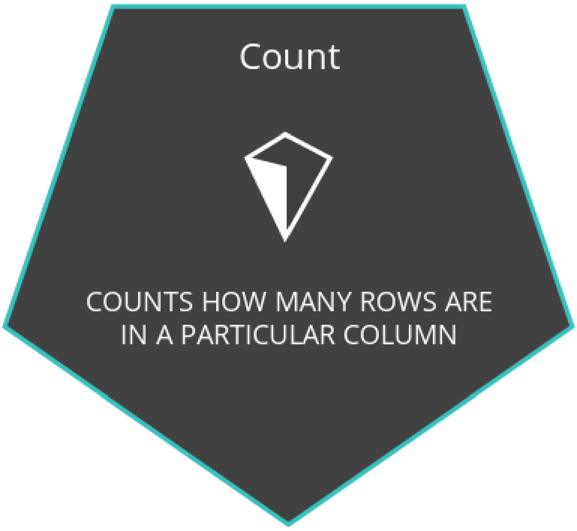
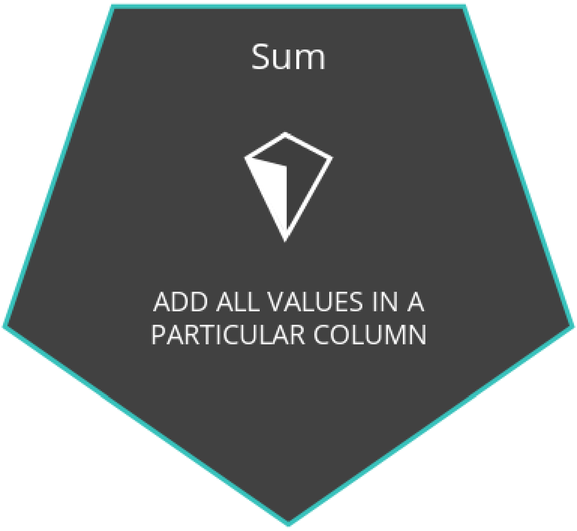
Introduction to Aggregation:-

If you're familiar with Excel, SQL commands are pretty similar.

- **Count, counts how many rows are in a particular column.**



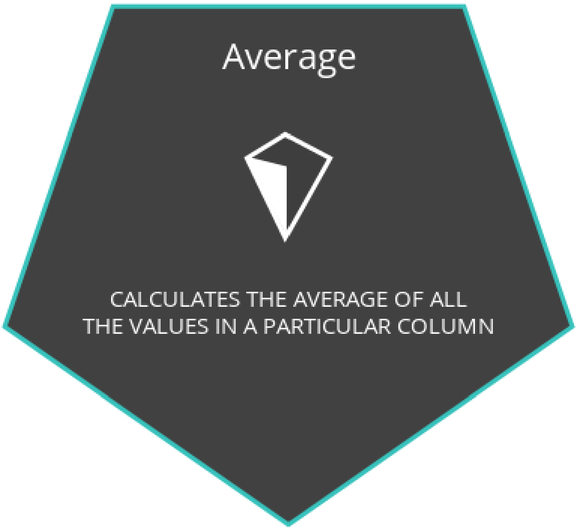
- **Sum, adds together all the values in a particular column.**



- **Min and Max, return the lowest and highest values in a particular column.**

Min & Max
RETURNS THE LOWEST AND HIGHEST VALUES IN A PARTICULAR COLUMN

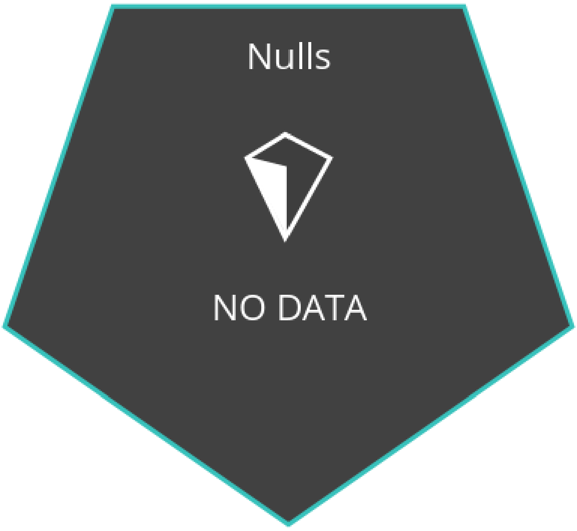
- **Average, calculates the average of all the values in a particular column.**


Average
CALCULATES THE AVERAGE OF ALL THE VALUES IN A PARTICULAR COLUMN

__ These functions operate down columns, not across rows. So you can do things like sum up all the quantities of paper ever delivered. Instead of getting results set many thousands of rows long,you just get one line with the answer. In practice, you'll find yourself using row-level output for the early exploratory work when searching your database to better understand the data. As you get a sense for what the data looks like and begin to look for answers to your questions, aggregates become more helpful. __

> # Introduction to NULLs:-

NULLs are a datatype that specifies where no data exists in SQL. They are often ignored in our aggregation functions



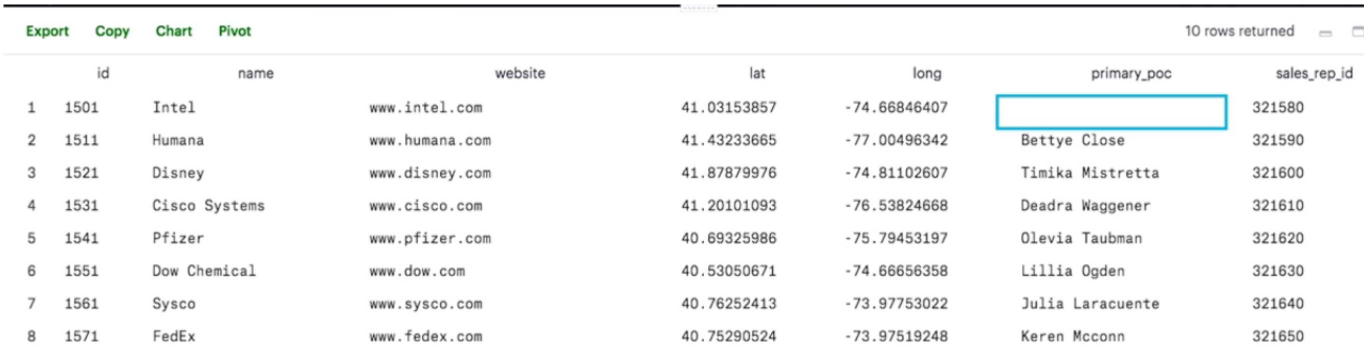
__ **It's different from a zero or a space. And there's a good reason. From a business perspective, for Parch & Posey a zero means that no paper was sold, which could mean that a sale was attempted but not made. A null could mean no sale was even attempted. And that's a pretty meaningful difference.**

__

Illustration:-

1. - **To get a feel for how nulls work, let's pull a set of records from the accounts table with IDs that fall between 1500 and 1600. We can see that the primary POC, which stands for Point Of Contact, is blank for the Intel account. This could simply be an error in the data. Maybe a point of contact that was accidentally deleted at some point, or it could be that Parch & Posey's point of contact left the company and they don't yet have a new point of contact for that account. Either way, there is no data in this particular cell. This cell is null.**

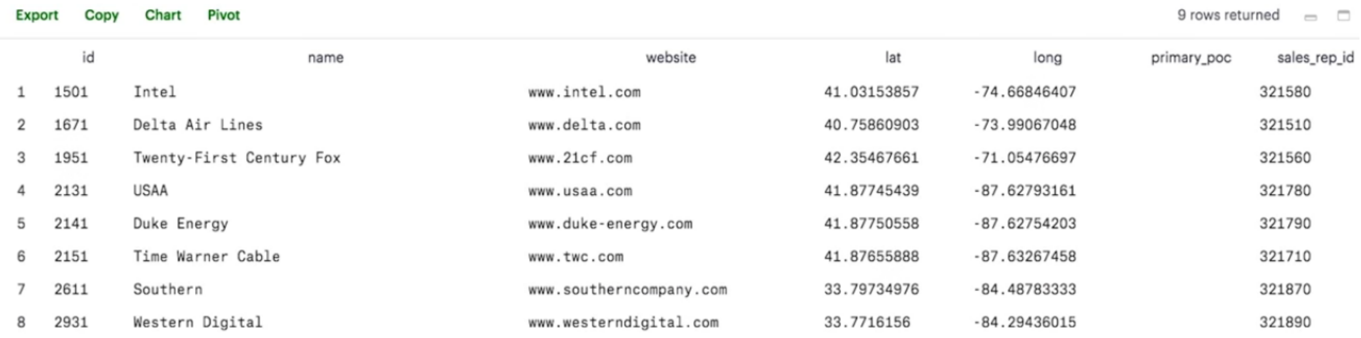
```
SELECT *
FROM demo.accounts
WHERE id > 1500 AND id < 1600
```



	id	name	website	lat	long	primary_poc	sales_rep_id
1	1501	Intel	www.intel.com	41.03153857	-74.66846407		321580
2	1511	Humana	www.humana.com	41.43233665	-77.00496342	Bettye Close	321590
3	1521	Disney	www.disney.com	41.87879976	-74.81102607	Timika Mistretta	321600
4	1531	Cisco Systems	www.cisco.com	41.20101093	-76.53824668	Deadra Waggener	321610
5	1541	Pfizer	www.pfizer.com	40.69325986	-75.79453197	Olevia Taubman	321620
6	1551	Dow Chemical	www.dow.com	40.53050671	-74.66656358	Lillia Ogden	321630
7	1561	Sysco	www.sysco.com	40.76252413	-73.97753022	Julia Laracuente	321640
8	1571	FedEx	www.fedex.com	40.75290524	-73.97519248	Keren Mcconn	321650

2. - **Imagining yourself as a sales manager at Parch & Posey, you may want to know all of the accounts for which the primary POC is null. If you don't have a point of contact, chances are you're not going to be able to keep that customer for much longer. In order to find all these accounts, we'll have to use some special syntax in our WHERE clause. Turns out, there are quite a few accounts without points of contact. So, the special thing about nulls that you need to write IS NULL instead of EQUALS NULL.**

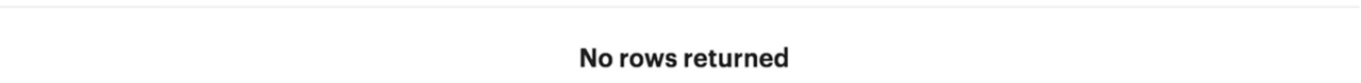
```
SELECT *
FROM demo.accounts
WHERE primary_poc IS NULL
```



	id	name	website	lat	long	primary_poc	sales_rep_id
1	1501	Intel	www.intel.com	41.03153857	-74.66846407		321580
2	1671	Delta Air Lines	www.delta.com	40.75860903	-73.99067048		321510
3	1951	Twenty-First Century Fox	www.21cf.com	42.35467661	-71.05476697		321560
4	2131	USAA	www.usaa.com	41.87745439	-87.62793161		321780
5	2141	Duke Energy	www.duke-energy.com	41.87750558	-87.62754203		321790
6	2151	Time Warner Cable	www.twc.com	41.87655888	-87.63267458		321710
7	2611	Southern	www.southerncompany.com	33.79734976	-84.48783333		321870
8	2931	Western Digital	www.westerndigital.com	33.7716156	-84.29436015		321890

3. - **The reason this doesn't work is that NULL is not a value, it's a property of the data. This is different from zero or a space, both of which are values.**

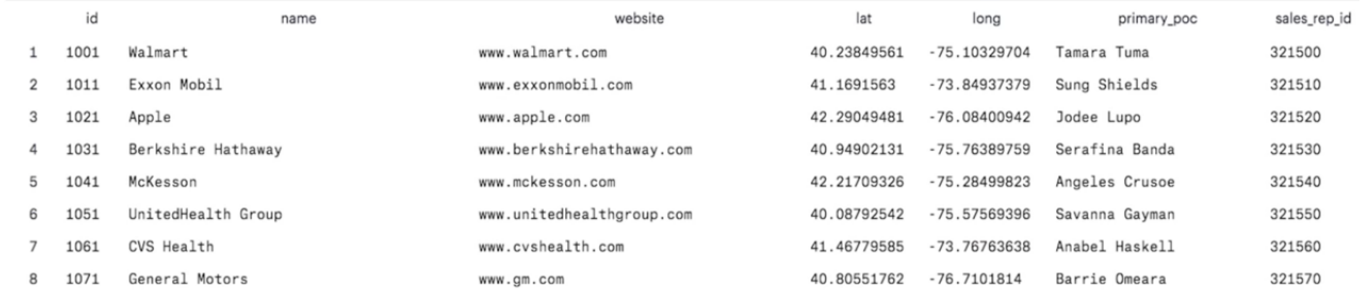
```
SELECT *
FROM demo.accounts
WHERE primary_poc = NULL
```



No rows returned

4. - **If you want to find the inverse of our previous result set, you can use this syntax, IS NOT NULL. As you can see, this returns all rows for which there are values in the primary_POC column.**

```
SELECT *
FROM demo.accounts
WHERE primary_poc IS NOT NULL
```



	id	name	website	lat	long	primary_poc	sales_rep_id
1	1001	Walmart	www.walmart.com	40.23849561	-75.10329704	Tamara Tuma	321500
2	1011	Exxon Mobil	www.exxonmobil.com	41.1691563	-73.84937379	Sung Shields	321510
3	1021	Apple	www.apple.com	42.29049481	-76.08400942	Jodee Lupo	321520
4	1031	Berkshire Hathaway	www.berkshirehathaway.com	40.94902131	-75.76389759	Serafina Banda	321530
5	1041	McKesson	www.mckesson.com	42.21709326	-75.28499823	Angeles Crusoe	321540
6	1051	UnitedHealth Group	www.unitedhealthgroup.com	40.08792542	-75.57569396	Savanna Gayman	321550
7	1061	CVS Health	www.cvshealth.com	41.46779585	-73.76763638	Anabel Haskell	321560
8	1071	General Motors	www.gm.com	40.80551762	-76.7101814	Barrie Omeara	321570

NULLs - Expert Tip

- **NULLs frequently occur when performing a LEFT or RIGHT JOIN. You saw in the last lesson - when some rows in the left table of a left join are not matched with rows in the right table, those rows will contain some NULL values in the result set.**
- **NULLs can also occur from simply missing data in our database.**

> # Count:-

COUNT the Number of Rows in a Table

Illustration:-

1. - **finding all the rows in the accounts table.**

```
SELECT COUNT(*)
FROM accounts;
```

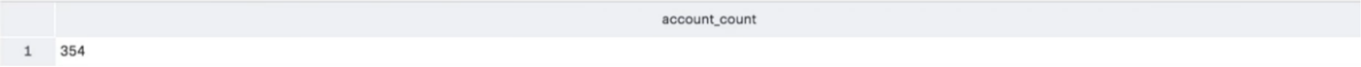
2. - **But we could have just as easily chosen a column to drop into the aggregation function:**

```
SELECT COUNT(accounts.id)
FROM accounts;
```

These two statements are equivalent, but this isn't always the case.

3. - **The count function can also be used to count the number of non-null records in an individual column. To illustrate this, let's take a look at the accounts table. As you can see, there are 354 rows in the accounts table.**

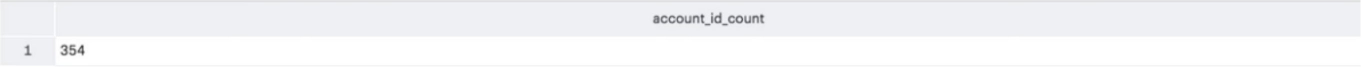
```
SELECT COUNT(*) AS account_count
FROM demo.accounts
```



	account_count
1	354

4. - **Now, by substituting ID for the star, we can see how many non-null records there are in the ID column. Let's give the column a more sensible name while we're at it. Since there are no null values in the ID column, it returns the same result as count star.**

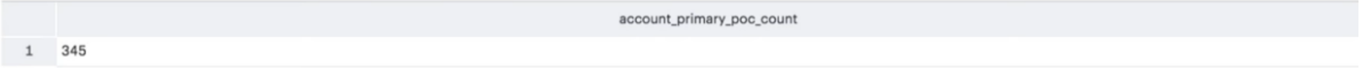
```
SELECT COUNT(id) AS account_count
FROM demo.accounts
```



	account_id_count
1	354

5. - **Now, let's try this with a column that we know contains some null values, primary poc. This time, we get a result that is nine lower than our previous result.**

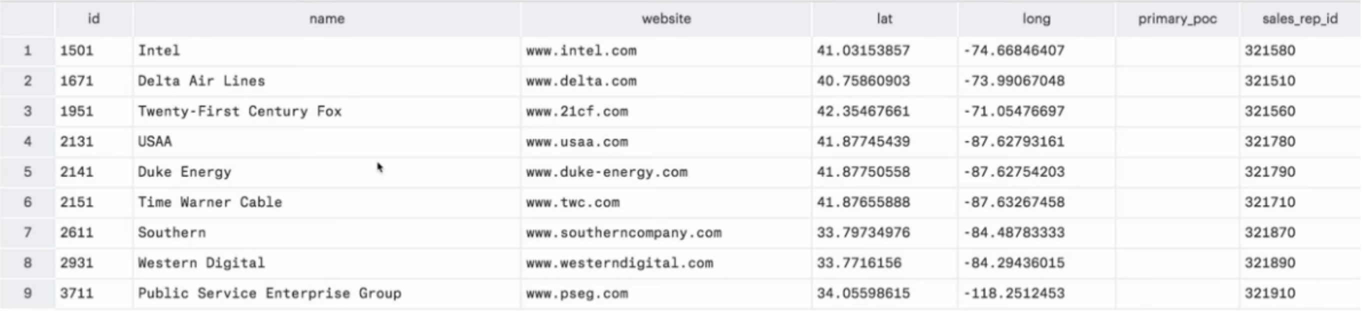
```
SELECT COUNT(primary_poc) AS account_primary_poc_count
FROM demo.accounts
```



	account_primary_poc_count
1	345

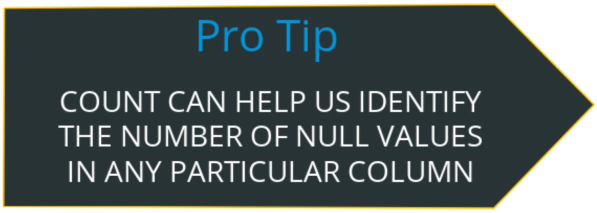
6. - **Let's run a quick query to verify that there are nine null values in the primary poc column. And here they are, the nine rows with null values. One thing you may have noticed is that count can be used in columns with non numerical values. This is not true of all aggregation functions, but it makes sense. The count function is just looking for non-null data and text is not null. Some of the functions we're about to learn like sum and average are impossible to apply to text because, well, how do you take the average of a bunch of account names.**

```
SELECT *
FROM demo.accounts
WHERE primary_poc IS NULL
```



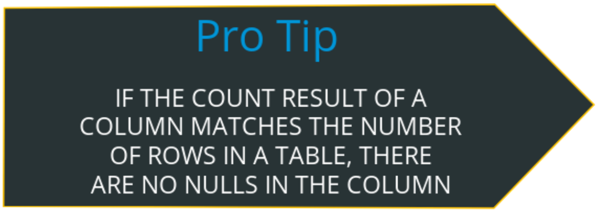
	id	name	website	lat	long	primary_poc	sales_rep_id
1	1501	Intel	www.intel.com	41.03153857	-74.66846407		321580
2	1671	Delta Air Lines	www.delta.com	40.75860903	-73.99067048		321510
3	1951	Twenty-First Century Fox	www.21cf.com	42.35467661	-71.05476697		321560
4	2131	USAA	www.usaa.com	41.87745439	-87.62793161		321780
5	2141	Duke Energy	www.duke-energy.com	41.87750558	-87.62754203		321790
6	2151	Time Warner Cable	www.twc.com	41.87655888	-87.63267458		321710
7	2611	Southern	www.southerncompany.com	33.79734976	-84.48783333		321870
8	2931	Western Digital	www.westerndigital.com	33.7716156	-84.29436015		321890
9	3711	Public Service Enterprise Group	www.pseg.com	34.05598615	-118.2512453		321910

Pro Tips:-



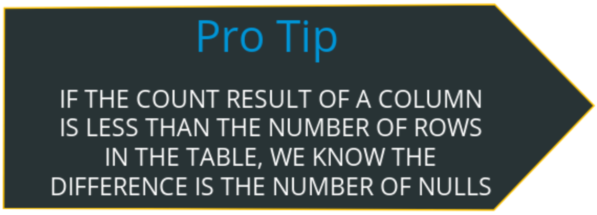
Pro Tip

COUNT CAN HELP US IDENTIFY THE NUMBER OF NULL VALUES IN ANY PARTICULAR COLUMN



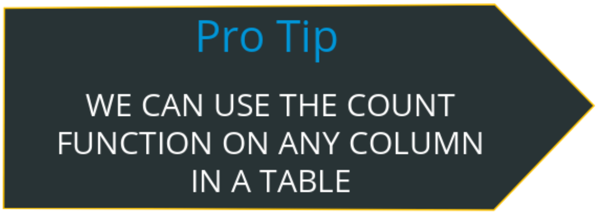
Pro Tip

IF THE COUNT RESULT OF A COLUMN MATCHES THE NUMBER OF ROWS IN A TABLE, THERE ARE NO NULLS IN THE COLUMN



Pro Tip

IF THE COUNT RESULT OF A COLUMN IS LESS THAN THE NUMBER OF ROWS IN THE TABLE, WE KNOW THE DIFFERENCE IS THE NUMBER OF NULLS



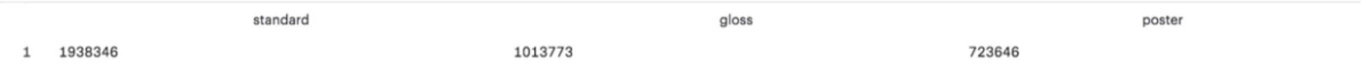
Pro Tip

WE CAN USE THE COUNT FUNCTION ON ANY COLUMN IN A TABLE

SUM:-

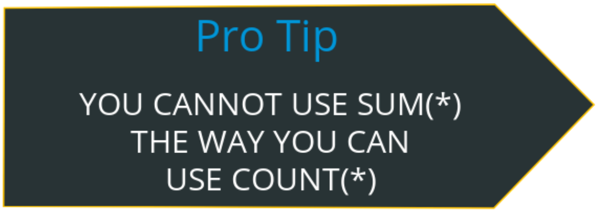
- **Imagine yourself as an operations manager at Parch & Posey. You're trying to do some inventory planning, and you want to know how much of each paper type to produce. A good place to start might be to total up all sales of each paper type and compare them to one another. We'll do this using SUM. It works similarly to COUNT, except that you'll want to specify column names rather than using star. It looks like standard is more popular than both of the non-standard paper types combined. Unlike COUNT, you can only use the SUM function on columns containing numerical values. You don't need to worry too much about the presence of nulls. The SUM function will just treat nulls as zero.**

```
SELECT SUM(standard_qty) AS standard,
       SUM(gloss_qty) AS gloss,
       SUM(poster_qty) AS poster
FROM demo.orders
```



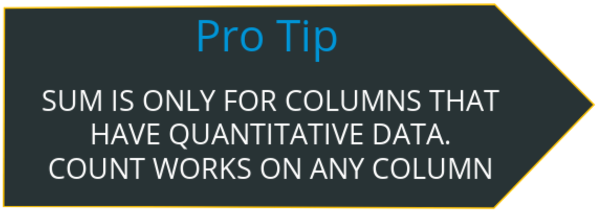
	standard	gloss	poster
1	1938346	1013773	723646

Pro Tips:-



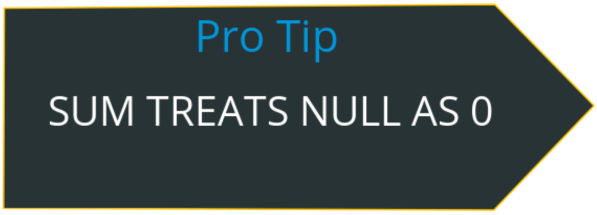
Pro Tip

YOU CANNOT USE SUM(*) THE WAY YOU CAN USE COUNT(*)



Pro Tip

SUM IS ONLY FOR COLUMNS THAT HAVE QUANTITATIVE DATA. COUNT WORKS ON ANY COLUMN



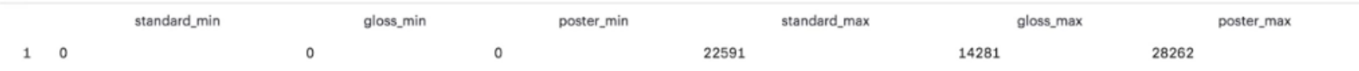
Pro Tip

SUM TREATS NULL AS 0

MIN & MAX:-

- **The syntax for MIN and MAX is similar to SUM and COUNT. It shouldn't be surprising that the minimum for each paper type is zero. Some customers only order one or two types of paper. What is surprising is that the largest single order is for poster paper, despite the fact that it's the least popular overall.**

```
SELECT MIN(standard_qty) AS standard_min,
       MIN(gloss_qty) AS gloss_min,
       MIN(poster_qty) AS poster_min,
       MAX(standard_qty) AS standard_max,
       MAX(gloss_qty) AS gloss_max,
       Max(poster_qty) AS poster_max
    FROM demo.orders
```



	standard_min	gloss_min	poster_min	standard_max	gloss_max	poster_max
1	0	0	0	22591	14281	28262

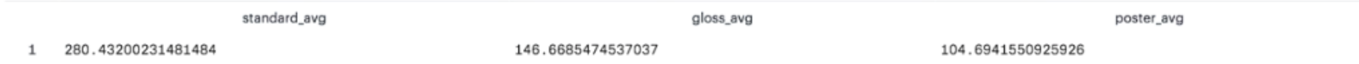
Expert Tip:-

- **Functionally, MIN and MAX are similar to COUNT in that they can be used on non-numerical columns. Depending on the column type, MIN will return the lowest number, earliest date, or non-numerical value as early in the alphabet as possible. As you might suspect, MAX does the opposite—it returns the highest number, the latest date, or the non-numerical value closest alphabetically to “Z”.**

AVG:-

- **So now we know which paper types are most popular and we have a sense of the largest order size we might need to fulfill at any given time. But what's the average order size? What can we expect to see on a regular basis? We'll use the average function which is typed as AVG and has a similar syntax to all of the other aggregation functions.**

```
SELECT  AVG(standard_qty) AS standard_avg,
        AVG(gloss_qty) AS gloss_avg,
        AVG(poster_qty) AS poster_avg
FROM demo.orders
```



	standard_avg	gloss_avg	poster_avg
1	280.43200231481484	146.6685474537037	104.6941550925926

- **So it looks like that large poster paper order must have been a major outlier because the average poster order is only about a third the size of the average standard order. When you're using the average function, keep in mind that it can only be used on numerical columns. Also, it ignores nulls completely, meaning that rows with null values are not counted in the numerator or the denominator when calculating the average.**

MEDIAN Expert Tip:-

- **One quick note that a median might be a more appropriate measure of center for this data, but finding the median happens to be a pretty difficult thing to get using SQL alone — so difficult that finding a median is occasionally asked as an interview question.**

```
SELECT *
FROM (SELECT total_amt_usd
      FROM orders
      ORDER BY total_amt_usd
      LIMIT 3457) AS table1
ORDER BY total_amt_usd DESC
```

GROUP BY:-

- **GROUP BY can be used to aggregate data within subsets of the data. For example, grouping for different accounts, different regions, or different sales representatives.**

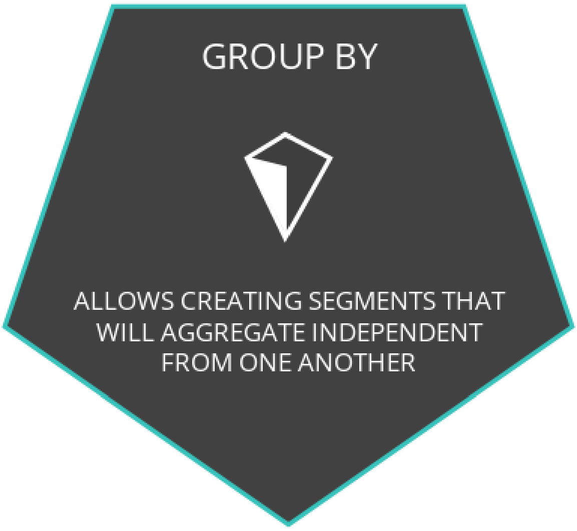
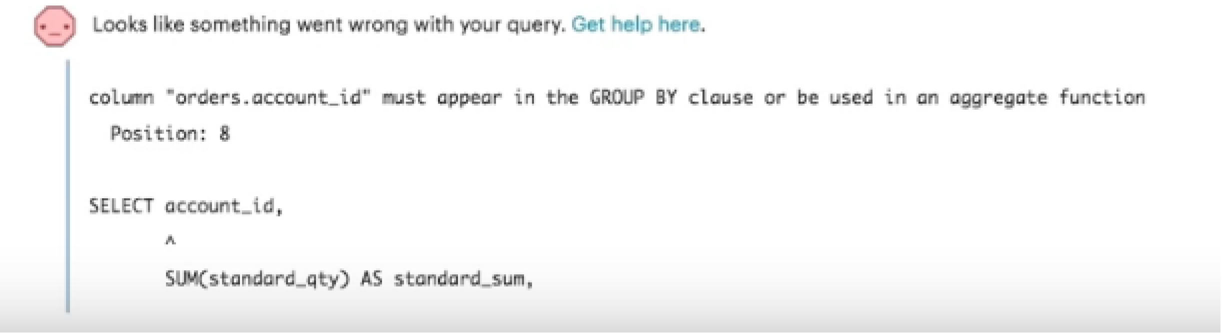

GROUP BY
ALLOWS CREATING SEGMENTS THAT WILL AGGREGATE INDEPENDENT FROM ONE ANOTHER

Illustration:-

1. - **we want to create a separate set of sums for each account id. So, let's add the account id column into our Select statement. As you can see, this returns an error.**

```
SELECT account_id,
       SUM(standard_qty) AS standard_sum,
       SUM(gloss_qty) AS gloss_sum,
       SUM(poster_qty) AS poster_sum
FROM   demo.orders
```


Looks like something went wrong with your query. Get help here.

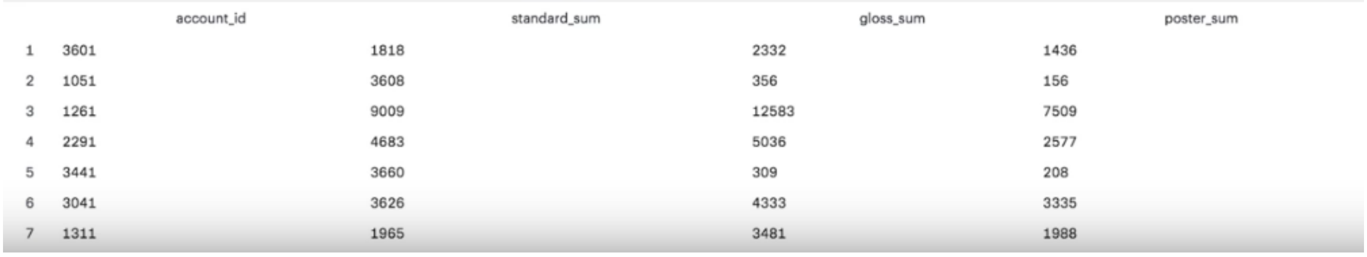
```
column "orders.account_id" must appear in the GROUP BY clause or be used in an aggregate function
  Position: 8

SELECT account_id,
       ^
       SUM(standard_qty) AS standard_sum,
```

2. - **As we aggregate in this query, we're effectively collapsing the number of rows returned. In our previous query, we collapsed all the way down to a single row. The reason we're**

getting an error here, is that we've included the account id column but this column isn't being collapsed like the columns that are being aggregated. The query isn't sure whether to sum the account id as well or whether to make it into a grouping. We have to be explicit about this. We want to tell the query to aggregate into segments where each segment is one of the values in the account id column. We'll do this using the GROUP BY clause.

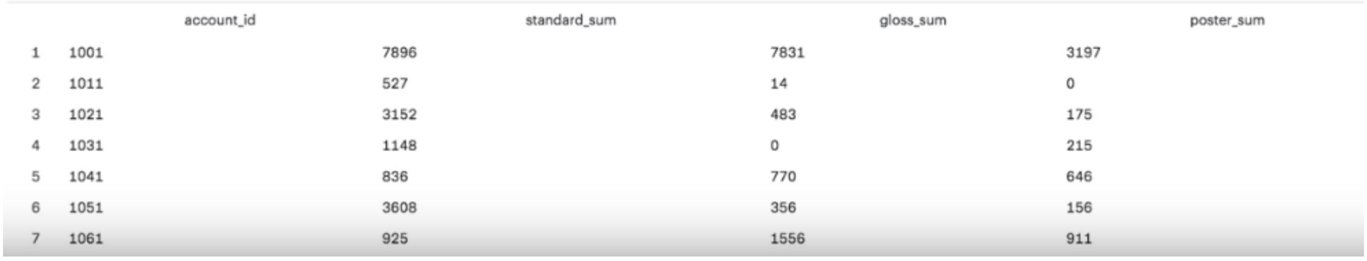
```
SELECT account_id,
       SUM(standard_qty) AS standard_sum,
       SUM(gloss_qty) AS gloss_sum,
       SUM(poster_qty) AS poster_sum
FROM   demo.orders
GROUP BY account_id
```



	account_id	standard_sum	gloss_sum	poster_sum
1	3601	1818	2332	1436
2	1051	3608	356	156
3	1261	9009	12583	7509
4	2291	4683	5036	2577
5	3441	3660	309	208
6	3041	3626	4333	3335
7	1311	1965	3481	1988

3. - **You can see that this isn't ordered intuitively, so let's fix that. The GROUP BY clause always goes between the WHERE clause if there is one and the ORDER BY clause. Whenever there's a field in the Select statement that's not being aggregated, the query expects it to be in the GROUP BY clause. A column that's not aggregated and not in the GROUP BY will return the error we saw before. This is pretty important and it's the key to correctly using GROUP BY statements.**

```
SELECT account_id,
       SUM(standard_qty) AS standard_sum,
       SUM(gloss_qty) AS gloss_sum,
       SUM(poster_qty) AS poster_sum
FROM   demo.orders
GROUP BY account_id
ORDER BY account_id
```



	account_id	standard_sum	gloss_sum	poster_sum
1	1001	7896	7831	3197
2	1011	527	14	0
3	1021	3152	483	175
4	1031	1148	0	215
5	1041	836	770	646
6	1051	3608	356	156
7	1061	925	1556	911

Expert Tip:-

- **Before we dive deeper into aggregations using GROUP BY statements, it is worth noting that SQL evaluates the aggregations before the LIMIT clause. If you don’t group by any columns,**

you’ll get a 1-row result—no problem there. If you group by a column with enough unique values that it exceeds the LIMIT number, the aggregates will be calculated, and then some rows will simply be omitted from the results.

- **The GROUP BY always goes between WHERE and ORDER BY.**
- **ORDER BY works like SORT in spreadsheet software.**

Example:-

1. **Which account (by name) placed the earliest order? Your solution should have the account name and the date of the order.**

```
SELECT a.name, o.occurred_at
FROM accounts a
JOIN orders o
ON a.id = o.account_id
ORDER BY occurred_at
LIMIT 1;
```

2. **Find the total sales in usd for each account. You should include two columns - the total sales for each company's orders in usd and the company name.**

```
SELECT a.name, SUM(total_amt_usd) total_sales
FROM orders o
JOIN accounts a
ON a.id = o.account_id
GROUP BY a.name;
```

3. **Via what channel did the most recent (latest) web_event occur, which account was associated with this web_event? Your query should return only three values - the date, channel, and account name.**

```
SELECT w.occurred_at, w.channel, a.name
FROM web_events w
JOIN accounts a
ON w.account_id = a.id
ORDER BY w.occurred_at DESC
LIMIT 1;
```

4. **Find the total number of times each type of channel from the web_events was used. Your final table should have two columns - the channel and the number of times the channel was used.**

```
SELECT w.channel, COUNT(*)
FROM web_events w
GROUP BY w.channel
```

5. **Who was the primary contact associated with the earliest web_event?**

```sql
SELECT a.primary_poc
FROM web_events w
JOIN accounts a
ON a.id = w.account_id
ORDER BY w.occurred_at
LIMIT 1;
```

6. **What was the smallest order placed by each account in terms of total usd. Provide only two columns - the account name and the total usd. Order from smallest dollar amounts to largest.**

```sql
SELECT a.name, MIN(total_amt_usd) smallest_order
FROM accounts a
JOIN orders o
ON a.id = o.account_id
GROUP BY a.name
ORDER BY smallest_order;
```

Sort of strange we have a bunch of orders with no dollars. We might want to look into those.

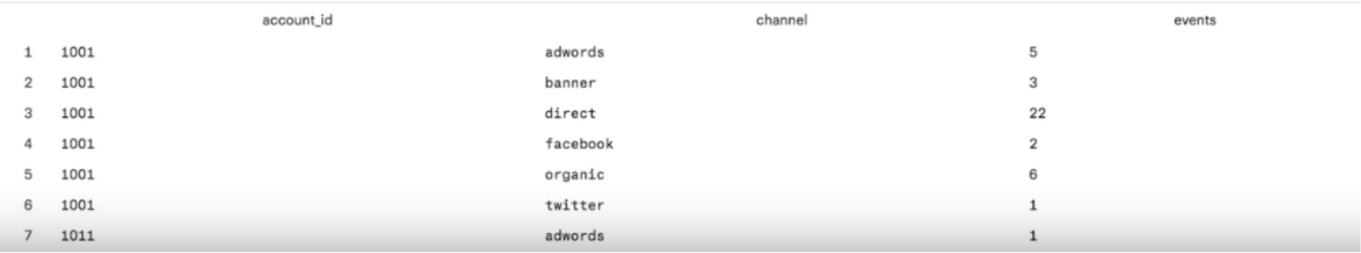
7. **Find the number of sales reps in each region. Your final table should have two columns - the region and the number of sales_reps. Order from fewest reps to most reps.**

```sql
SELECT r.name, COUNT(*) num_reps
FROM region r
JOIN sales_reps s
ON r.id = s.region_id
GROUP BY r.name
ORDER BY num_reps;
```

- **If we want to segment our data into even more granular chunks, we can group by multiple columns. Imagine yourself as a marketing manager at Parch & Posey, trying to understand how each account interacted with various advertising channels.**
- **Which channels are driving traffic and leading to purchases?**
- **Are we investing in channels that aren't worth the cost?**
- **How much traffic are we obtaining from each channel?**
- **One way we might begin to look into these questions, is to count up all of the events for each channel, for each account ID.**

```sql
SELECT account_id,
       channel,
       COUNT(id) AS events
```

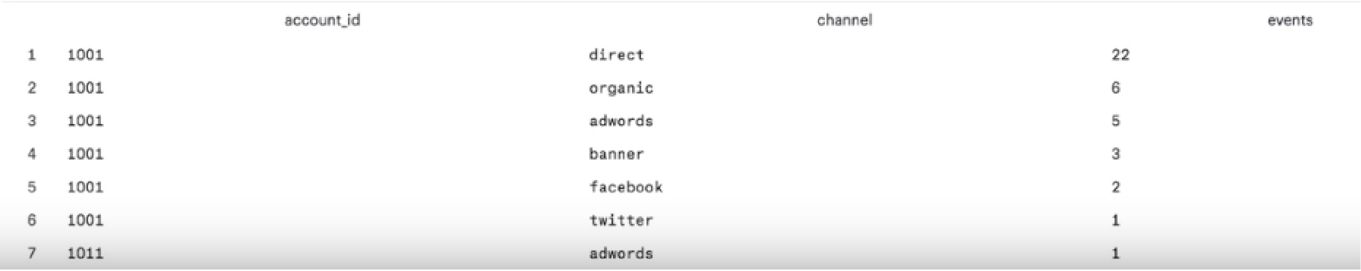
```
    FROM demo.orders
    GROUP BY account_id, channel
    ORDER BY account_id, channel
```



	account_id	channel	events
1	1001	adwords	5
2	1001	banner	3
3	1001	direct	22
4	1001	facebook	2
5	1001	organic	6
6	1001	twitter	1
7	1011	adwords	1

- **It looks like the really useful information here is in the events column. Let's reorder this to highlight the highest volume channels for each account.**

```
    SELECT account_id,
           channel,
           COUNT(id) AS events
    FROM demo.orders
    GROUP BY account_id, channel
    ORDER BY account_id, events DESC
```



	account_id	channel	events
1	1001	direct	22
2	1001	organic	6
3	1001	adwords	5
4	1001	banner	3
5	1001	facebook	2
6	1001	twitter	1
7	1011	adwords	1

Example:-

1. **For each account, determine the average amount of each type of paper they purchased across their orders. Your result should have four columns - one for the account name and one for the average spent on each of the paper types.**

```
    SELECT a.name, AVG(o.standard_qty) avg_stand, AVG(o.gloss_qty)
avg_gloss, AVG(o.poster_qty) avg_post
    FROM accounts a
    JOIN orders o
    ON a.id = o.account_id
    GROUP BY a.name;
```

2. **For each account, determine the average amount spent per order on each paper type. Your result should have four columns - one for the account name and one for the average amount spent on each paper type.**

```
    SELECT a.name, AVG(o.standard_amt_usd) avg_stand, AVG(o.gloss_amt_usd)
avg_gloss, AVG(o.poster_amt_usd) avg_post
    FROM accounts a
    JOIN orders o
    ON a.id = o.account_id
    GROUP BY a.name;
```

3. **Determine the number of times a particular channel was used in the web_events table for each sales rep. Your final table should have three columns - the name of the sales rep, the channel, and the number of occurrences. Order your table with the highest number of occurrences first.**

```
    SELECT s.name, w.channel, COUNT(*) num_events
    FROM accounts a
    JOIN web_events w
    ON a.id = w.account_id
    JOIN sales_reps s
    ON s.id = a.sales_rep_id
    GROUP BY s.name, w.channel
    ORDER BY num_events DESC;
```

4. **Determine the number of times a particular channel was used in the web_events table for each region. Your final table should have three columns - the region name, the channel, and the number of occurrences. Order your table with the highest number of occurrences first.**

```
    SELECT r.name, w.channel, COUNT(*) num_events
    FROM accounts a
    JOIN web_events w
    ON a.id = w.account_id
    JOIN sales_reps s
    ON s.id = a.sales_rep_id
    JOIN region r
    ON r.id = s.region_id
    GROUP BY r.name, w.channel
    ORDER BY num_events DESC;
```

GROUP BY - Expert Tips

- **The order of column names in your GROUP BY clause doesn’t matter—the results will be the same regardless. If we run the same query and reverse the order in the GROUP BY clause, you can see we get the same results.**
- **As with ORDER BY, you can substitute numbers for column names in the GROUP BY clause. It’s generally recommended to do this only when you’re grouping many columns, or if something else is causing the text in the GROUP BY clause to be excessively long.**
- **A reminder here that any column that is not within an aggregation must show up in your GROUP BY statement. If you forget, you will likely get an error. However, in the off chance that**

your query does work, you might not like the results!

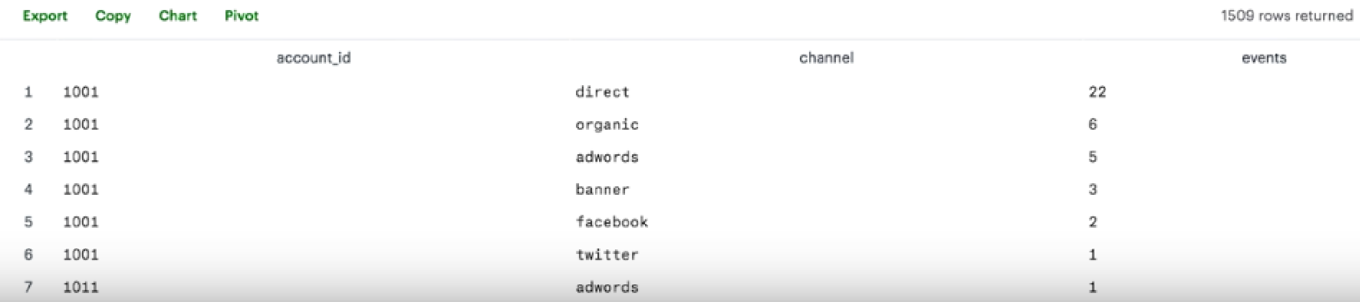
DISTINCT:-

- **DISTINCT is always used in SELECT statements, and it provides the unique rows for all columns written in the SELECT statement. Therefore, you only use DISTINCT once in any particular SELECT statement.**

Illustration:-

1. - **let's revisit the count of events by channel by account we looked at in the GROUP BY segment. Notice the row count, 1509.**

```
SELECT account_id,
       channel,
       COUNT(id) AS events
FROM demo.web_events
GROUP BY account_id, channel
ORDER BY account_id, events DESC
```

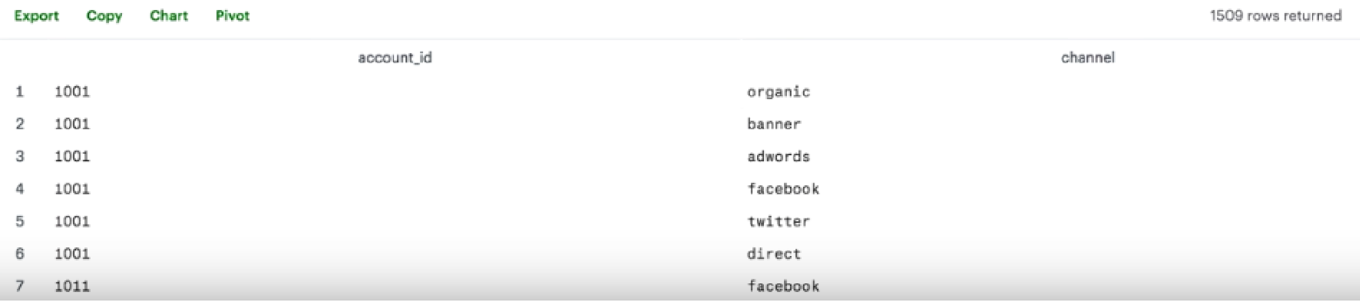


1509 rows returned

	account_id	channel	events
1	1001	direct	22
2	1001	organic	6
3	1001	adwords	5
4	1001	banner	3
5	1001	facebook	2
6	1001	twitter	1
7	1011	adwords	1

2. - **If we get rid of the events column, you can see that the resulting query returns basically the same results with the same row count.**

```
SELECT account_id,
       channel
FROM demo.web_events
GROUP BY account_id, channel
ORDER BY account_id
```

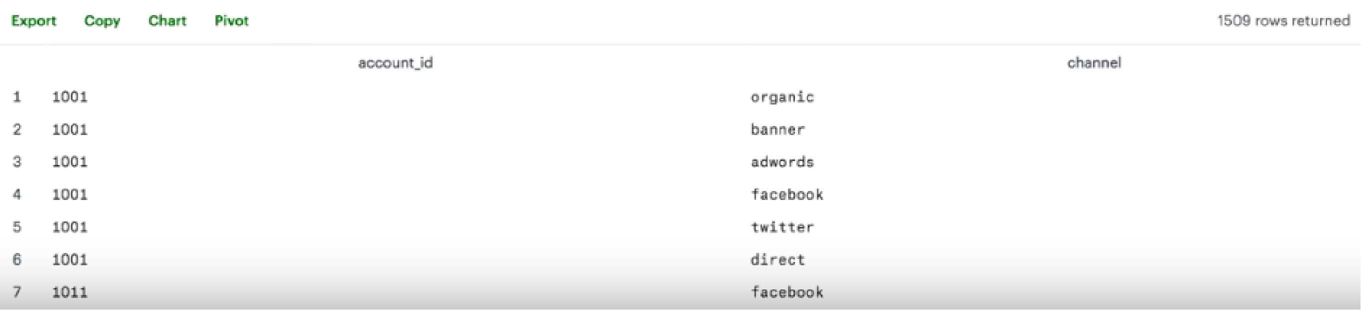


1509 rows returned

	account_id	channel
1	1001	organic
2	1001	banner
3	1001	adwords
4	1001	facebook
5	1001	twitter
6	1001	direct
7	1011	facebook

3.
    - **And if we run that query again with DISTINCT, you can see that the results are the same. Of course, they don't include the COUNT anymore because we've removed it from our select statement. Since it's no longer in our select statement, and since we're no longer doing an aggregation, we don't need the GROUP BY clause either.**

```
SELECT DISTINCT account_id,
       channel
FROM demo.web_events
ORDER BY account_id
```



1509 rows returned

	account_id	channel
1	1001	organic
2	1001	banner
3	1001	adwords
4	1001	facebook
5	1001	twitter
6	1001	direct
7	1011	facebook

DISTINCT - Expert Tip:-

- **It’s worth noting that using DISTINCT, particularly in aggregations, can slow your queries down quite a bit.**

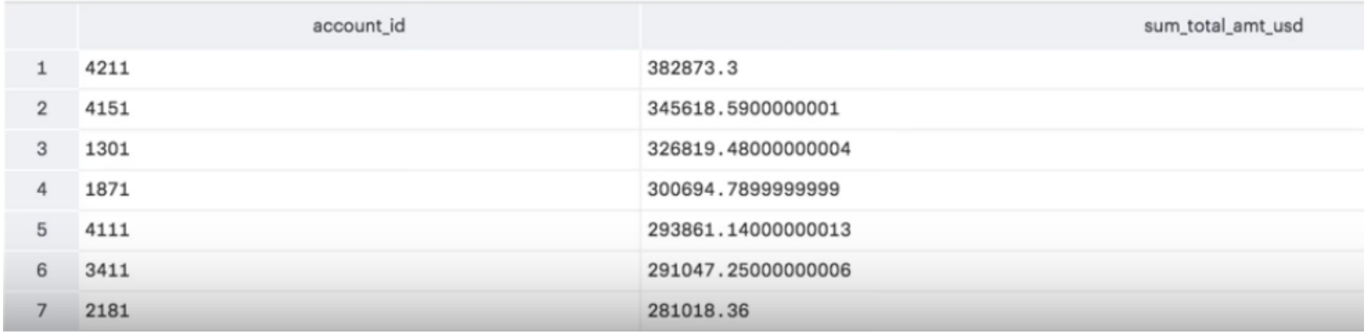
HAVING:-

- **The HAVING clause was added to SQL because the WHERE keyword could not be used with aggregate functions.**

Illustration:-

1.
    - **You might want to identify the total sales in US dollars for accounts with over $250,000 in sales, to better understand the proportion of revenue that comes from these large accounts. To get this list, let's first get the sum of sales for each account. We'll order them in descending order so that we can see all the highest value accounts at the top of the result set.**

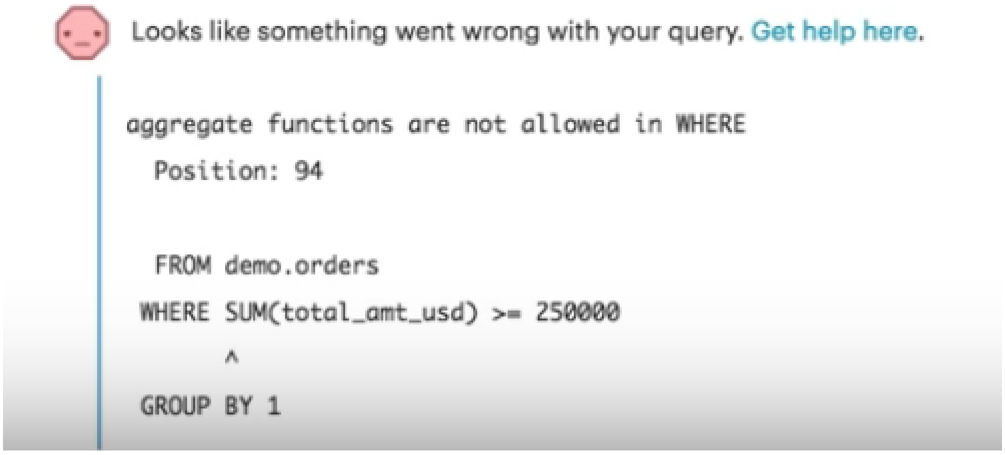
```
SELECT account_id,
       SUM(total_amt_usd) AS sum_total_amt_usd
FROM orders
GROUP BY 1
ORDER BY 2 DESC
```



	account_id	sum_total_amt_usd
1	4211	382873.3
2	4151	345618.5900000001
3	1301	326819.48000000004
4	1871	300694.7899999999
5	4111	293861.14000000013
6	3411	291047.25000000006
7	2181	281018.36

2. - **Now let's filter down to just the accounts with more than $250,000 in sales. You'll notice that the WHERE clause isn't exactly built for this. The WHERE clause won't work for this because it doesn't allow you to filter on aggregate columns.**

```
SELECT account_id,
       SUM(total_amt_usd) AS sum_total_amt_usd
FROM orders
WHERE SUM(total_amt_usd) >= 250000
GROUP BY 1
ORDER BY 2 DESC
```



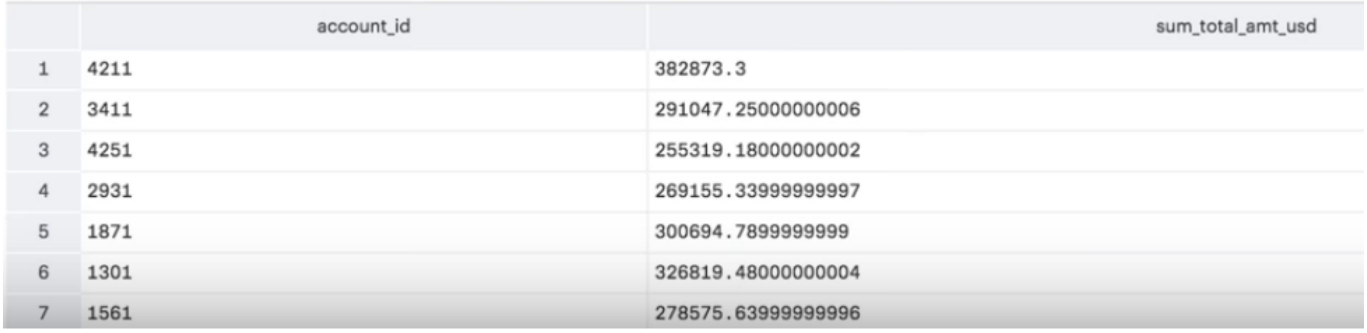
Looks like something went wrong with your query. Get help here.

```
aggregate functions are not allowed in WHERE
  Position: 94


  FROM demo.orders
 WHERE SUM(total_amt_usd) >= 250000
       ^
 GROUP BY 1
```

3. - **That's where the HAVING clause comes in. This filters the query down to just the account IDs with more than $250,000 in total sales. One thing to keep in mind is that this is really only useful when grouping by one or more columns. If you're aggregating across the entire dataset, the output is only one line anyway, so there's no need to filter beyond that.**

```
SELECT account_id,
       SUM(total_amt_usd) AS sum_total_amt_usd
FROM orders
GROUP BY 1
HAVING SUM(total_amt_usd) >= 250000
```



	account_id	sum_total_amt_usd
1	4211	382873.3
2	3411	291047.25000000006
3	4251	255319.18000000002
4	2931	269155.33999999997
5	1871	300694.7899999999
6	1301	326819.48000000004
7	1561	278575.63999999996

Examples:-

1. **How many of the sales reps have more than 5 accounts that they manage?**

```
SELECT s.id, s.name, COUNT(*) num_accounts
FROM accounts a
JOIN sales_reps s
ON s.id = a.sales_rep_id
GROUP BY s.id, s.name
HAVING COUNT(*) > 5
ORDER BY num_accounts;
```

and technically, we can get this using a SUBQUERY as shown below. This same logic can be used for the other queries, but this will not be shown.

```
SELECT COUNT(*) num_reps_above5
FROM(SELECT s.id, s.name, COUNT(*) num_accounts
 FROM accounts a
 JOIN sales_reps s
 ON s.id = a.sales_rep_id
 GROUP BY s.id, s.name
 HAVING COUNT(*) > 5
 ORDER BY num_accounts) AS Table1;
```

2. **How many accounts have more than 20 orders?**

```
SELECT a.id, a.name, COUNT(*) num_orders
FROM accounts a
JOIN orders o
ON a.id = o.account_id
GROUP BY a.id, a.name
HAVING COUNT(*) > 20
ORDER BY num_orders;
```

3. **Which account has the most orders?**

```
SELECT a.id, a.name, COUNT(*) num_orders
FROM accounts a
JOIN orders o
ON a.id = o.account_id
GROUP BY a.id, a.name
ORDER BY num_orders DESC
LIMIT 1;
```

4. **How many accounts spent more than 30,000 usd total across all orders?**

```
SELECT a.id, a.name, SUM(o.total_amt_usd) total_spent
FROM accounts a
JOIN orders o
ON a.id = o.account_id
GROUP BY a.id, a.name
HAVING SUM(o.total_amt_usd) > 30000
ORDER BY total_spent;
```

5. **How many accounts spent less than 1,000 usd total across all orders?**

```
SELECT a.id, a.name, SUM(o.total_amt_usd) total_spent
FROM accounts a
JOIN orders o
ON a.id = o.account_id
GROUP BY a.id, a.name
HAVING SUM(o.total_amt_usd) < 1000
ORDER BY total_spent;
```

6. **Which account has spent the most with us?**

```
SELECT a.id, a.name, SUM(o.total_amt_usd) total_spent
FROM accounts a
JOIN orders o
ON a.id = o.account_id
GROUP BY a.id, a.name
ORDER BY total_spent DESC
LIMIT 1;
```

7. **Which account has spent the least with us?**

```
SELECT a.id, a.name, SUM(o.total_amt_usd) total_spent
FROM accounts a
JOIN orders o
ON a.id = o.account_id
```

```
GROUP BY a.id, a.name
ORDER BY total_spent
LIMIT 1;
```

8. **Which accounts used facebook as a channel to contact customers more than 6 times?**

```
SELECT a.id, a.name, w.channel, COUNT(*) use_of_channel
FROM accounts a
JOIN web_events w
ON a.id = w.account_id
GROUP BY a.id, a.name, w.channel
HAVING COUNT(*) > 6 AND w.channel = 'facebook'
ORDER BY use_of_channel;
```

9. **Which account used facebook most as a channel?**

```
SELECT a.id, a.name, w.channel, COUNT(*) use_of_channel
FROM accounts a
JOIN web_events w
ON a.id = w.account_id
WHERE w.channel = 'facebook'
GROUP BY a.id, a.name, w.channel
ORDER BY use_of_channel DESC
LIMIT 1;
```

Note: This query above only works if there are no ties for the account that used facebook the most. It is a best practice to use a larger limit number first such as 3 or 5 to see if there are ties before using LIMIT 1.

10. **Which channel was most frequently used by most accounts?**

```
SELECT a.id, a.name, w.channel, COUNT(*) use_of_channel
FROM accounts a
JOIN web_events w
ON a.id = w.account_id
GROUP BY a.id, a.name, w.channel
ORDER BY use_of_channel DESC
LIMIT 10;
```

All of the top 10 are direct.

HAVING - Expert Tip:-

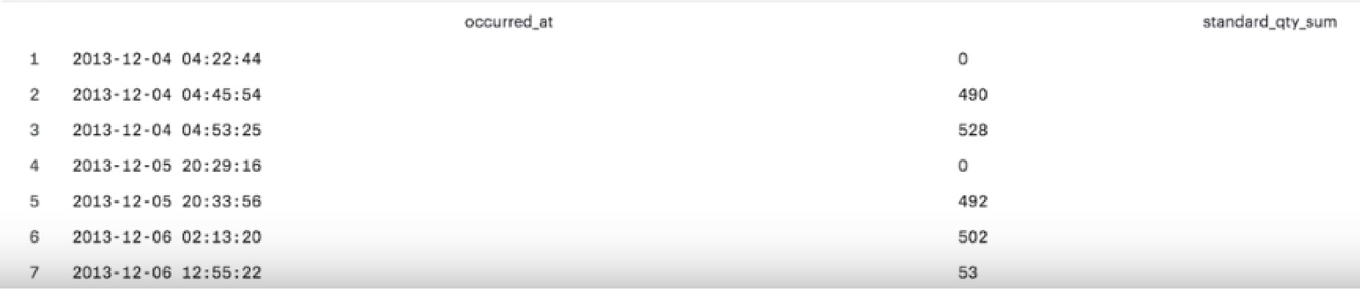
- **HAVING is the “clean” way to filter a query that has been aggregated, but this is also commonly done using a subquery. Essentially, any time you want to perform a WHERE on an element of**

your query that was created by an aggregate, you need to use HAVING instead.

DATE Functions:-

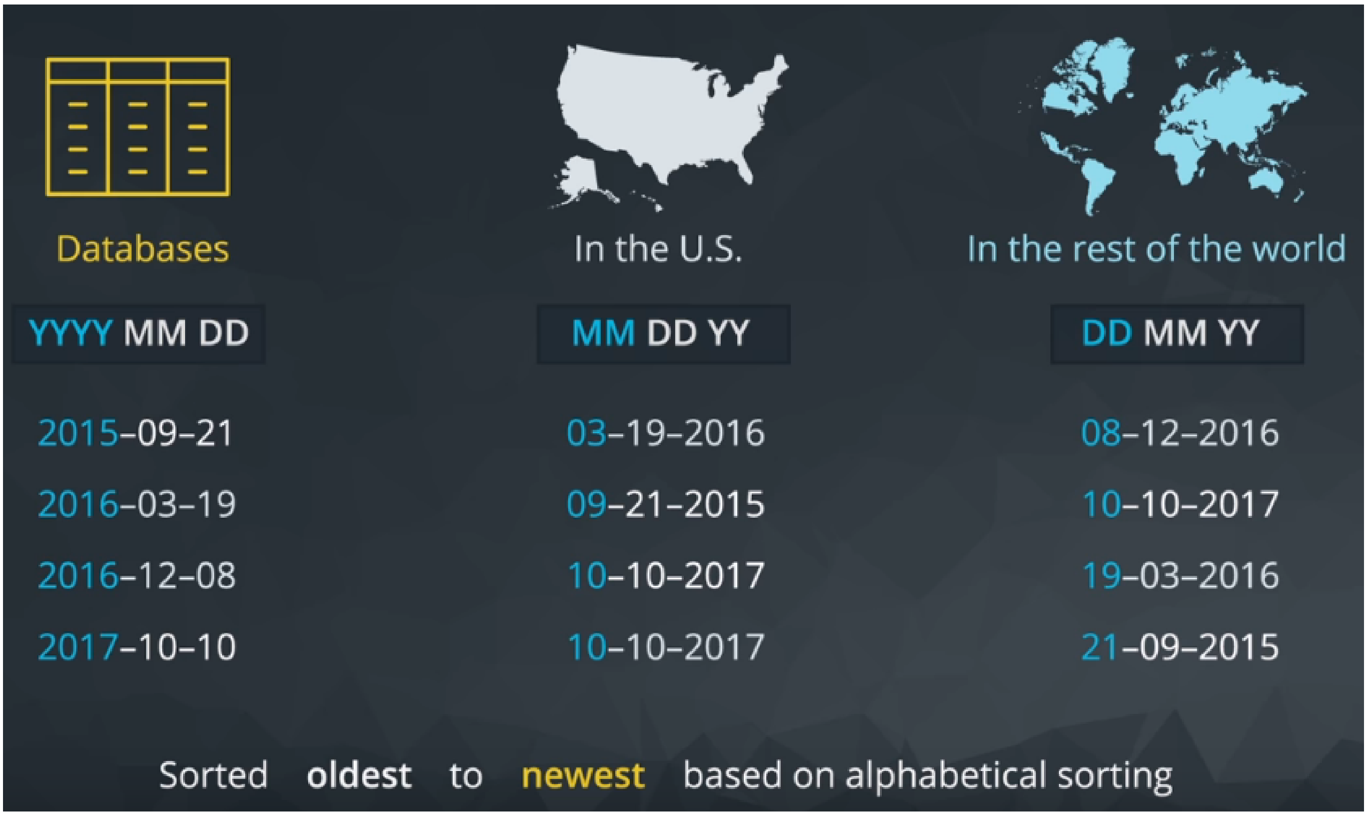
- **Aggregating by date fields, in particular, doesn't work in a practical way. It treats each time stamp is unique. When it would be more practical to round to the nearest day, week, or month, and aggregate across that period. Take for example, this sum of standard paper quantities by time period. You can see in the results here that this really isn't any more useful than looking at the raw data. This aggregates from six 6,912 rows in the raw data down to 6,908.**

```
SELECT occurred_at,
       SUM(standard_qty) AS standard_qty_sum
FROM orders
GROUP BY occurred_at
ORDER BY occurred_at
```



	occurred_at	standard_qty_sum
1	2013-12-04 04:22:44	0
2	2013-12-04 04:45:54	490
3	2013-12-04 04:53:25	528
4	2013-12-05 20:29:16	0
5	2013-12-05 20:33:56	492
6	2013-12-06 02:13:20	502
7	2013-12-06 12:55:22	53

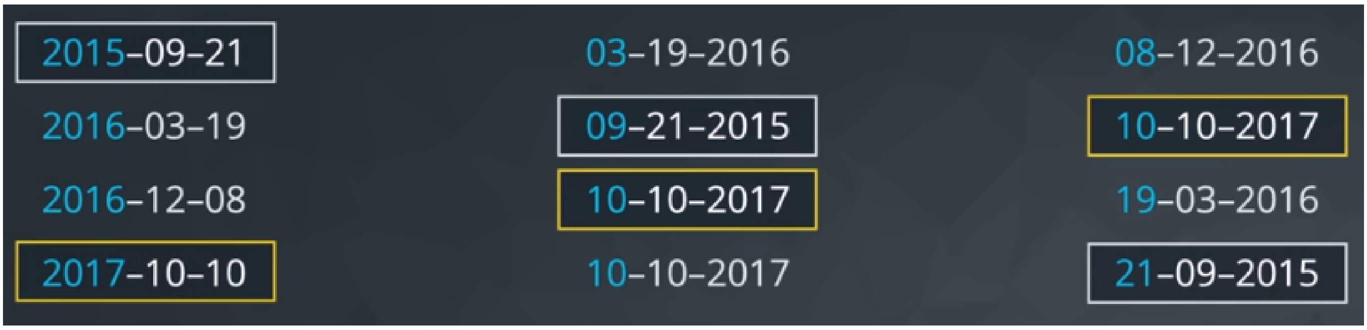
- **let's take a look at how dates are stored. If you live in the United States, you're probably used to seeing dates formatted as month-month, day-day, year-year-year-year, or similar month first format. see the most other places in the world follow a day-day, month-month, year-year-year-year, format. Databases do it yet another way. year-year-year-year, month-month, day-day.**



Databases	In the U.S.	In the rest of the world
YYYY MM DD	MM DD YY	DD MM YY
2015-09-21	03-19-2016	08-12-2016
2016-03-19	09-21-2015	10-10-2017
2016-12-08	10-10-2017	19-03-2016
2017-10-10	10-10-2017	21-09-2015

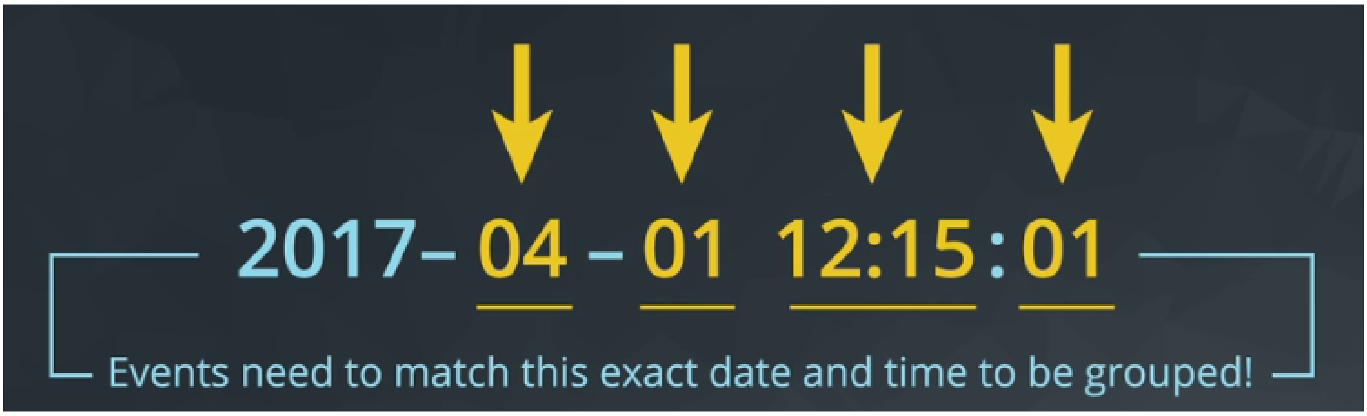
Sorted oldest to newest based on alphabetical sorting

- **we can see that the year first way the databases store dates, is ideal for sorting the way we'll want to retrieve this information in the future. Whether we want the most recent or oldest information, day first and month first date formats sort of funny ways that don't make a ton of sense.**



2015-09-21	03-19-2016	08-12-2016
2016-03-19	09-21-2015	10-10-2017
2016-12-08	10-10-2017	19-03-2016
2017-10-10	10-10-2017	21-09-2015

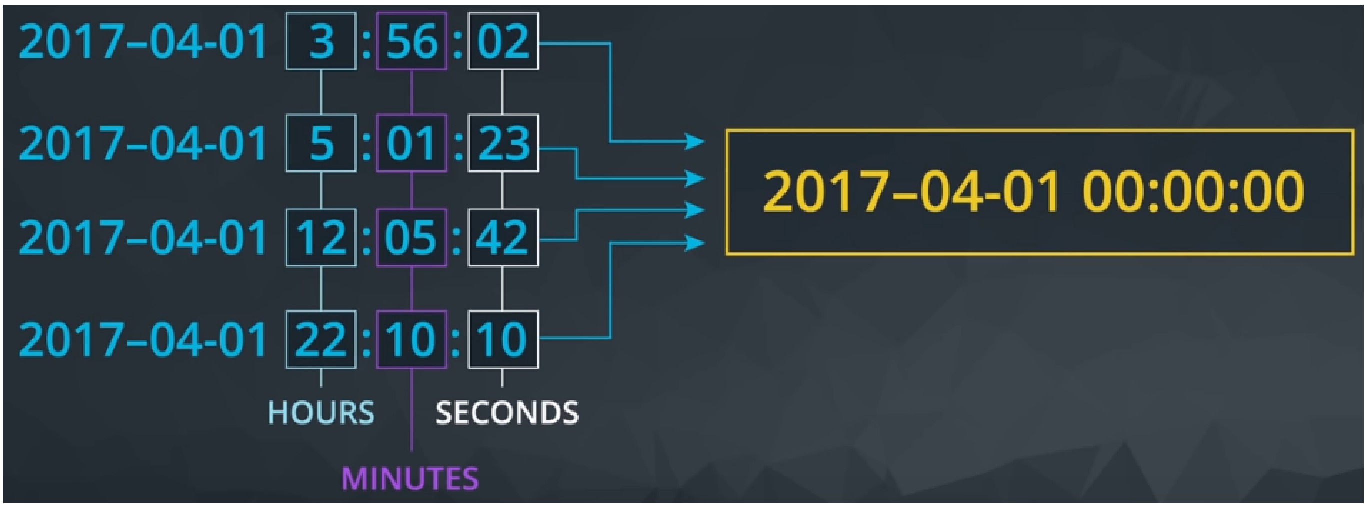
- **Another benefit is the date can easily be truncated in order to group them for analysis. Take the date 2017- 04- 01 12:15:01. If we want to group that with other events that occurred on the same day, we can't do that with the date in its current format. Grouping now or group by every event that occurred on April 1st, at 12:15, and 1 second. That won't help us very much.**



2017- 04 - 01 12:15:01

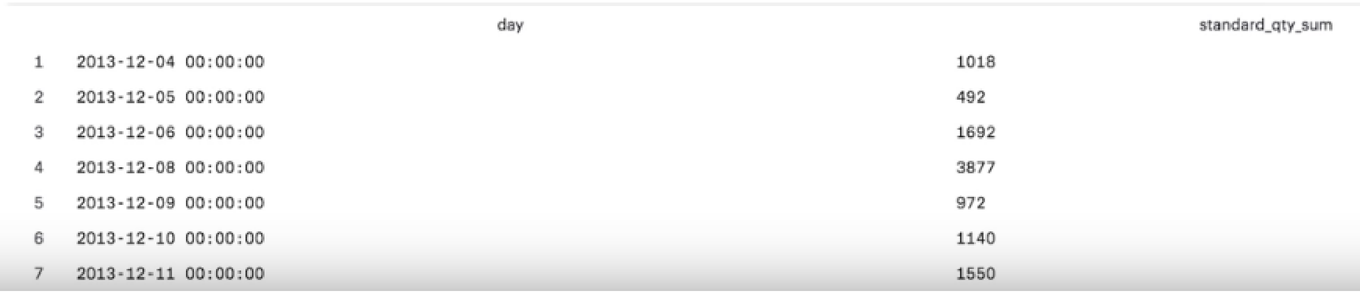
Events need to match this exact date and time to be grouped!

- **In order to group by day, we'll need to adjust all the times on April 1st 2017 to read: 2017-04-01 00:00:00. That way when we group by date, we get every event that occurred for all hours, minutes, and seconds of April 1st. They'll all be grouped together into the same grouping.**



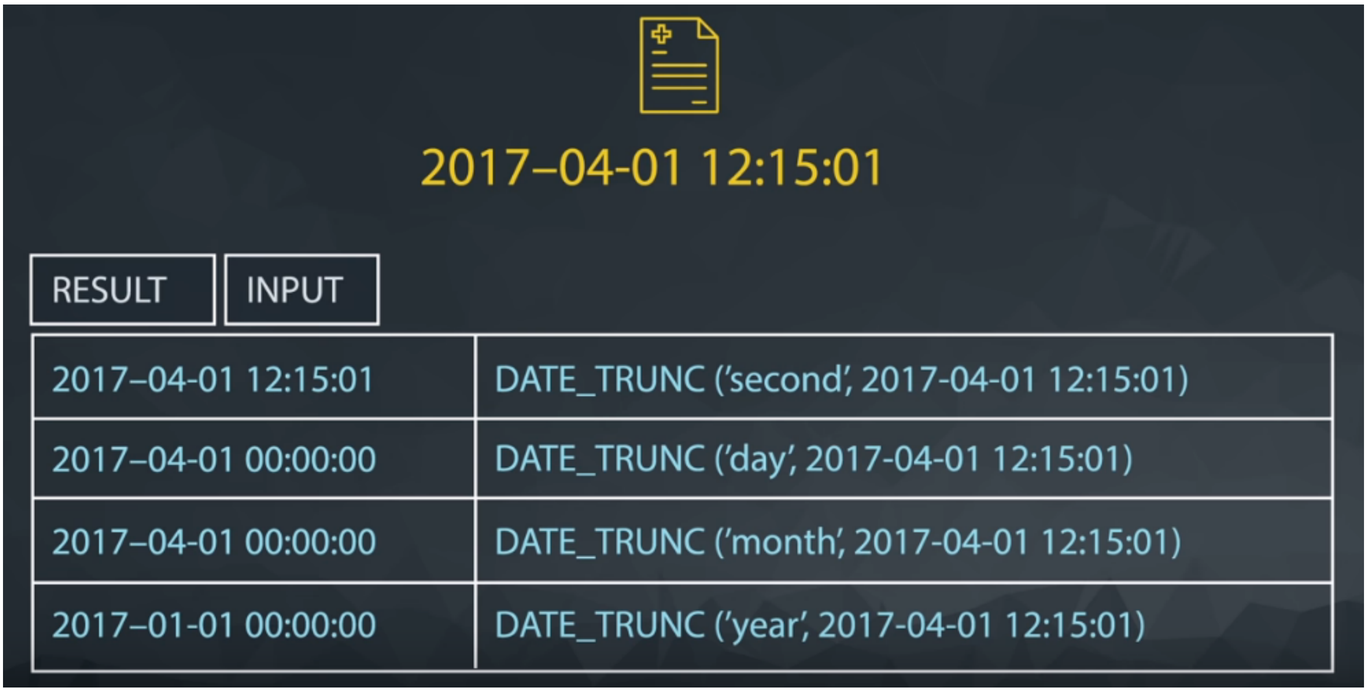
- **We can do this using the date trunc function. Let's start by grouping by occurred at without any truncation. As you can see, this doesn't help us much at all. If we replace each instance of occurred at with a truncated version, we'll get a result set that sums the quantities of standard paper by day. It's important to group by the same metric that's included in the select statement to assure your results are consistent. The easiest way to make sure you group correctly is to use column numbers instead of retyping the exact functions.**

```
SELECT DATE_TRUNC('day', occurred_at) AS day,
       SUM(standard_qty) AS standard_qty_sum
FROM orders
GROUP BY 1
ORDER BY 1
```



	day	standard_qty_sum
1	2013-12-04 00:00:00	1018
2	2013-12-05 00:00:00	492
3	2013-12-06 00:00:00	1692
4	2013-12-08 00:00:00	3877
5	2013-12-09 00:00:00	972
6	2013-12-10 00:00:00	1140
7	2013-12-11 00:00:00	1550

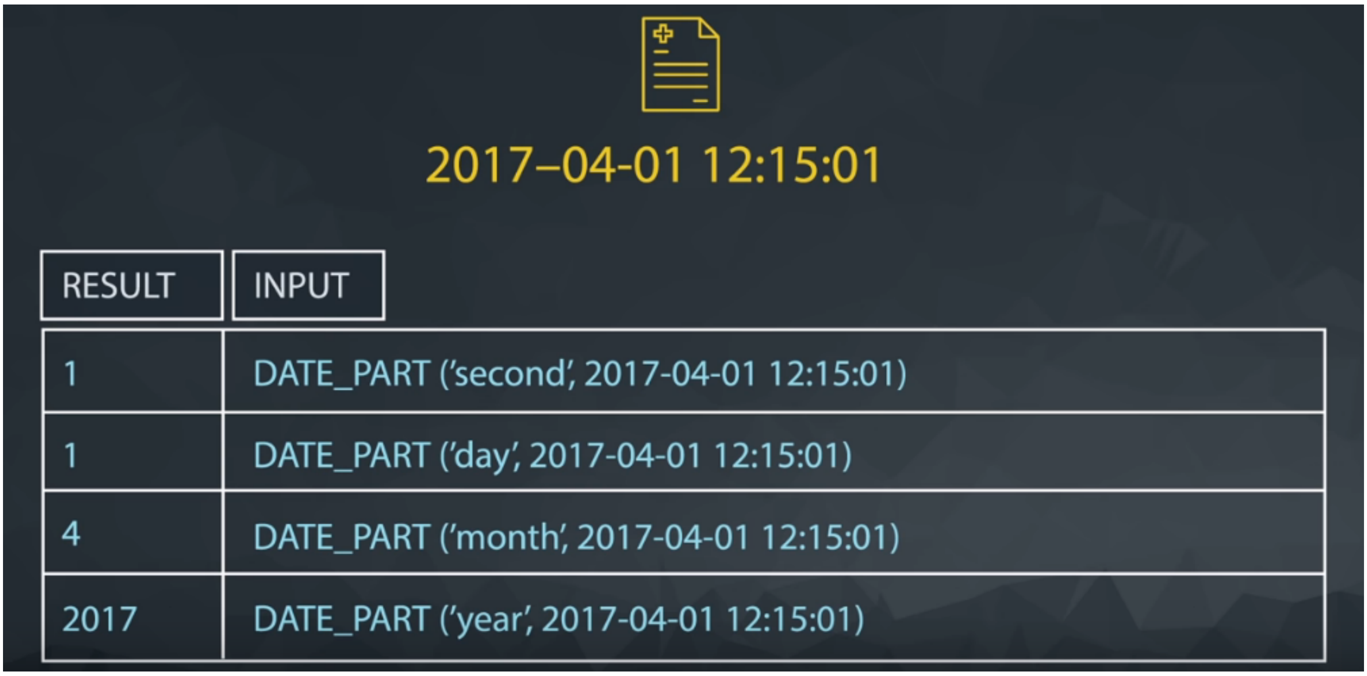
- **Date trunc can be used to aggregate at very granular levels like second. That might be useful if you're working with server logs or many events happen in a given second. Most of the time though, you'll use this to aggregate at intervals that make sense from a business perspective: day, week, month, quarter, and year. Here, we can see different truncations. Notice that if our month or day are 01, there's no change made to these values, as you can see.**



2017–04-01 12:15:01

RESULT	INPUT
2017–04-01 12:15:01	DATE_TRUNC (‘second’, 2017-04-01 12:15:01)
2017–04-01 00:00:00	DATE_TRUNC (‘day’, 2017-04-01 12:15:01)
2017–04-01 00:00:00	DATE_TRUNC (‘month’, 2017-04-01 12:15:01)
2017–01-01 00:00:00	DATE_TRUNC (‘year’, 2017-04-01 12:15:01)

- **There are some cases where you might want to just pull out a given part of the day. For example, if you want to know what day of the week Parch & Posey's website sees the most traffic, you wouldn't want to use date trunc. To get the day of the week, you'd have to use date part. Date part allows you to pull the part of the date that you're interested in. But notice that regardless of year, a date part would provide the same month for an event that happens in April 2016 and April 2017 where a date trunc would differentiate these events.**

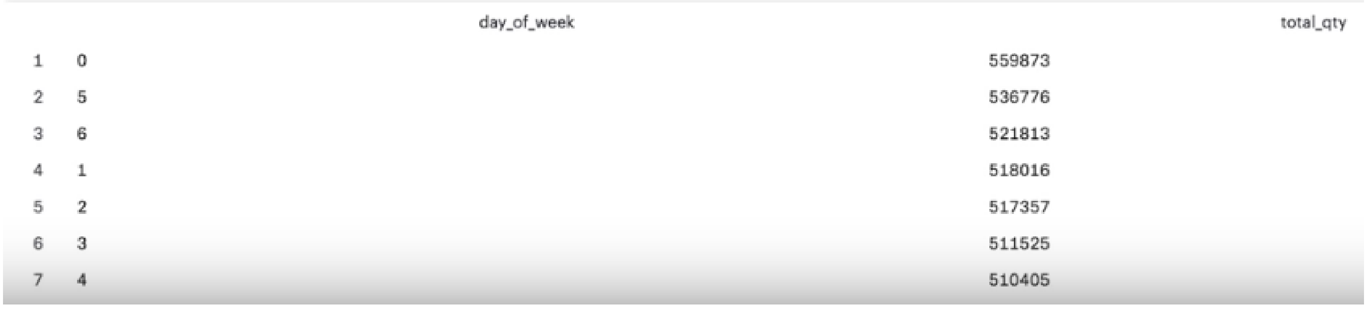


2017–04-01 12:15:01

RESULT	INPUT
1	DATE_PART (‘second’, 2017-04-01 12:15:01)
1	DATE_PART (‘day’, 2017-04-01 12:15:01)
4	DATE_PART (‘month’, 2017-04-01 12:15:01)
2017	DATE_PART (‘year’, 2017-04-01 12:15:01)

- **Let's explore this example using Parch & Posey's data. On what day of the week are the most sales made? Let's start by figuring out the day of the week for each one. DOW stands for day of week and returns a value from zero to six, where zero is Sunday and six is Saturday. Now that we have this column, we can aggregate to figure out the day with the most reams of paper sold. We'll order it by the sum in descending order so that the day with the most sales will be at the top of the result set. Looks like the most paper was ordered on Sunday and the least paper was ordered on Thursday.**

```
    SELECT DATE_PART('dow', occurred_at) AS day_of_week,
           SUM(total) AS total_qty
    FROM orders
    GROUP BY 1
    ORDER BY 2 DESC
```



	day_of_week	total_qty
1	0	559873
2	5	536776
3	6	521813
4	1	518016
5	2	517357
6	3	511525
7	4	510405

Examples:-

1. **Find the sales in terms of total dollars for all orders in each year, ordered from greatest to least. Do you notice any trends in the yearly sales totals?**

```
    SELECT DATE_PART('year', occurred_at) ord_year,  SUM(total_amt_usd)
total_spent
    FROM orders
    GROUP BY 1
    ORDER BY 2 DESC;
```

When we look at the yearly totals, you might notice that 2013 and 2017 have much smaller totals than all other years. If we look further at the monthly data, we see that for 2013 and 2017 there is only one month of sales for each of these years (12 for 2013 and 1 for 2017). Therefore, neither of these are evenly represented. Sales have been increasing year over year, with 2016 being the largest sales to date. At this rate, we might expect 2017 to have the largest sales.

2. **Which month did Parch & Posey have the greatest sales in terms of total dollars? Are all months evenly represented by the dataset?**

In order for this to be 'fair', we should remove the sales from 2013 and 2017. For the same reasons as discussed above.

```
    SELECT DATE_PART('month', occurred_at) ord_month, SUM(total_amt_usd)
total_spent
    FROM orders
    WHERE occurred_at BETWEEN '2014-01-01' AND '2017-01-01'
    GROUP BY 1
    ORDER BY 2 DESC;
```

The greatest sales amounts occur in December (12).

3. **Which year did Parch & Posey have the greatest sales in terms of total number of orders? Are all years evenly represented by the dataset?**

```
    SELECT DATE_PART('year', occurred_at) ord_year,  COUNT(*) total_sales
    FROM orders
    GROUP BY 1
    ORDER BY 2 DESC;
```

Again, 2016 by far has the most amount of orders, but again 2013 and 2017 are not evenly represented to the other years in the dataset.

4. **Which month did Parch & Posey have the greatest sales in terms of total number of orders? Are all months evenly represented by the dataset?**

```
    SELECT DATE_PART('month', occurred_at) ord_month, COUNT(*) total_sales
    FROM orders
    WHERE occurred_at BETWEEN '2014-01-01' AND '2017-01-01'
    GROUP BY 1
    ORDER BY 2 DESC;
```

December still has the most sales, but interestingly, November has the second most sales (but not the most dollar sales. To make a fair comparison from one month to another 2017 and 2013 data were removed.

5. **In which month of which year did Walmart spend the most on gloss paper in terms of dollars?**

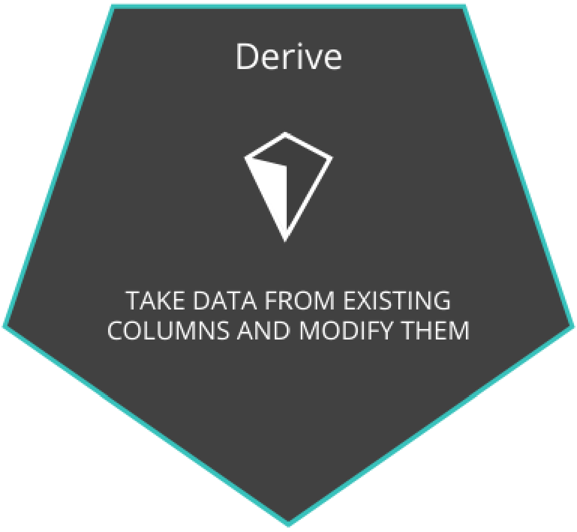
```
    SELECT DATE_TRUNC('month', o.occurred_at) ord_date,
SUM(o.gloss_amt_usd) tot_spent
    FROM orders o
    JOIN accounts a
    ON a.id = o.account_id
    WHERE a.name = 'Walmart'
    GROUP BY 1
    ORDER BY 2 DESC
    LIMIT 1;
```

May 2016 was when Walmart spent the most on gloss paper.

> # CASE Statements:-

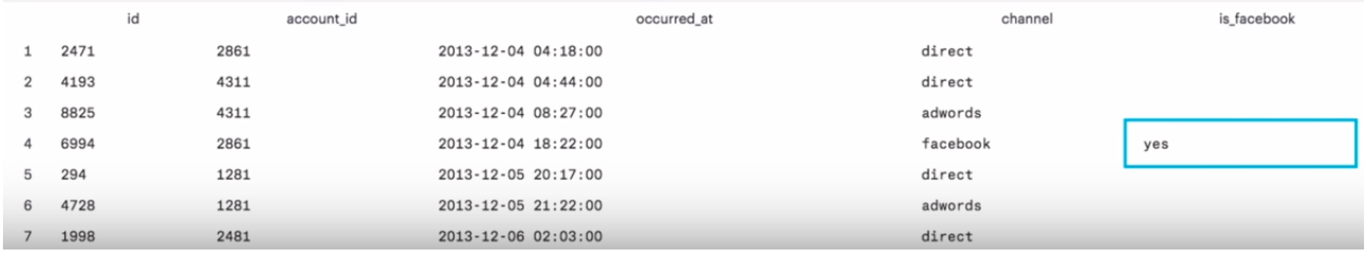
---

1. - **You know Facebook is a great channel for your business but, is it better than all the rest combined? Let's find out. In order to do this, you'll need to create a derived column. That means you'll take data from existing columns and modify it.**



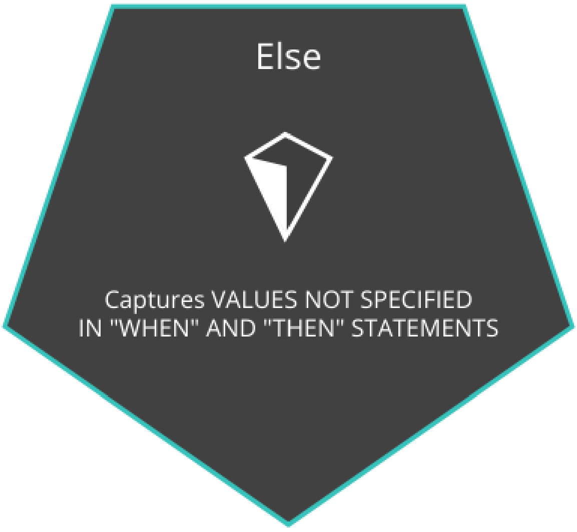
2. - **the "CASE" statement which is SQL's way of handling "IF" "then" logic. The case statement is followed by at least one pair of "WHEN" and "THEN" statements. SQL's equivalent of "IF" "THEN". It must finish with the word "END". As you can see, the case statement checks each row to see if the conditional statement "channel equals Facebook" is true. If so, it results in the value "yes" being printed in the column "is_Facebook".**

```
SELECT id,
       account_id,
       occurred_at,
       channel,
       CASE WHEN channel = 'facebook' THEN 'yes' END AS is_facebook
FROM web_events_full
ORDER BY occurred_at
```



	id	account_id	occurred_at	channel	is_facebook
1	2471	2861	2013-12-04 04:18:00	direct	
2	4193	4311	2013-12-04 04:44:00	direct	
3	8825	4311	2013-12-04 08:27:00	adwords	
4	6994	2861	2013-12-04 18:22:00	facebook	yes
5	294	1281	2013-12-05 20:17:00	direct	
6	4728	1281	2013-12-05 21:22:00	adwords	
7	1998	2481	2013-12-06 02:03:00	direct	

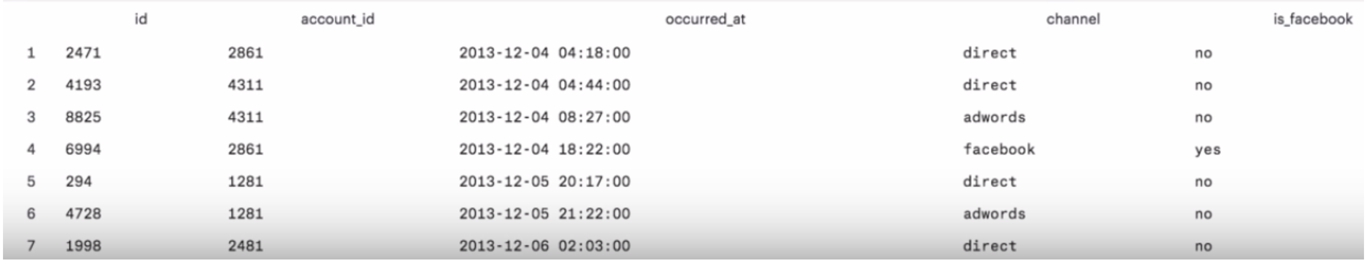
3. - **Now, what we'd really like this query to do is filled in those nulls with the word "no". We can do this with the ELSE statement which provides a way to capture values not specified in "WHEN" "THEN" statements.**



Else

Captures VALUES NOT SPECIFIED
IN "WHEN" AND "THEN" STATEMENTS

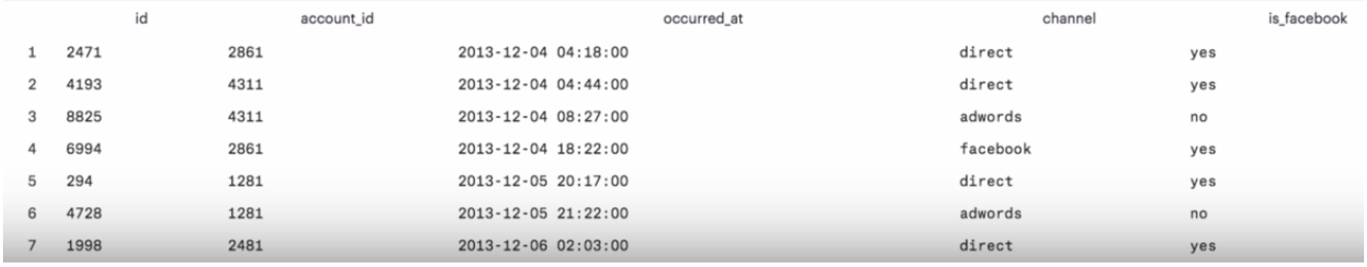
```
    SELECT id,
           account_id,
           occurred_at,
           channel,
           CASE WHEN channel = 'facebook' THEN 'yes' ELSE 'no' END AS
is_facebook
    FROM web_events_full
    ORDER BY occurred_at
```



	id	account_id	occurred_at	channel	is_facebook
1	2471	2861	2013-12-04 04:18:00	direct	no
2	4193	4311	2013-12-04 04:44:00	direct	no
3	8825	4311	2013-12-04 08:27:00	adwords	no
4	6994	2861	2013-12-04 18:22:00	facebook	yes
5	294	1281	2013-12-05 20:17:00	direct	no
6	4728	1281	2013-12-05 21:22:00	adwords	no
7	1998	2481	2013-12-06 02:03:00	direct	no

4.
    - **If we want this new column to keep track of not just our we could change our case statement to use the "OR" operator. The "WHEN" statement is a logical condition similar to what you would put in a "WHERE" clause. So you can use "AND", "LIKE", "IN" or any other operators you've already seen.**

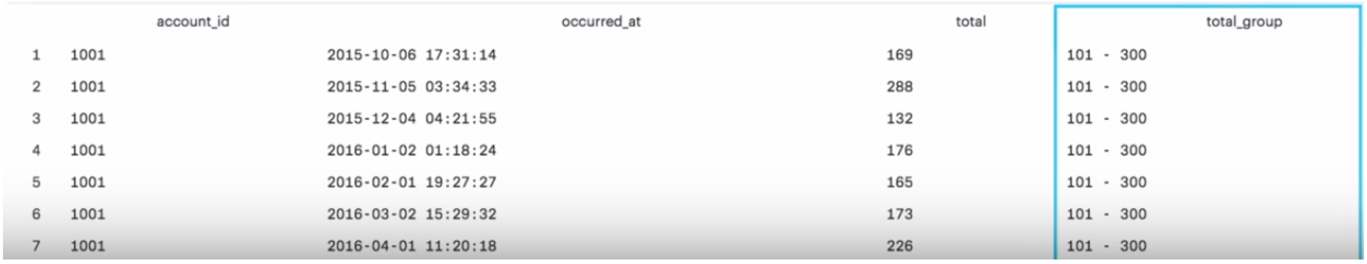
```
    SELECT id,
           account_id,
           occurred_at,
           channel,
           CASE WHEN channel = 'facebook' OR channel = 'direct' THEN 'yes'
ELSE 'no' END AS is_facebook
    FROM web_events_full
    ORDER BY occurred_at
```



	id	account_id	occurred_at	channel	is_facebook
1	2471	2861	2013-12-04 04:18:00	direct	yes
2	4193	4311	2013-12-04 04:44:00	direct	yes
3	8825	4311	2013-12-04 08:27:00	adwords	no
4	6994	2861	2013-12-04 18:22:00	facebook	yes
5	294	1281	2013-12-05 20:17:00	direct	yes
6	4728	1281	2013-12-05 21:22:00	adwords	no
7	1998	2481	2013-12-06 02:03:00	direct	yes

5. - **You can use a case statement to define a number ofoutcomes by including as many "WHEN" "THEN" statements asyou'd like.In this example, the "WHEN" statementswill get evaluated in the order that they're written.So, if the value in the total column of a given row is 600,it will produce a result of over 500.If the value in the total column is 169,the database will first check to see if the total isgreater than 500 because that's the first "WHEN" statement.169 is not greater than 500,so we'll move on to evaluate the next "WHEN.This process continues until a logical "WHEN" statementevaluates totrue in which case the "THEN" statement will be recorded inthe total group column.**

```
SELECT account_id,
       occurred_at,
       total,
       CASE WHEN total > 500 THEN 'Over 500'
            WHEN total > 300 THEN '301 - 500'
            WHEN total > 100 THEN '101 - 300'
            ELSE '100 or under' END AS total_group
FROM orders
```

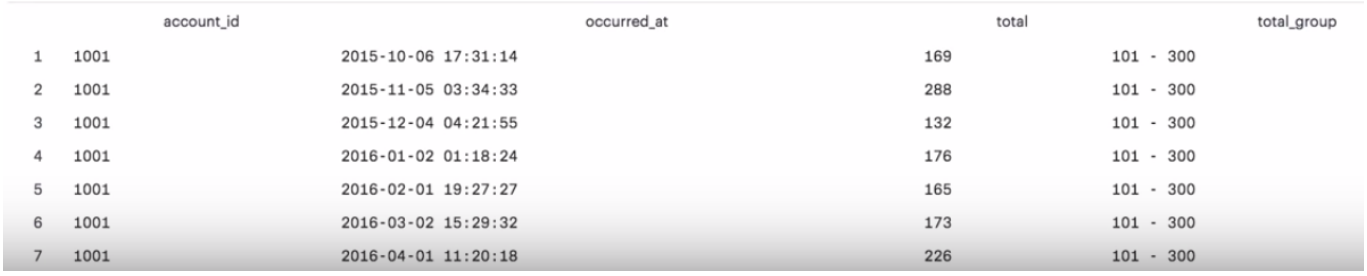


	account_id	occurred_at	total	total_group
1	1001	2015-10-06 17:31:14	169	101 - 300
2	1001	2015-11-05 03:34:33	288	101 - 300
3	1001	2015-12-04 04:21:55	132	101 - 300
4	1001	2016-01-02 01:18:24	176	101 - 300
5	1001	2016-02-01 19:27:27	165	101 - 300
6	1001	2016-03-02 15:29:32	173	101 - 300
7	1001	2016-04-01 11:20:18	226	101 - 300

6. - **While the above works, it's really best to create "WHEN" statements that don't overlap. The conditional statement "when total is greater than 500" overlaps with the statement "when total is greater than 300" for every value greater than 500 which is a little confusing. A better way to write the above would be to define specific groups that don't overlap with one another. You can do this by stringing together multiple conditional statements with "AND" and "OR", the same way you might in a "WHERE" clause. In the final parts of this lesson, we'll take these casements just one step further by combining them with aggregations that we looked at earlier.**

```
SELECT account_id,
       occurred_at,
       total,
       CASE WHEN total > 500 THEN 'Over 500'
            WHEN total > 300 AND total <= 500 THEN '301 - 500'
```

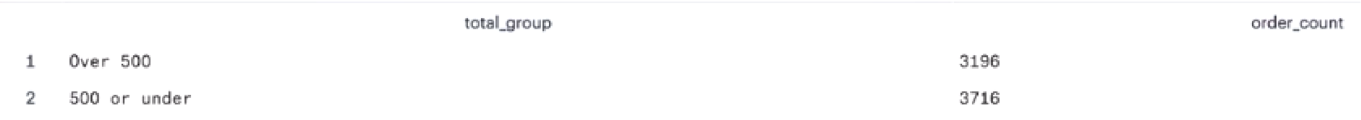
```
                WHEN total > 100 AND total <= 300 THEN '101 - 300'
                ELSE '100 or under' END AS total_group
    FROM orders
```



	account_id	occurred_at	total	total_group
1	1001	2015-10-06 17:31:14	169	101 - 300
2	1001	2015-11-05 03:34:33	288	101 - 300
3	1001	2015-12-04 04:21:55	132	101 - 300
4	1001	2016-01-02 01:18:24	176	101 - 300
5	1001	2016-02-01 19:27:27	165	101 - 300
6	1001	2016-03-02 15:29:32	173	101 - 300
7	1001	2016-04-01 11:20:18	226	101 - 300

7. - **Aggregating based on these new categories will make it easier to report back to company leaders and take action. The easiest way to count all the members of a group is to create a column that groups the way you want it to, then create another column to count by that group. Here, we're using CASE to group orders into those with total quantity sold over 500, and those with 500 or less. This query is an excellent place to use numbers instead of full column calculation in the GROUP BY clause, because repeating the CASE statement in the GROUP BY would make the query obnoxiously long.**

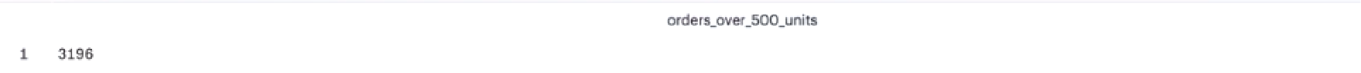
```
    SELECT CASE WHEN total > 500 THEN 'Over 500' ELSE '500 or under' END AS
total_group
    FROM orders
    GROUP BY 1
```



	total_group	order_count
1	Over 500	3196
2	500 or under	3716

8. - **Now, you might be thinking, why wouldn't I just use a WHERE clause to filter out rows I don't want to count? You could do that, and it would look like this. Unfortunately, using the WHERE clause only allows you to count one condition at a time. This would be tedious if we had a number of different cases. We would need a separate query for each one.**

```
    SELECT COUNT(1) AS orders_over_500_units
    FROM orders
    WHERE total > 500
```



	orders_over_500_units
1	3196

CASE - Expert Tip:-

- **The CASE statement always goes in the SELECT clause.**

- **CASE must include the following components: WHEN, THEN, and END. ELSE is an optional component to catch cases that didn’t meet any of the other previous CASE conditions.**
- **You can make any conditional statement using any conditional operator (like WHERE) between WHEN and THEN. This includes stringing together multiple conditional statements using AND and OR.**
- **You can include multiple WHEN statements, as well as an ELSE statement again, to deal with any unaddressed conditions.**