS 2
          | Email Client 1 | 2021-09-01    |        1004 |
|        1005 | f551g340h864 | gesparza | Human Resources       | South-366  | f551g340h864 | OS 3
          | Email Client 2 | 2021-12-01    |        1005 |
|        1006 | g329h357i597 | alevitsk | Information Technology | East-320   | g329h357i597 | OS 1
          | Email Client 2 | 2021-06-01    |        1006 |
|        1007 | h174i497j413 | wjaffrey | Finance               | North-406  | h174i497j413 | OS 2
          | Email Client 1 | 2021-03-01    |        1007 |
|        1008 | i858j583k571 | abernard | Finance               | South-170  | i858j583k571 | OS 2
          | Email Client 2 | 2021-06-01    |        1008 |
|        1009 | NULL         | lrodriqu | Sales                 | South-134  | NULL         | NULL
          | NULL          | NULL          |        NULL |
```

SELECT *
FROM employees
LEFT JOIN machines ON employees.device_id = machines.device_id.

This query assigns the employees table as the left table, and the machines table as the right table. This query returns all entries from the left table. Row entries from the right machines table that match on the device_id column, with corresponding entries from the left employees table, are also returned.



I noticed that the employee device_id = NULL entries were maintained from the employees table (see comment in the employees table section above) due to the left join applied to the left employees table, and that the right machines table was returned with corresponding null entries to indicate that there was no matching entry from the machines table.

I again noticed that there were no 0 employee_id elements from the machines table (see comment in the machines table section above). This is because the corresponding machines table's device_id did not match any of the employee table's device_id entries in these cases.

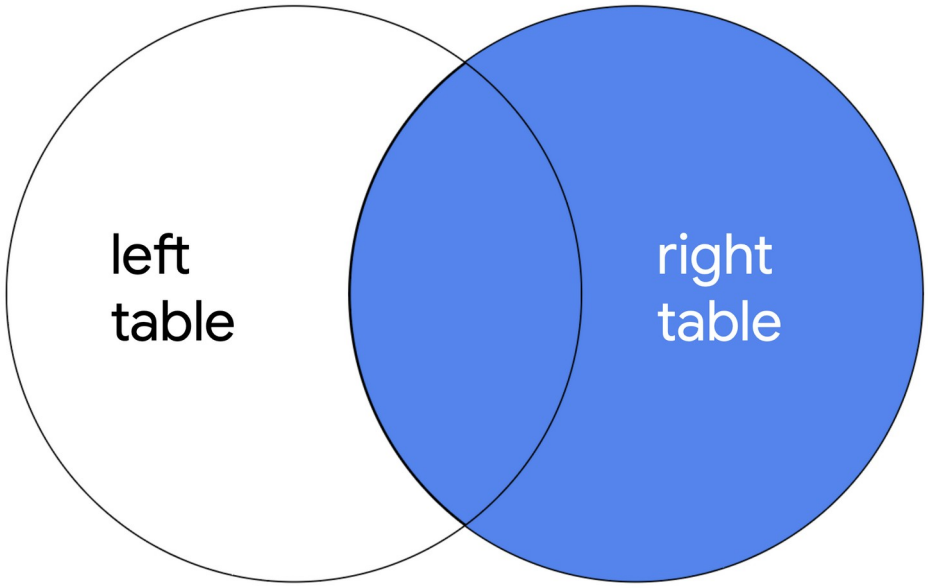
**Right Join**

```
MariaDB [organization]> SELECT *
    -> FROM employees
    -> RIGHT JOIN machines on employees.device_id = machines.device_id;
+-------------+--------------+----------+-----------------------+-------------+--------------+-------
----------+---------------+--------------+-------------+
| employee_id | device_id    | username | department            | office      | device_id    | operat
ing_system | email_client   | OS_patch_date | employee_id |
+-------------+--------------+----------+-----------------------+-------------+--------------+-------
----------+---------------+--------------+-------------+
|        1000 | a320b137c219 | elarson  | Marketing             | East-170    | a320b137c219 | OS 2
          | Email Client 2 | 2021-03-01    |        1000 |
|        1001 | b239c825d303 | bmoreno  | Marketing             | Central-276 | b239c825d303 | OS 1
          | Email Client 1 | 2021-03-01    |        1001 |
|        1002 | c116d593e558 | tshah    | Human Resources       | North-434   | c116d593e558 | OS 3
          | Email Client 1 | 2021-09-01    |        1002 |
|        NULL | NULL         | NULL     | NULL                  | NULL        | a398b471c573 | OS 3
          | Email Client 2 | 2021-12-01    |           0 |
|        NULL | NULL         | NULL     | NULL                  | NULL        | b157c491d493 | OS 2
          | Email Client 1 | 2021-03-01    |           0 |
|        NULL | NULL         | NULL     | NULL                  | NULL        | c185d679e493 | OS 1
          | Email Client 2 | 2021-09-01    |           0 |
```

SELECT *
FROM employees
RIGHT JOIN machines ON employees.device_id = machines.device_id;

This query uses the employees table as the left table, and the machines table as the right table.

The right join returns all row entries from the right machines table. Row entries from the left employees table that match on corresponding device_id column data are also returned.




I noticed that some of the entries have 0 listed as the employee_id from entries in the machines table (see comment in the machines table section above). These entries are preserved due to the right join, and have null listed in columns from the employee table columns because the respective machines

table’s device_id data does not return any corresponding matches from the employee’s device_id column in these cases.

I also noticed that the null device id entries from the employees table (see comment in the employees table section above) are not preserved. This is due to there being no corresponding match from the machines table’s device_id column data.

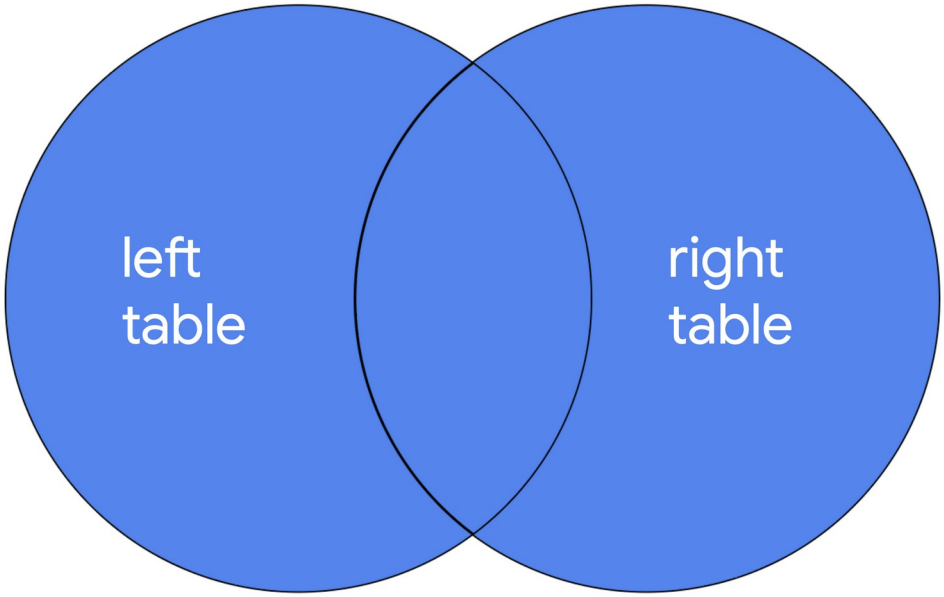
```
MariaDB [organization]> SELECT * FROM employees RIGHT JOIN machines on employees.device_id = machines.
device_id WHERE username = 'lrodriqu';
Empty set (0.001 sec)

MariaDB [organization]> SELECT * FROM employees RIGHT JOIN machines on employees.device_id = machines.
device_id WHERE username = 'abernard';
+-------------+--------------+----------+------------+-----------+--------------+------------------+--
-------------+--------------+-------------+
| employee_id | device_id    | username | department | office    | device_id    | operating_system | e
mail_client   | OS_patch_date | employee_id |
+-------------+--------------+----------+------------+-----------+--------------+------------------+--
-------------+--------------+-------------+
|        1008 | i858j583k571 | abernard | Finance    | South-170 | i858j583k571 | OS 2             | E
mail Client 2 | 2021-06-01    |        1008 |
+-------------+--------------+----------+------------+-----------+--------------+------------------+--
-------------+--------------+-------------+
1 row in set (0.001 sec)
```

The lrodriqu user is not present in this RIGHT JOINED table (see screenshot in the employees table section above)

**Full Outer Joins**

SELECT *
FROM employees
FULL OUTER JOIN machines ON employees.device_id = machines.device.id;

Full outer joins returns all entries from both the left employees table and the right machines table. The entries are matched on corresponding entries from the device_id column where possible.




```
MariaDB [organization]> SELECT *  FROM employees  FULL JOIN machines ON employees.device_id = machines
.device_id;
ERROR 1054 (42S22): Unknown column 'employees.device_id' in 'on clause'
MariaDB [organization]> SELECT *  FROM employees  OUTER JOIN machines ON employees.device_id = machine
s.device_id;
ERROR 1064 (42000): You have an error in your SQL syntax; check the manual that corresponds to your Ma
riaDB server version for the right syntax to use near 'OUTER JOIN machines ON employees.device_id = ma
chines.device_id' at line 1
MariaDB [organization]> SELECT *  FROM employees FULL OUTER JOIN machines ON employees.device_id = mac
hines.device_id;
ERROR 1064 (42000): You have an error in your SQL syntax; check the manual that corresponds to your Ma
riaDB server version for the right syntax to use near 'OUTER JOIN machines ON employees.device_id = ma
chines.device_id' at line 1
```

Unfortunately this version [2] of Maria DB used does not support full outer joins [1].

```
MariaDB [organization]> SELECT @@version;
+----------------------------+
| @@version                  |
+----------------------------+
| 10.3.39-MariaDB-0+deb10u1 |
+----------------------------+
1 row in set (0.001 sec)
```

It is expected that all entries in the screenshots returned in the right join section and left join section above should be returned in the full outer join.

This means the null device_id entry in the employee table's entry (see employee table's section above), and the machine table's entry with 0 in the employee id (see machine table's section above) should both be returned.

**Summary**

In this lab I explored inner join, left join, right join and full outer join SQL queries in MariaDB. I also discovered a limitation of MariaDB at the time of writing.

**References**

1. MariaDB Tutorial (2020) *A Visual Explanation of MariaDB Joins with Practical Examples*. https://www.mariadbtutorial.com/mariadb-basics/mariadb-join/.
2. Ian (2021) *6 Ways to Check your MariaDB Version*. https://database.guide/6-ways-to-check-your-mariadb-version/.