

# Introducing Set Theory

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# Overview



## Set theory

### Set operations

- Unions
- Intersections
- Exceptions



# Set Theory

**Mathematical concept**

**A set is an collection of elements**

- Unduplicated
- Unordered

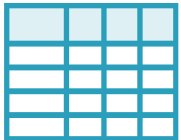
**Object to set membership**



# Set Theory in SQL



Results of a query can be considered a set



SQL sets have the same number of columns



SQL set columns have the same data type

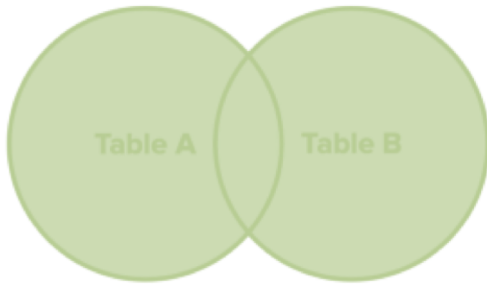


# Set operations

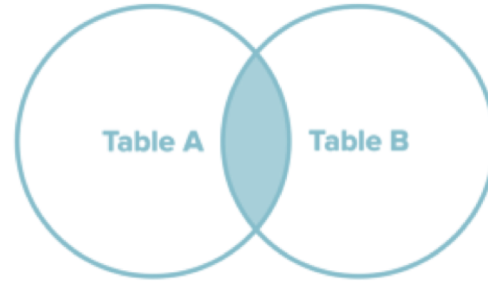
Operations that combine the results of multiple queries into a single result set



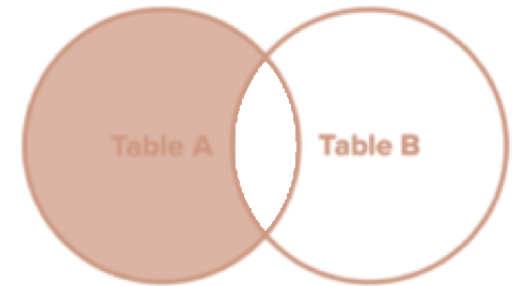
# Set Operators



**UNION**



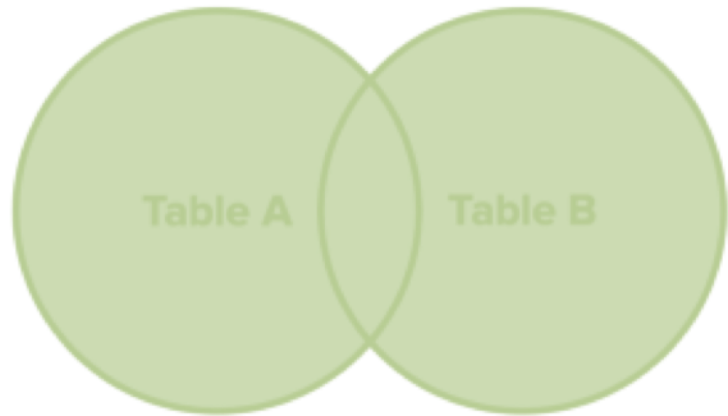
**INTERSECT**



**EXCEPT**



# Unions



Returns results from multiple queries as one result set

## UNION

- returns a distinct list of rows

## UNION ALL

- returns all rows from both tables

# Unions



Customers  
Current

cust_id	first_name	last_name	city	state
121	John	Smith	Tuscaloosa	Alabama
122	Jane	Doe	Meridian	Mississippi
123	Bob	Clark	Santa Fe	New Mexico
124	Estella	Dodd	Tulsa	Oklahoma



Customers  
Archived

arch_id	first_name	last_name	city	state
101	Lucy	Jones	Houston	Texas
108	Joseph	Alexander	Atlanta	Georgia
111	Elvis	Jones	Las Vegas	Nevada
124	Estella	Dodd	Tulsa	Oklahoma





```
SELECT 'Active' AS status, curr.*
```

```
FROM customers_current curr
```

```
UNION
```

```
SELECT 'Inactive' AS status, old.*
```

```
FROM customers_archive old
```

```
ORDER BY last_name;
```

## Unions

**UNION** operator combines the results of the two sets

**ORDER BY** applies to the combined result set

Can add **additional fields**



# Union Results



## Customers Current

cust_id	first_name	last_name	city	state
121	John	Smith	Tuscaloosa	Alabama
122	Jane	Doe	Meridian	Mississippi
123	Bob	Clark	Santa Fe	New Mexico
124	Estella	Dodd	Tulsa	Oklahoma



## Customers Archived

arch_id	first_name	last_name	city	state
101	Lucy	Jones	Houston	Texas
108	Joseph	Alexander	Atlanta	Georgia
111	Elvis	Jones	Las Vegas	Nevada
124	Estella	Dodd	Tulsa	Oklahoma

## UNION

Status	cust_id	first_name	last_name	city	state
Inactive	108	Joseph	Alexander	Atlanta	Georgia
Active	123	Bob	Clark	Santa Fe	New Mexico
Active	124	Estella	Dodd	Tulsa	Oklahoma
Inactive	124	Estella	Dodd	Tulsa	Oklahoma
Active	122	Jane	Doe	Meridian	Mississippi
Inactive	101	Lucy	Jones	Houston	Texas
Inactive	111	Elvis	Jones	Las Vegas	Nevada
Active	121	John	Smith	Tuscaloosa	Alabama



```
SELECT curr.*
```

```
FROM customers_current curr
```

**UNION**

```
SELECT old.*
```

```
FROM customers_archive old
```

```
ORDER BY 1;
```

◀ **UNION** filters duplicate rows

◀ **UNION ALL** returns all rows



## Customers Current

cust_id	first_name	last_name	city	state
121	John	Smith	Tuscaloosa	Alabama
123	Bob	Clark	Santa Fe	New Mexico
124	Estella	Dodd	Tulsa	Oklahoma



## Customers Archived

arch_id	first_name	last_name	city	state
101	Lucy	Jones	Houston	Texas
124	Estella	Dodd	Tulsa	Oklahoma

cust_id	first_name	last_name	city	state
101	Lucy	Jones	Houston	Texas
121	John	Smith	Tuscaloosa	Alabama
123	Bob	Clark	Santa Fe	New Mexico
124	Estella	Dodd	Tulsa	Oklahoma



```
SELECT curr.*
```

```
FROM customers_current curr
```

```
UNION ALL
```

```
SELECT old.*
```

```
FROM customers_archive old
```

```
ORDER BY 1;
```

◀ **UNION** filters duplicate rows

◀ **UNION ALL** returns all rows



## Customers Current

cust_id	first_name	last_name	city	state
121	John	Smith	Tuscaloosa	Alabama
123	Bob	Clark	Santa Fe	New Mexico
124	Estella	Dodd	Tulsa	Oklahoma



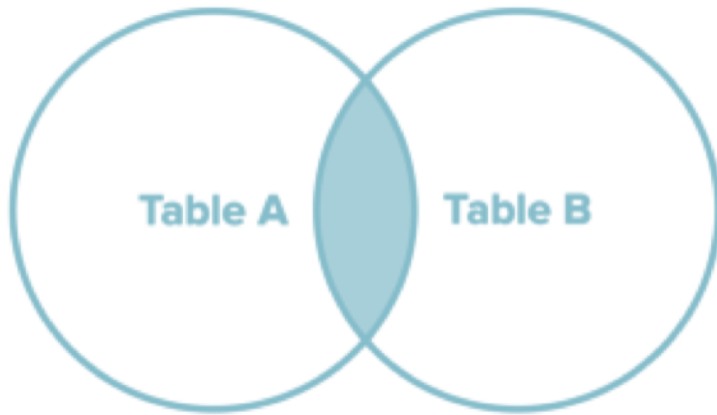
## Customers Archived

arch_id	first_name	last_name	city	state
101	Lucy	Jones	Houston	Texas
124	Estella	Dodd	Tulsa	Oklahoma

cust_id	first_name	last_name	city	state
121	John	Smith	Tuscaloosa	Alabama
123	Bob	Clark	Santa Fe	New Mexico
124	Estella	Dodd	Tulsa	Oklahoma
101	Lucy	Jones	Houston	Texas
124	Estella	Dodd	Tulsa	Oklahoma



# Intersections



Returns results from multiple queries as one result set only if the record appears in the result set from both queries

## INTERSECT

- returns a distinct list of rows

## INTERSECT ALL

- does not remove duplicate rows

# Intersections



## Customers Current

cust_id	first_name	last_name	city	state
121	John	Smith	Tuscaloosa	Alabama
122	Jane	Doe	Meridian	Mississippi
123	Bob	Clark	Santa Fe	New Mexico
124	Estella	Dodd	Tulsa	Oklahoma



## Customers Archived

arch_id	first_name	last_name	city	state
101	Lucy	Jones	Houston	Texas
108	Joseph	Alexander	Atlanta	Georgia
111	Elvis	Jones	Las Vegas	Nevada
124	Estella	Dodd	Tulsa	Oklahoma



```
SELECT curr.*
```

```
FROM customers_current curr
```

**INTERSECT**

```
SELECT old.*
```

```
FROM customers_archive old
```

```
ORDER BY last_name;
```

## Intersections

**INTERSECT** operator returns the results of the two sets **when the result appears in both sets**

**ORDER BY** applies to the combined result set



# Intersection Results



## Customers Current

cust_id	first_name	last_name	city	state
121	John	Smith	Tuscaloosa	Alabama
122	Jane	Doe	Meridian	Mississippi
123	Bob	Clark	Santa Fe	New Mexico
124	Estella	Dodd	Tulsa	Oklahoma



## Customers Archived

arch_id	first_name	last_name	city	state
101	Lucy	Jones	Houston	Texas
108	Joseph	Alexander	Atlanta	Georgia
111	Elvis	Jones	Las Vegas	Nevada
124	Estella	Dodd	Tulsa	Oklahoma

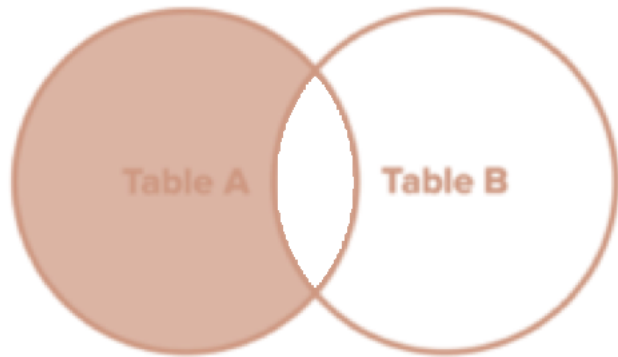
## INTERSECT

cust_id	first_name	last_name	city	state
124	Estella	Dodd	Tulsa	Oklahoma





# Exceptions



Returns results from two queries that appear in only the left query

Useful when trying to find rows that are in one set but not in another

## EXCEPT

- returns a distinct list of rows

## EXCEPT ALL

- does not remove duplicate rows

# Exceptions



## Customers Current

cust_id	first_name	last_name	city	state
121	John	Smith	Tuscaloosa	Alabama
122	Jane	Doe	Meridian	Mississippi
123	Bob	Clark	Santa Fe	New Mexico
124	Estella	Dodd	Tulsa	Oklahoma



## Customers Archived

arch_id	first_name	last_name	city	state
101	Lucy	Jones	Houston	Texas
108	Joseph	Alexander	Atlanta	Georgia
111	Elvis	Jones	Las Vegas	Nevada
124	Estella	Dodd	Tulsa	Oklahoma



```
SELECT curr.*  
  
FROM customers_current curr  
  
EXCEPT  
  
SELECT old.*  
  
FROM customers_archive old  
  
ORDER BY last_name;
```

## Exceptions

**EXCEPT** operator returns the results of the two sets **when the result appears only in the left set**

**ORDER BY** applies to the combined result set



# Exception Results



## Customers Current

cust_id	first_name	last_name	city	state
121	John	Smith	Tuscaloosa	Alabama
122	Jane	Doe	Meridian	Mississippi
123	Bob	Clark	Santa Fe	New Mexico
124	Estella	Dodd	Tulsa	Oklahoma



## Customers Archived

arch_id	first_name	last_name	city	state
101	Lucy	Jones	Houston	Texas
108	Joseph	Alexander	Atlanta	Georgia
111	Elvis	Jones	Las Vegas	Nevada
124	Estella	Dodd	Tulsa	Oklahoma

## EXCEPT

cust_id	first_name	last_name	city	state
121	John	Smith	Tuscaloosa	Alabama
122	Jane	Doe	Meridian	Mississippi
123	Bob	Clark	Santa Fe	New Mexico



# Duplicate Records

## DISTINCT

Regular SQL queries

SELECT keyword returns all rows

Includes duplicates

**DISTINCT** keyword removes duplicates

## ALL

Set theory

Set operators return unique rows

Excludes duplicates

**ALL** keyword includes duplicate rows



# Demo



Using set operators to retrieve and analyze records



# Summary



**UNION** returns records from both sets

**INTERSECT** returns records that exist in both sets

**EXCEPT** returns records that exist only in the left (first) set

Use the **ALL** keyword to include duplicate records

