JOINS

Welcome to this section on JOINS !

JOINS will allow us to combine information from multiple tables!

- Section Overview
  - Creating an alias with the AS clause
  - Understanding different kinds of JOINs
    - INNER JOINS
    - OUTER JOINS
    - FULL JOINS
    - UNIONS
  - Challenge Tasks

AS

- Before we learn about JOINs , let’s quickly cover the AS clause which allows us to create an “alias” for a column or result.
- Syntax

```
SELECT column AS new_name
FROM table
```

- ```
  SELECT SUM(column) AS new_name
  FROM table
  ```
  ```

- Example

Query Editor | Query History

```
1  SELECT customer_id
2  FROM payment;
```

Data Output | Explain | Messages | Notifications

	customer_id smallint
1	341

- Example

Query Editor | Query History

```
1  SELECT amount AS rental_price
2  FROM payment;
```

Data Output | Explain | Messages | Notifications

	rental_price numeric (5,2)
1	7.99
2	1.99

- Example

Query Editor | Query History

```
1  SELECT SUM(amount) AS net_revenue
2  FROM payment;
```

Data Output | Explain | Messages | Notifications

	net_revenue numeric
1	61312.04

- The AS operator gets executed at the very end of a query, meaning that we can not use the ALIAS inside a WHERE operator.

INNER JOIN

- There are several types of JOINs, in this lecture we will go through the simplest JOIN type, which is an **INNER JOIN**

What is a JOIN operation?

- JOINs allow us to combine multiple tables together.
- The main reason for the different JOIN types is to decide how to deal with information only present in one of the joined tables.

Let’s imagine a simple example.

- Our company is holding a conference for people in the movie rental industry.
- We’ll have people register online beforehand and then login the day of the conference.

- After the conference we have these tables

REGISTRATIONS	
reg_id	name
1	Andrew
2	Bob
3	Charlie
4	David

LOGINS	
log_id	name
1	Xavier
2	Andrew
3	Yolanda
4	Bob

- The respective id columns indicate what order they registered or logged in on site.

REGISTRATIONS	
reg_id	name
1	Andrew
2	Bob
3	Charlie
4	David

LOGINS	
log_id	name
1	Xavier
2	Andrew
3	Yolanda
4	Bob

- For the sake of simplicity, we will assume the names are unique.

REGISTRATIONS	
reg_id	name
1	Andrew
2	Bob
3	Charlie
4	David

LOGINS	
log_id	name
1	Xavier
2	Andrew
3	Yolanda
4	Bob

- To help you keep track, Registrations names' first letters go A,B,C,D

REGISTRATIONS	
reg_id	name
1	Andrew
2	Bob
3	Charlie
4	David

LOGINS	
log_id	name
1	Xavier
2	Andrew
3	Yolanda
4	Bob

- An INNER JOIN will result with the set of records that match in both tables.

REGISTRATIONS	
reg_id	name
1	Andrew
2	Bob
3	Charlie
4	David

LOGINS	
log_id	name
1	Xavier
2	Andrew
3	Yolanda
4	Bob

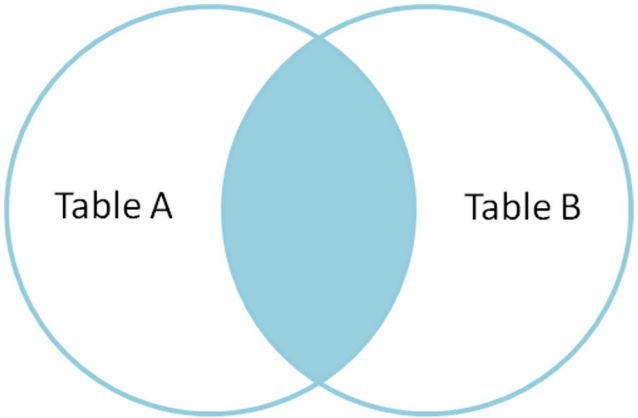
- An INNER JOIN will result with the set of records that **match in both** tables.

REGISTRATIONS	
reg_id	name
1	Andrew
2	Bob
3	Charlie
4	David

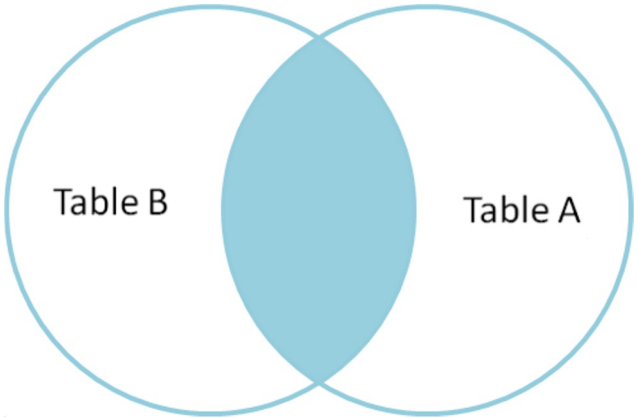
LOGINS	
log_id	name
1	Xavier
2	Andrew
3	Yolanda
4	Bob

- ```
  SELECT * FROM TableA
  INNER JOIN TableB
  ON TableA.col_match = TableB.col_match
  ```
  ```

- ```
  SELECT * FROM TableA
  INNER JOIN TableB
  ON TableA.col_match = TableB.col_match
  ```

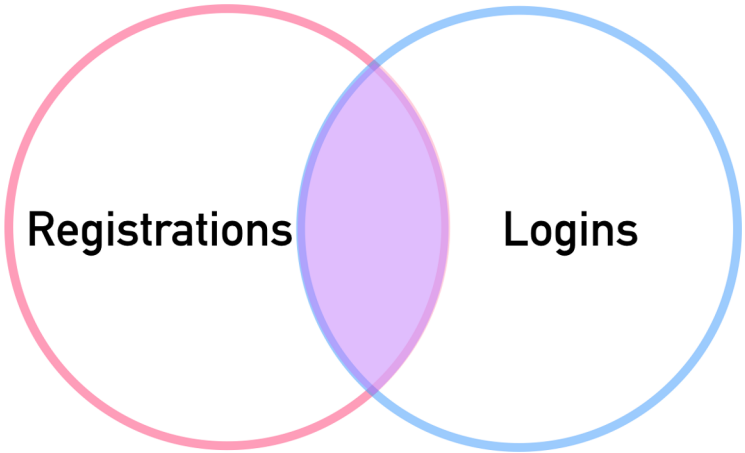

  ```

- ```
  SELECT * FROM TableB
  INNER JOIN TableA
  ON TableA.col_match = TableB.col_match
  ```


  ```

- ```
  SELECT * FROM Registrations
  INNER JOIN Logins
  ON Registrations.name = Logins.name
  ```

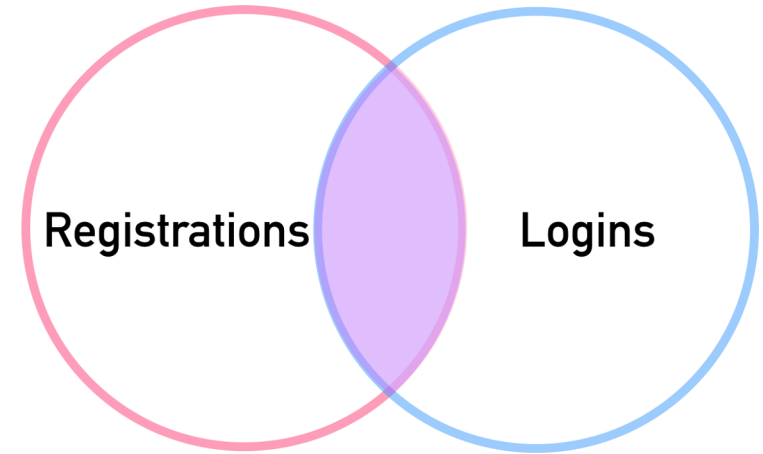
REGISTRATIONS	
reg_id	name
1	Andrew
2	Bob
3	Charlie
4	David



LOGINS	
log_id	name
1	Xavier
2	Andrew
3	Yolanda
4	Bob
  ```

- ```
  SELECT * FROM Registrations
  INNER JOIN Logins
  ON Registrations.name = Logins.name
  ```

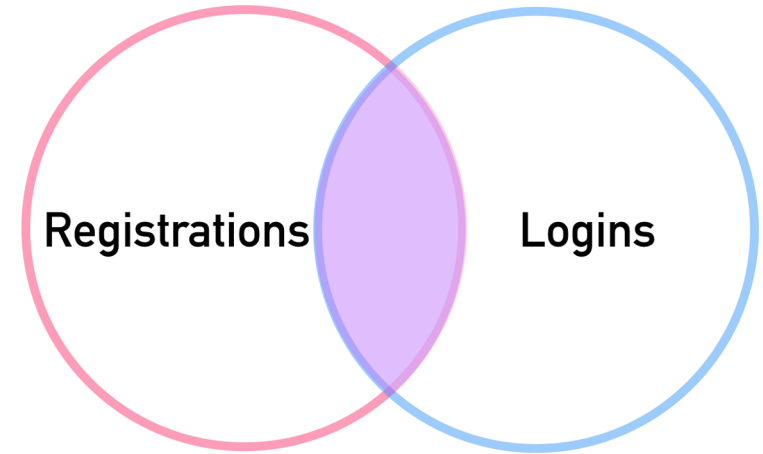
REGISTRATIONS	
reg_id	name
1	Andrew
2	Bob
3	Charlie
4	David



LOGINS	
log_id	name
1	Xavier
2	Andrew
3	Yolanda
4	Bob
  ```

- ```
  SELECT * FROM Registrations
  INNER JOIN Logins
  ON Registrations.name = Logins.name
  ```

REGISTRATIONS	
reg_id	name
1	Andrew
2	Bob
3	Charlie
4	David



LOGINS	
log_id	name
1	Xavier
2	Andrew
3	Yolanda
4	Bob
  ```

- ```
  SELECT * FROM Registrations
  INNER JOIN Logins
  ON Registrations.name = Logins.name
  ```

REGISTRATIONS	
reg_id	name
1	Andrew
2	Bob
3	Charlie
4	David

RESULTS			
reg_id	name	log_id	name
1	Andrew	2	Andrew
2	Bob	4	Bob

LOGINS	
log_id	name
1	Xavier
2	Andrew
3	Yolanda
4	Bob
  ```

```
SELECT reg_id,Logins.name,log_id
FROM Registrations
INNER JOIN Logins
ON Registrations.name = Logins.name
```

RESULTS		
reg_id	name	log_id
1	Andrew	2
2	Bob	4

```
SELECT reg_id,Logins.name,log_id
FROM Registrations
INNER JOIN Logins
ON Registrations.name = Logins.name
```

RESULTS		
reg_id	name	log_id
1	Andrew	2
2	Bob	4

- Remember that table order won’t matter in an INNER JOIN
- Also if you see just JOIN without the INNER, PostgreSQL will treat it as an INNER JOIN.

OUTER JOINS

- There are few different types of OUTER JOINs
- They will allow us to specify how to deal with values only present in one of the tables being joined.
- These are the more complex JOINs, take your time when trying to understand them!

- In these lectures we will explain:
  - FULL OUTER JOIN
    - Clarifying WHERE null
  - LEFT OUTER JOIN
    - Clarifying WHERE null
  - RIGHT OUTER JOIN
    - Clarifying WHERE null

FULL OUTER JOIN

- Let’s review our two example tables from the previous lectures.

REGISTRATIONS	
reg_id	name
1	Andrew
2	Bob
3	Charlie
4	David

LOGINS	
log_id	name
1	Xavier
2	Andrew
3	Yolanda
4	Bob

- We know we would join these tables together on the name column

REGISTRATIONS	
reg_id	name
1	Andrew
2	Bob
3	Charlie
4	David

LOGINS	
log_id	name
1	Xavier
2	Andrew
3	Yolanda
4	Bob

- Recall we match Andrew and Bob in both tables

REGISTRATIONS	
reg_id	name
1	Andrew
2	Bob
3	Charlie
4	David

LOGINS	
log_id	name
1	Xavier
2	Andrew
3	Yolanda
4	Bob

- But we have names that only appear in one table!

REGISTRATIONS	
reg_id	name
1	Andrew
2	Bob
3	Charlie
4	David

LOGINS	
log_id	name
1	Xavier
2	Andrew
3	Yolanda
4	Bob

- Let’s see how the different OUTER JOINs deal with this discrepancy.

REGISTRATIONS	
reg_id	name
1	Andrew
2	Bob
3	Charlie
4	David

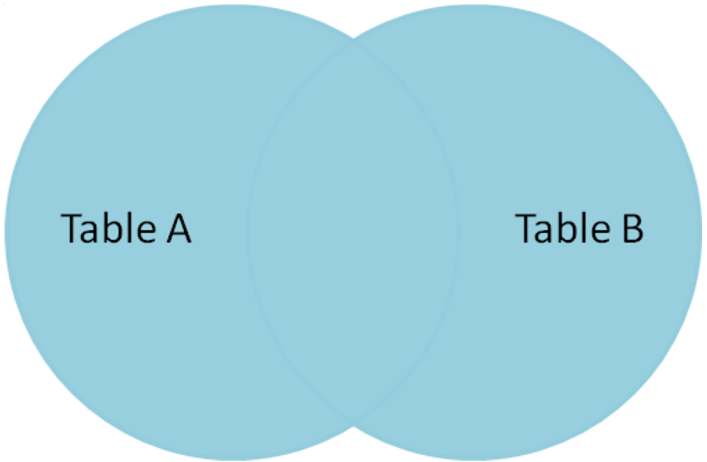
LOGINS	
log_id	name
1	Xavier
2	Andrew
3	Yolanda
4	Bob

We will first take a look at the simplest, which is a **FULL OUTER JOIN**

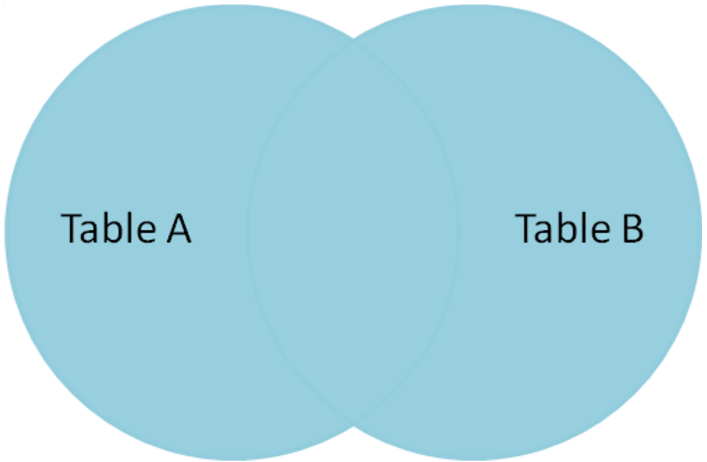
REGISTRATIONS	
reg_id	name
1	Andrew
2	Bob
3	Charlie
4	David

LOGINS	
log_id	name
1	Xavier
2	Andrew
3	Yolanda
4	Bob

- ```
  SELECT * FROM TableA
  FULL OUTER JOIN TableB
  ON TableA.col_match = TableB.col_match
  ```

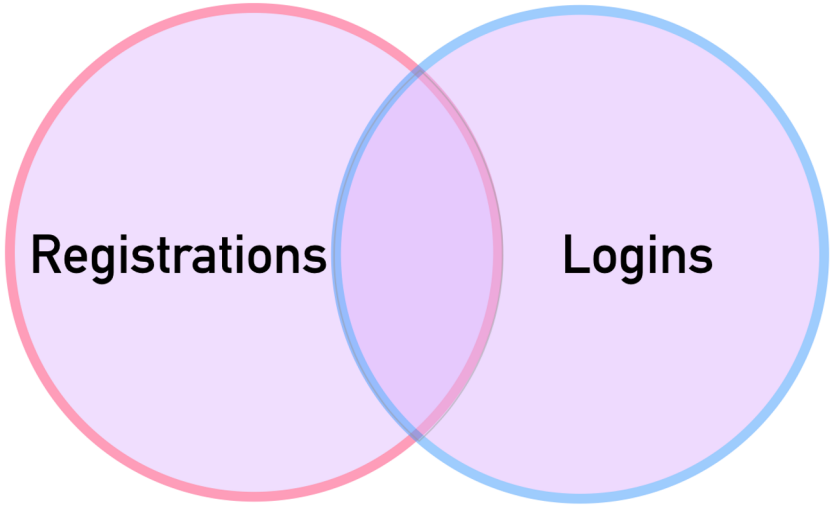

  ```

- SELECT * FROM **TableB**
  FULL OUTER JOIN **TableA**
  ON **TableA**.col_match = **TableB**.col_match



- ```
  SELECT * FROM Registrations
  FULL OUTER JOIN Logins
  ON Registrations.name = Logins.name
  ```

REGISTRATIONS	
reg_id	name
1	Andrew
2	Bob
3	Charlie
4	David



LOGINS	
log_id	name
1	Xavier
2	Andrew
3	Yolanda
4	Bob
  ```

- `SELECT * FROM Registrations FULL OUTER JOIN Logins ON Registrations.name = Logins.name`

REGISTRATIONS	
reg_id	name
1	Andrew
2	Bob
3	Charlie
4	David

RESULTS			
reg_id	name	log_id	name
1	Andrew		
2	Bob		
3	Charlie		
4	David		

LOGINS	
log_id	name
1	Xavier
2	Andrew
3	Yolanda
4	Bob

- `SELECT * FROM Registrations FULL OUTER JOIN Logins ON Registrations.name = Logins.name`

REGISTRATIONS	
reg_id	name
1	Andrew
2	Bob
3	Charlie
4	David

RESULTS			
reg_id	name	log_id	name
1	Andrew	2	Andrew
2	Bob	4	Bob
3	Charlie		
4	David		

LOGINS	
log_id	name
1	Xavier
2	Andrew
3	Yolanda
4	Bob

- `SELECT * FROM Registrations FULL OUTER JOIN Logins ON Registrations.name = Logins.name`

REGISTRATIONS	
reg_id	name
1	Andrew
2	Bob
3	Charlie
4	David

RESULTS			
reg_id	name	log_id	name
1	Andrew	2	Andrew
2	Bob	4	Bob
3	Charlie	null	null
4	David	null	null

LOGINS	
log_id	name
1	Xavier
2	Andrew
3	Yolanda
4	Bob

- `SELECT * FROM Registrations FULL OUTER JOIN Logins ON Registrations.name = Logins.name`

REGISTRATIONS

reg_id	name
1	Andrew
2	Bob
3	Charlie
4	David

RESULTS

reg_id	name	log_id	name
1	Andrew	2	Andrew
2	Bob	4	Bob
3	Charlie	null	null
4	David	null	null
null	null	1	Xavier
null	null	3	Yolanda

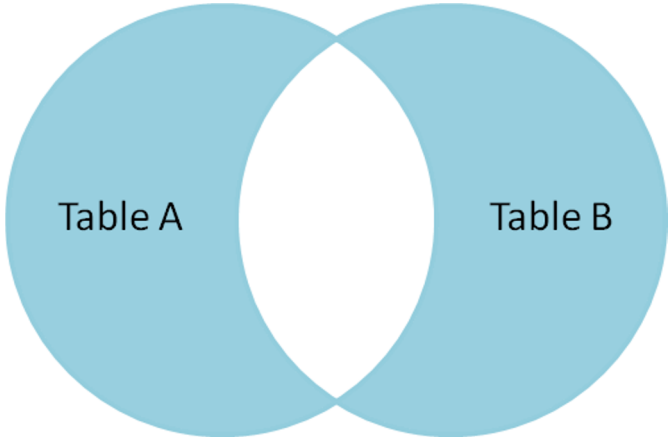
LOGINS

log_id	name
1	Xavier
2	Andrew
3	Yolanda
4	Bob

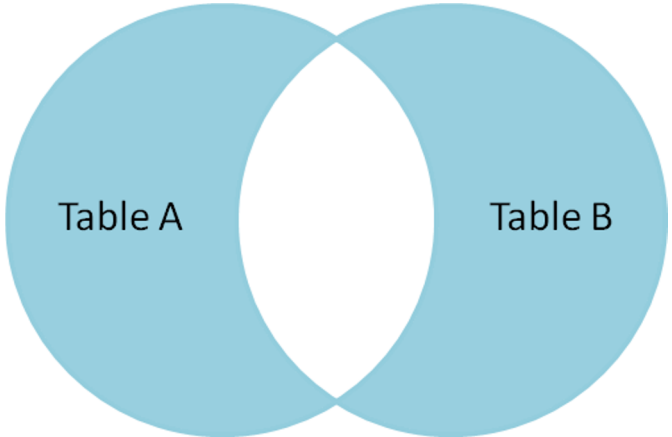
FULL OUTER JOIN with WHERE

Get rows unique to either table
(rows not found in both tables)

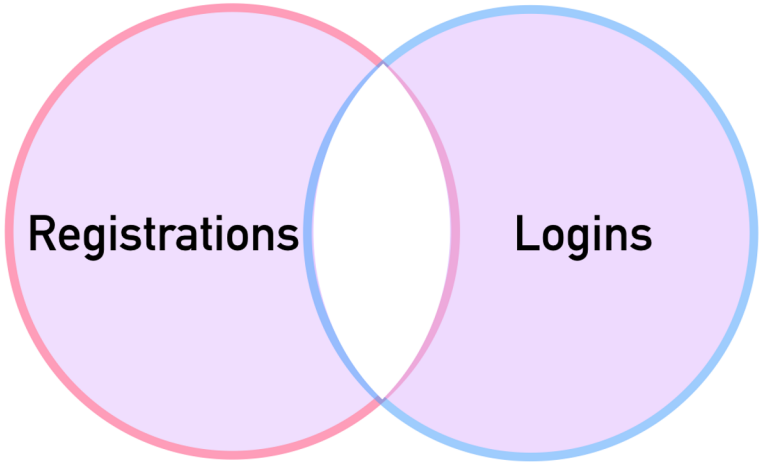
- ```
  SELECT * FROM TableA
  FULL OUTER JOIN TableB
  ON TableA.col_match = TableB.col_match
  WHERE TableA.id IS null OR
  TableB.id IS null
  ```


  ```

- ```
  SELECT * FROM TableB
  FULL OUTER JOIN TableA
  ON TableA.col_match = TableB.col_match
  WHERE TableA.id IS null OR
  TableB.id IS null
  ```


  ```

```
SELECT * FROM Registrations FULL OUTER JOIN Logins
ON Registrations.name = Logins.name
WHERE Registrations.reg_id IS null OR
Logins.log_id IS null
```



- `SELECT * FROM Registrations FULL OUTER JOIN Logins ON Registrations.name = Logins.name`

REGISTRATIONS	
reg_id	name
1	Andrew
2	Bob
3	Charlie
4	David

RESULTS			
reg_id	name	log_id	name
1	Andrew	2	Andrew
2	Bob	4	Bob
3	Charlie	null	null
4	David	null	null
null	null	1	Xavier
null	null	3	Yolanda

LOGINS	
log_id	name
1	Xavier
2	Andrew
3	Yolanda
4	Bob

- SELECT * FROM Registrations FULL OUTER JOIN Logins ON Registrations.name = Logins.name WHERE Registrations.reg_id IS null OR Logins.log_id IS null

REGISTRATIONS	
reg_id	name
1	Andrew
2	Bob
3	Charlie
4	David

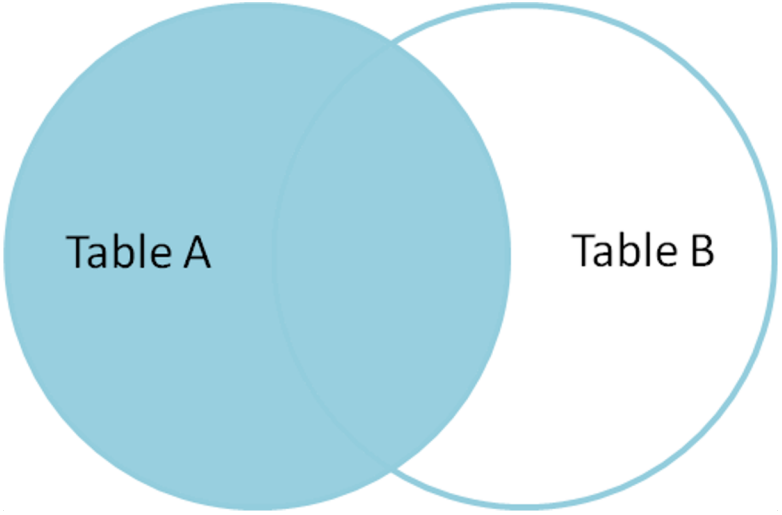
RESULTS			
reg_id	name	log_id	name
3	Charlie	null	null
4	David	null	null
null	null	1	Xavier
null	null	3	Yolanda

LOGINS	
log_id	name
1	Xavier
2	Andrew
3	Yolanda
4	Bob

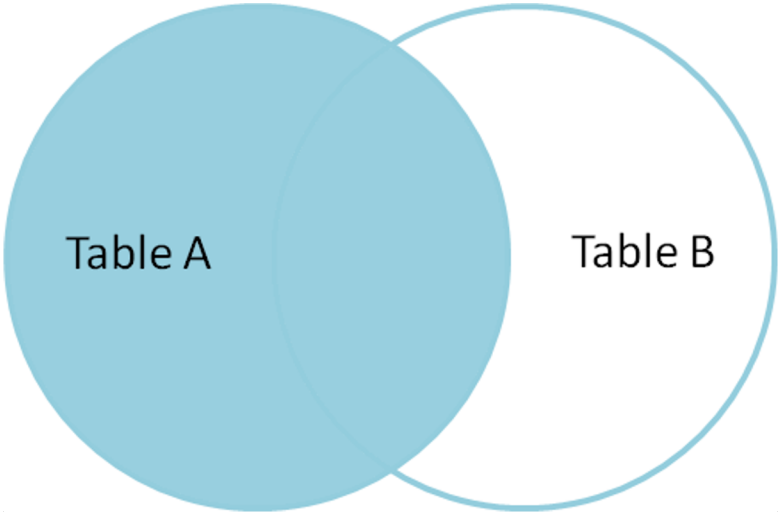
LEFT OUTER JOIN

- A LEFT OUTER JOIN results in the set of records that are in the left table, if there is no match with the right table, the results are null.
- Later on we will learn how to add WHERE statements to further modify a LEFT OUTER JOIN

- ```
  SELECT * FROM TableA
  LEFT OUTER JOIN TableB
  ON TableA.col_match = TableB.col_match
  ```

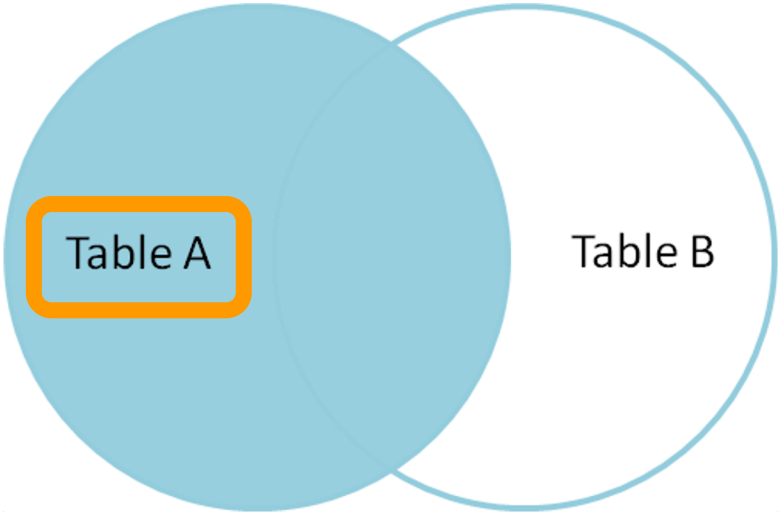

  ```

- ```
  SELECT * FROM TableA
  LEFT JOIN TableB
  ON TableA.col_match = TableB.col_match
  ```


  ```

ORDER MATTERS FOR LEFT OUTER JOIN!

- ```
  SELECT * FROM TableA
  LEFT OUTER JOIN TableB
  ON TableA.col_match = TableB.col_match
  ```


  ```

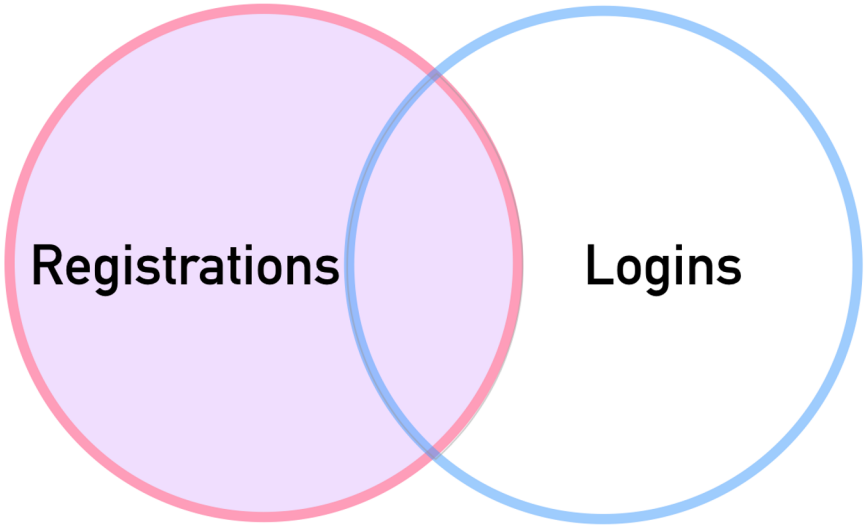
Let’s explore a **LEFT OUTER JOIN** with our two example tables.

REGISTRATIONS	
reg_id	name
1	Andrew
2	Bob
3	Charlie
4	David

LOGINS	
log_id	name
1	Xavier
2	Andrew
3	Yolanda
4	Bob

- ```
  SELECT * FROM Registrations
  LEFT OUTER JOIN Logins
  ON Registrations.name = Logins.name
  ```

REGISTRATIONS	
reg_id	name
1	Andrew
2	Bob
3	Charlie
4	David



LOGINS	
log_id	name
1	Xavier
2	Andrew
3	Yolanda
4	Bob
  ```

```
SELECT * FROM Registrations
LEFT OUTER JOIN Logins
ON Registrations.name = Logins.name
```

REGISTRATIONS	
reg_id	name
1	Andrew
2	Bob
3	Charlie
4	David

RESULTS			
reg_id	name	log_id	name
1	Andrew	2	Andrew
2	Bob	4	Bob
3	Charlie	null	null
4	David	null	null

LOGINS	
log_id	name
1	Xavier
2	Andrew
3	Yolanda
4	Bob

- SELECT * FROM Registrations
  LEFT OUTER JOIN Logins
  ON Registrations.name = Logins.name

REGISTRATIONS	
reg_id	name
1	Andrew
2	Bob
3	Charlie
4	David

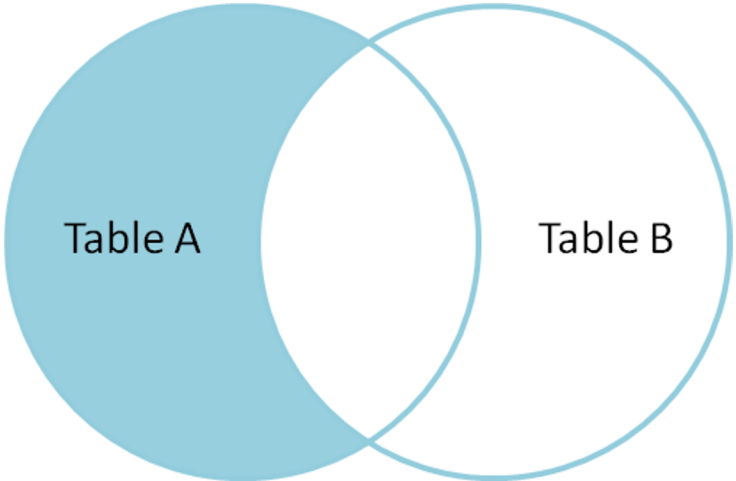
RESULTS			
reg_id	name	log_id	name
1	Andrew	2	Andrew
2	Bob	4	Bob
3	Charlie	null	null
4	David	null	null

LOGINS	
log_id	name
1	Xavier
2	Andrew
3	Yolanda
4	Bob

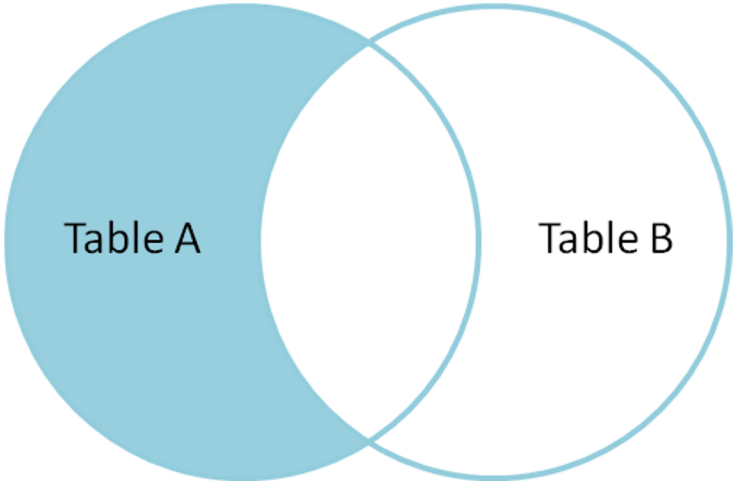
LEFT OUTER JOIN With WHERE

Get rows unique to left table

- What if we only wanted entries unique to Table A? Those rows found in Table A and **not** found in Table B.



- ```
  SELECT * FROM TableA
  LEFT OUTER JOIN TableB
  ON TableA.col_match = TableB.col_match
  WHERE TableB.id IS null
  ```


  ```

- ```
  SELECT * FROM Registrations
  LEFT OUTER JOIN Logins
  ON Registrations.name = Logins.name
  ```

REGISTRATIONS	
reg_id	name
1	Andrew
2	Bob
3	Charlie
4	David

RESULTS			
reg_id	name	log_id	name
1	Andrew	2	Andrew
2	Bob	4	Bob
3	Charlie	null	null
4	David	null	null

LOGINS	
log_id	name
1	Xavier
2	Andrew
3	Yolanda
4	Bob
  ```

```
SELECT * FROM Registrations
LEFT OUTER JOIN Logins
ON Registrations.name = Logins.name
WHERE Logins.log_id IS null
```

REGISTRATIONS	
reg_id	name
1	Andrew
2	Bob
3	Charlie
4	David

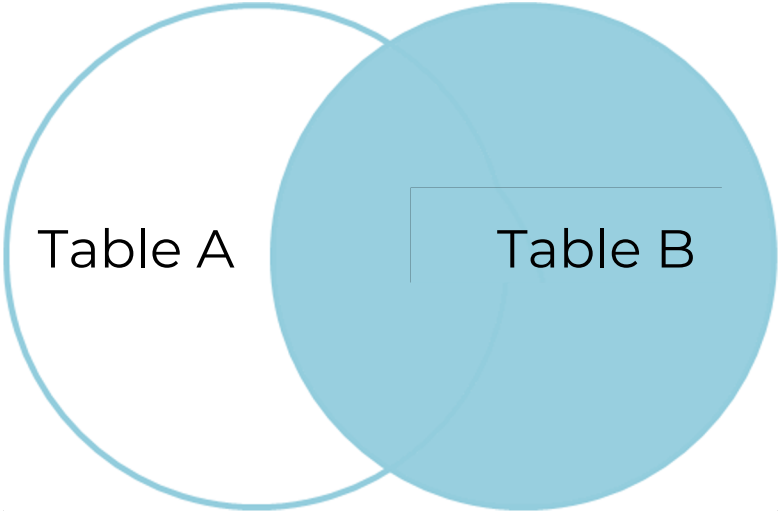
RESULTS			
reg_id	name	log_id	name
3	Charlie	null	null
4	David	null	null

LOGINS	
log_id	name
1	Xavier
2	Andrew
3	Yolanda
4	Bob

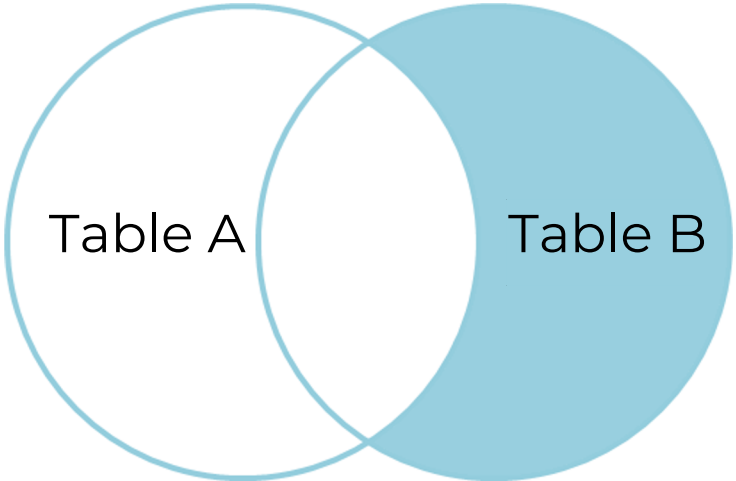
RIGHT JOINS

- A RIGHT JOIN is essentially the same as a LEFT JOIN, except the tables are switched.
- This would be the same as switching the table order in a LEFT OUTER JOIN.
- Let’s quickly see some examples of a RIGHT JOIN.

- ```
  SELECT * FROM TableA
  RIGHT OUTER JOIN TableB
  ON TableA.col_match = TableB.col_match
  ```


  ```

- ```
  SELECT * FROM TableA
  RIGHT OUTER JOIN TableB
  ON TableA.col_match = TableB.col_match
  WHERE TableA.id IS null
  ```


  ```

- It is up to you and how you have the tables organized “in your mind” when it comes to choosing a LEFT vs RIGHT join, since depending on the table order you specify in the JOIN, you can perform duplicate JOINs with either method.

UNIONS

- The UNION operator is used to combine the result-set of two or more SELECT statements.
- It basically serves to directly concatenate two results together, essentially “pasting” them together.

```
SELECT column_name(s) FROM table1
UNION
SELECT column_name(s) FROM table2;
```

Let’s explore a **UNION** with two example tables.

Sales2021_Q1	
name	amount
David	100
Claire	50

Sales2021_Q2	
name	amount
David	200
Claire	100

- ```
  SELECT * FROM Sales2021_Q1
  UNION
  SELECT * FROM Sales2021_Q2;
  ```

name	amount
David	100
Claire	50
David	200
Claire	100
  ```

JOIN Challenges

- California sales tax laws have changed and we need to alert our customers to this through email.
- What are the emails of the customers who live in California?

- Expected Results

	district character varying (20)	email character varying (50)
1	California	patricia.johnson@sakilacust...
2	California	betty.white@sakilacustomer...
3	California	alice.stewart@sakilacustom...
4	California	rosa.reynolds@sakilacusto...
5	California	renee.lane@sakilacustomer....
6	California	kristin.johnston@sakilacust...
7	California	cassandra.walters@sakilacu...
8	California	jacob.lance@sakilacustome...
9	California	rene.mcalister@sakilacusto...

- Hints
  - You will need to use the address and customer tables.
  - Look at the district column

```
SELECT district,email FROM address
INNER JOIN customer ON
address.address_id = customer.address_id
WHERE district = 'California'
```

- A customer walks in and is a huge fan of the actor “Nick Wahlberg” and wants to know which movies he is in.
- Get a list of all the movies “Nick Wahlberg” has been in.

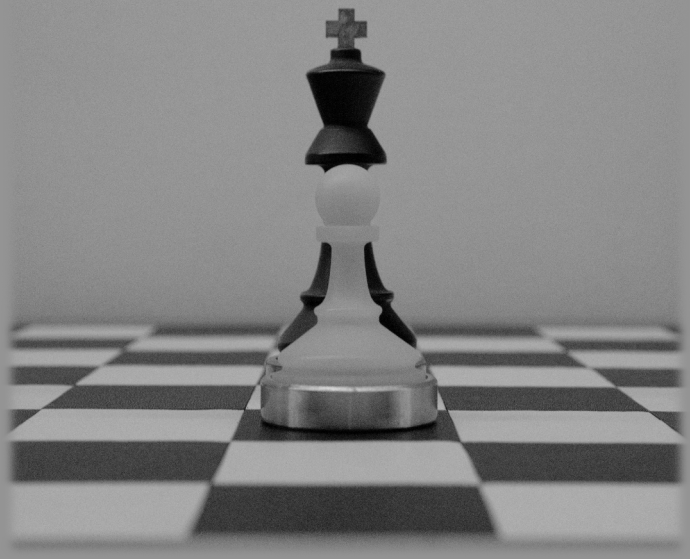
- Expected Results

	title character varying (255)	first_name character varying (45)	last_name character varying (45)
1	Adaptation Holes	Nick	Wahlberg
2	Apache Divine	Nick	Wahlberg
3	Baby Hall	Nick	Wahlberg
4	Bull Shawshank	Nick	Wahlberg
5	Chainsaw Uptown	Nick	Wahlberg
...			
21	Mask Peach	Nick	Wahlberg
22	Roof Champion	Nick	Wahlberg
23	Rushmore Mermaid	Nick	Wahlberg
24	Smile Earring	Nick	Wahlberg
25	Wardrobe Phantom	Nick	Wahlberg

- HINTS
  - You will need to do 2 JOINs in a row to do this in a single query.
  - Try using the online documentation or a simple google search to see how this is done.
  - Tables to use: actor, film, film_actor

```
SELECT title,first_name,last_name
     FROM film_actor INNER JOIN actor
ON film_actor.actor_id = actor.actor_id
     INNER JOIN film
ON film_actor.film_id = film.film_id
     WHERE first_name = 'Nick'
     AND last_name = 'Wahlberg'
```

Challenge!



Department: Customer Service

Request: "We need a complete customer directory showing each customer's name, email, phone, and their branch information. Show customer details along with branch name and city."

Expected Answer
Customer information combined with their branch details showing names, contact info, and branch location.

Hints

- Use **customers** and **branches** tables
- Use **accounts** table to connect customers to branches
- Use INNER JOINs to connect the three tables
- Include customer contact info and branch details

Department: Account Management

Request: "Show all customers with their account details. Include customer name, account number, account type, balance, and date opened. Sort by customer last name, then by balance (highest first)."

Expected Answer
Combined customer and account information showing personal details with account specifics.

Hints

- Use **customers** and **accounts** tables
- Use INNER JOIN to connect customers with their accounts
- Include customer names and all requested account details
- Sort by multiple criteria

Department: Transaction Analysis

Request: "Find all transactions over $5,000 with customer and account information. Show customer name, account number, transaction date, amount, and description. Sort by transaction amount (highest first)."

Expected Answer
High-value transactions with associated customer and account details.

Hints

- Use **customers**, **accounts**, and **transactions** tables
- Use INNER JOINs to connect all three tables
- Filter transactions by amount in WHERE clause
- Include customer names and transaction details

Department: Loan Management

Request: "Show all customers who have loans along with their loan details and branch information. Include customer name, loan type, loan amount, balance remaining, and the branch where the loan was issued."

Expected Answer
Customer loan information combined with branch details for all customers with loans.

Hints

- Use **customers**, **loans**, and **branches** tables
- Use INNER JOINs to connect customers to loans and loans to branches
- Include customer names, loan details, and branch information
- Only include customers who have loans

Department: Marketing Analytics

Request: "Find customers who DON'T have any accounts. We need to identify potential data issues or inactive customers. Show customer number, name, email, and phone."

Expected Answer
Customers without accounts using appropriate JOIN to find missing relationships.

Hints

- Use **customers** and **accounts** tables
- Use LEFT JOIN to include all customers
- Use WHERE clause to find customers without accounts (NULL values)
- Check for NULL account information to identify customers without accounts