Aggregate Functions

Agenda

- Aggregate Function
  - COUNT
  - SUM
  - AVG
  - MIN
  - MAX
- Aggregate with Group by
- Aggregate with Having clause
- Having without Group by

Aggregate Functions

- Aggregate Functions are all about performing calculations on multiple rows of a single column of a table and returning a single value

- The ISO standard defines five (5) aggregate functions namely
  - COUNT
  - SUM
  - AVG
  - MIN
  - MAX

Why Use Aggregate Functions?

- Aggregate functions allow us to easily produce summarized data from our database
- For instance, from our company database , management may require following reports:
  - Minimum Salary of a particular department
  - Highest paid employee details
  - Average salary of HR department

Create Table

- Before we go through each of the function one by one. Let's first have a sample data table we'll use to demonstrate the usage

```
CREATE TABLE employee (month INT, emp_id INT, emp_name
VARCHAR(15), dept_name VARCHAR(15), salary INT );

INSERT INTO employee VALUES
(1, 101, "Oliver", "HR", 9000),
(1, 102, "George", "IT", 8000),
(3, 103, "Harry", "HR", 20000),
(6, 104, "Jack", "IT", 110123),
(6, 105, "Jacob", "SALES", 3000),
(12,106, "Noah", "SALES", 101000),
(12,107, "Charlie", "IT", 123456),
(Null, 108, "Robert", "IT", 30400);
```

Create Table

- The *employee* table created looks as follows:

month	emp_id	emp_name	dept_name	salary
1	101	Oliver	HR	9000
1	102	George	IT	8000
3	103	Harry	HR	20000
6	104	Jack	IT	110123
6	105	Jacob	SALES	3000
12	106	Noah	SALES	101000
12	107	Charlie	IT	123456
NULL	108	Robert	IT	30400

COUNT

COUNT Function - Syntax

- If you want to count total records matching a condition, then call the COUNT function to get the number

Syntax:

```
SELECT COUNT([DISTINCT] field_name)FROM target_table[WHERE test_expr];
```

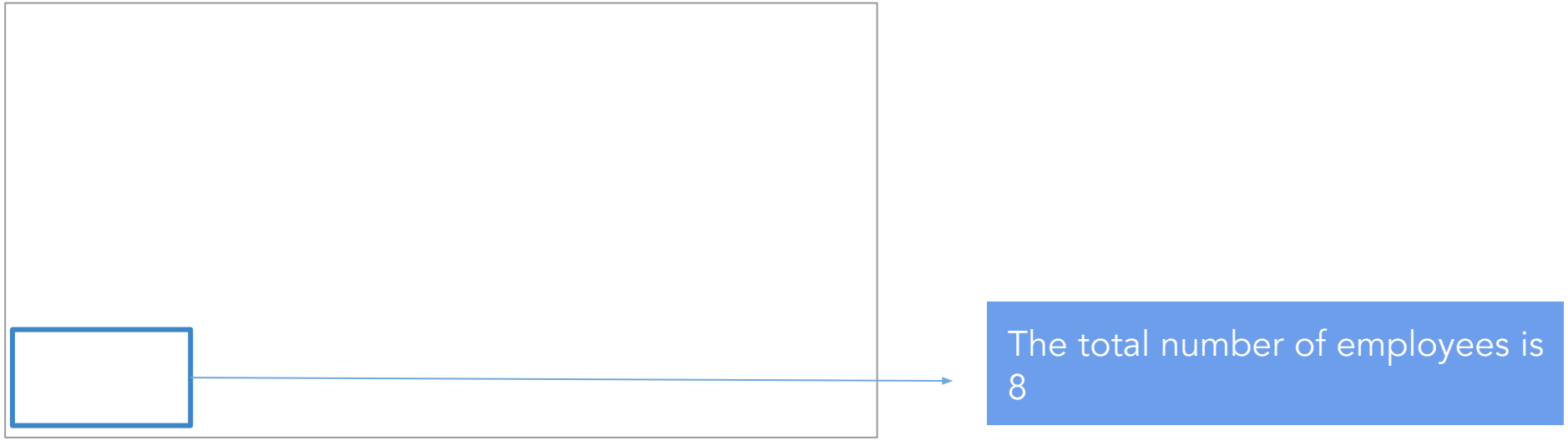
- The COUNT(DISTINCT field_name) returns the number of distinct rows that do not contain NULL values as the result of the expression.

COUNT Function - Example

- If you want to count the total number of employees, you can use the count function as follows

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

Output:



SUM

SUM Function - Syntax

- The SUM function gets total a set of values

Syntax:

```
SELECT SUM(field_name)FROM target_table[WHERE test_expr];
```

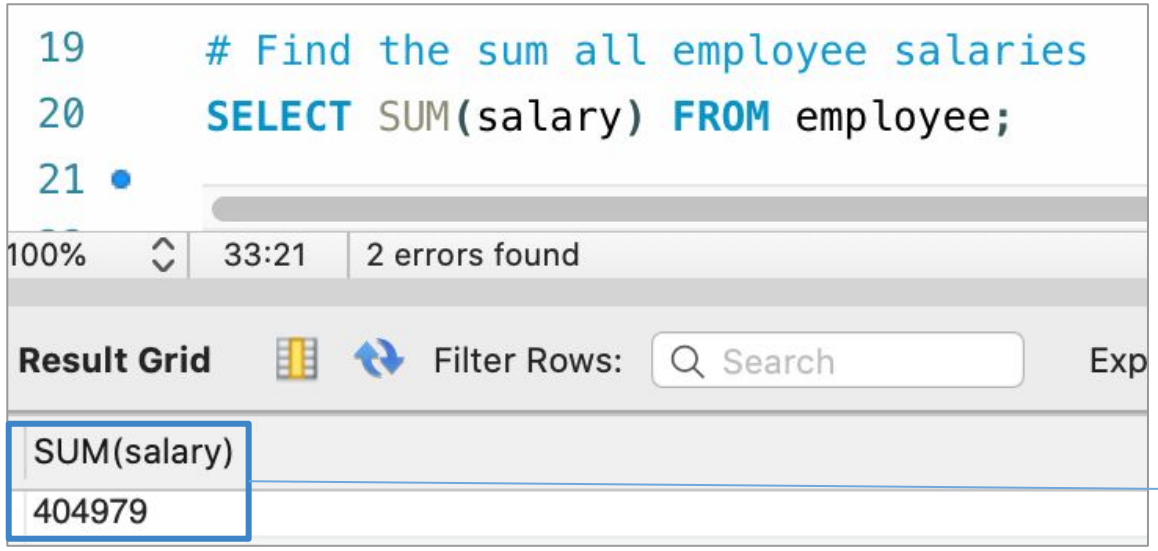
This is the column or expression that will be summed

SUM Function - Example

- Below is the query to find the sum of all employee salaries using sum() function

```
SELECT SUM(salary) FROM employee;
```

Output:



The total sum of salary of all the employees is 404979

AVERAGE (AVG)

AVG Function - Syntax

- The AVG function returns the average of a set of values

Syntax:

```
SELECT AVG(field_name) FROM target_table [WHERE test_expr];
```

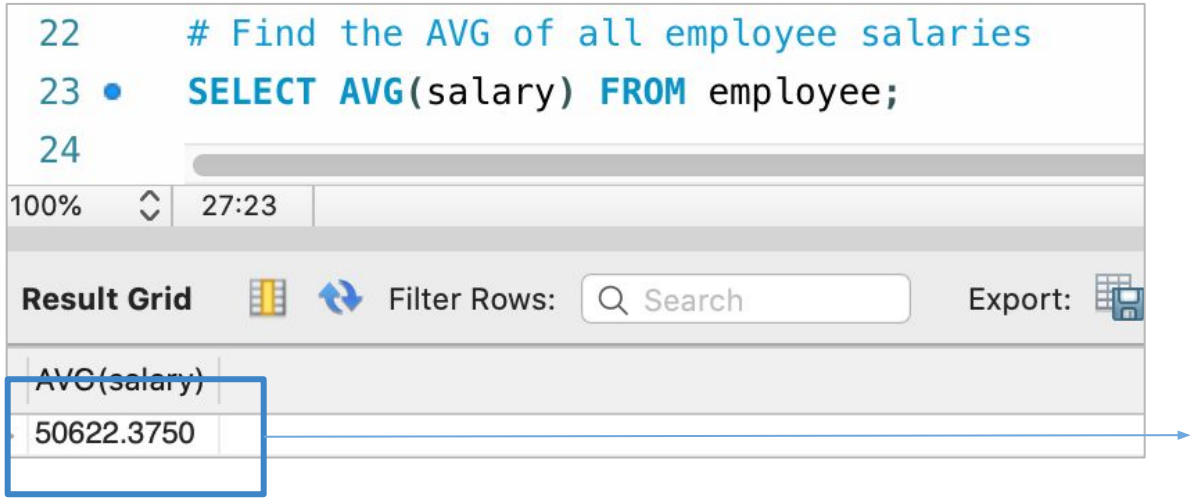
This is the column or expression that will be averaged

AVG Function - Example

- Find the average of all employee salaries, using the AVG function as follows

```
SELECT AVG(salary) FROM employee;
```

Output:



The average salary of all employees is 50622.3750

MINIMUM (MIN)

MIN Function - Syntax

- The MIN function returns the minimum from a set of value

Syntax:

```
SELECT MIN(field_name)FROM target_table [WHERE test_expr];
```

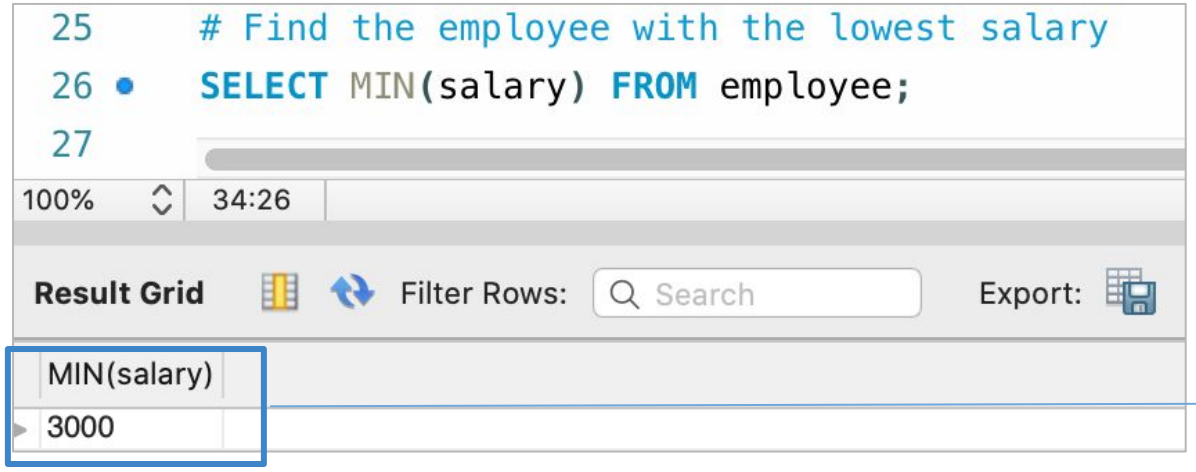
This is the column or expression that will give the minimum value of specific column

MIN Function - Example

- Find the lowest salary received by an employe using the MIN function as follows

```
SELECT MIN(salary) FROM employee;
```

Output:



The minimum salary of the employee is 3000

MAXIMUM (MAX)

MAX Function - Syntax

- The MAX function returns the maximum from a set of values

Syntax:

```
SELECT MAX(field_name)FROM target_table[WHERE test_expr];
```

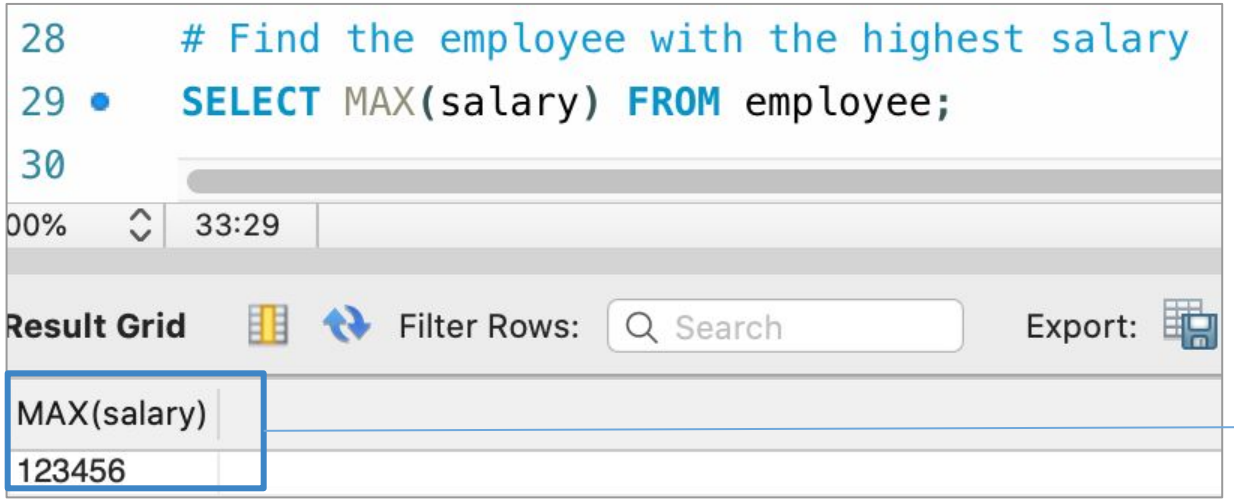
This is the column or expression that will give the maximum value

MAX Function - Example

- Find the highest salary received by an employee using the MAX function as follows

```
SELECT MAX(salary) FROM employee;
```

Output:



The maximum salary of the employee is 123456

The aggregate function discussed so far returns zero when no matching rows exist in the table

Grouped Queries

Group by Function - Syntax

- The GROUP BY statement groups rows that have the same values into summary rows

Syntax:

```
SELECT statements... GROUP BY column_name1[,column_name2,...]
[HAVING condition];
```

"[HAVING condition]" is optional; it is used to restrict the rows affected by the GROUP BY clause

'GROUP BY" column_name1" is the clause that performs the grouping based on column_name1. "[,column_name2,...]" is optional; represents other column names when the grouping is done on more than one column.

Grouping using Single Column

- Execute a simple query that returns all the department entries from the empl table

```
SELECT dept_name from employee;
```

Output:

dept_name
HR
IT
HR
IT
SALES
SALES
IT
IT

Gives the single group of dept_name column

Grouping using Single Column

- A GROUPBY function to display unique departments in the office:

```
SELECT dept FROM empl GROUP BY dept;
```

Output:

Result Grid

dept_name
HR
IT
SALES

There are 3 unique departments, namely HR, IT, and SALES

Aggregation with Group by Clause

Count Aggregation - Group By

- Count the number of employees, in each department, using the Group By clause along with the count aggregate function as follows

```
SELECT COUNT(*), dept_name FROM employee GROUP BY dept_name;
```

Output:

COUNT(*)	dept_name
2	HR
4	IT
2	SALES

Out of 8 employees, 2 employees belong to HR department, 4 belongs to IT department and 2 employees belongs to SALES department

SUM Aggregation - Group By

- Use the sum function to find the sum of salaries in each department as follows

```
SELECT dept_name, SUM(salary) FROM employee GROUP BY dept_name;
```

Output:

dept_name	SUM(salary
HR	29000
IT	271979
SALES	104000

SUM Aggregation - Group By

- Find the month-wise sum of salaries using the sum function as follows

```
SELECT month, SUM(salary) FROM employee GROUP BY month;
```

Output:

month	SUM(salary)
1	17000
3	20000
6	113123
12	224456
NULL	30400

AVG Aggregation - Group By

- Find the average of salaries in each department, using AVG function as follows

```
SELECT dept_name, AVG(salary) FROM employee GROUP BY dept_name;
```

Output:

dept_name	AVG(salary)
HR	14500.0000
IT	67994.7500
SALES	52000.0000

AVG Aggregation - Group By

- Find the month-wise average of salaries by using the AVG function as follows

```
SELECT month, AVG(salary) FROM employee GROUP BY month;
```

Output:

month	AVG(salary)
1	8500.0000
3	20000.0000
6	56561.5000
12	112228.0000
NULL	30400.0000

MIN Aggregation - Group By

- Find the lowest salary in each department, by using the MIN function as follows

```
SELECT dept_name, MIN(salary) FROM employee GROUP BY dept_name;
```

Output:

dept_name	MIN(salary)
HR	9000
IT	8000
SALES	3000

MIN Aggregation - Group By

- Find the month-wise minimum salary, by using the MIN function as follows

```
SELECT month, MIN(salary) FROM employee GROUP BY month;
```

Output:

month	MIN(salary
1	8000
3	20000
6	3000
12	101000
NULL	30400

MAX Aggregation - Group By

- Find the highest salaries in each department using the MAX function as follows

```
SELECT dept_name, MAX(salary) FROM employee GROUP BY dept_name;
```

Output:

dept_name	MAX(salary)
HR	20000
IT	123456
SALES	101000

Multiple Grouping Columns

Create Table

- Let's first have a sample data table we'll use to demonstrate the usage

```
CREATE TABLE employee1 (joining_month INT, emp_id INT,
emp_name  VARCHAR(15), dept_name VARCHAR(15), salary INT );

INSERT INTO employee1 VALUES
(1, 101, "Oliver", "HR", 9000),
(1, 102, "George", "IT", 8000),
(1, 103, "Harry", "HR", 20000),
(3, 104, "Jack", "IT", 110123),
(6, 105, "Jacob", "SALES", 3000),
(6,106, "Noah", "SALES", 101000),
(3,107, "Charlie", "IT", 123456),
(Null, 108, "Robert", "IT", 30400);
```

Create Table

- The *employee1* table created looks as follows:

joining_month	emp_id	emp_name	dept_name	salary
1	101	Oliver	HR	9000
1	102	George	IT	8000
1	103	Harry	HR	20000
3	104	Jack	IT	110123
6	105	Jacob	SALES	3000
6	106	Noah	SALES	101000
3	107	Charlie	IT	123456
NULL	108	Robert	IT	30400

Multiple Grouping Columns

A GROUP BY clause can contain two or more columns- or, in other words, a grouping can consist of two or more columns

Multiple Grouping Columns

- Get sum of salaries and as well as average of all employees in each dept as per the joining month

```
SELECT dept_name, joining_month,
SUM(salary), AVG(salary) FROM employee1
GROUP BY dept_name, joining_month;
```

Output:

dept_name	joining_month	sum(salary)	avg(salary)
HR	1	29000	14500.0000
IT	1	8000	8000.0000
IT	3	233579	116789.5000
SALES	6	104000	52000.0000
IT	NULL	30400	30400.0000

- Here we are grouping salary data by using multiple columns : dept & joining month

*All grouping columns that are given in the select list **must be included** in the group by clause in only_full_group_by mode*

```
Select dept_name,
joining_month, sum(salary)
From employee1 group by
dept_name;
```

SELECT list is not in GROUP BY clause and contains nonaggregated column 'company.employee.joining_month' which is not functionally dependent on columns in GROUP BY clause; this is incompatible with sql_mode=only_full_group_by

```
Select dept_name,
joining_month, sum(salary)
From employee1 group by
dept_name , joining_month;
```

dept_name	joining_month	sum(salary)
HR	1	29000
IT	1	8000
IT	3	233579
SALES	6	104000
IT	NULL	30400

Group by functions should not be included in the group-by clause

```
Select dept_name,
joining_month, sum(salary)
From employee1 group by
sum(salary);
```

Error Code: 1056. Can't group on 'sum(salary)'

```
Select dept_name,
joining_month, sum(salary)
From employee1 group by
dept_name, joining_month;
```

dept_name	joining_month	sum(salary)
HR	1	29000
IT	1	8000
IT	3	233579
SALES	6	104000
IT	NULL	30400

Comparison Conditions cannot be included in the group by clause as they cannot act on grouped result set

```
Select dept_name,
joining_month, sum(salary)
From employee1 group by
sum(salary)  > 10000;
```

Error Code: 1111. Invalid use of group function

```
Select dept_name,
joining_month, sum(salary)
From employee1 group by
dept_name, joining_month >
10000;
```

dept_name	joining_month	sum(salary)
HR	1	29000
IT	1	241579
SALES	6	104000
IT	NULL	30400

Some other Restriction on Grouped Queries

- WHERE clause with conditions can be issued before the group-by clause in order to filter the records and then apply Group By feature

- But , WHERE clause should always mention before the GROUP BY
  - Grouping columns should have less unique values.
  - Grouping columns should be primary business entities and facts and should not contain transactional data.

    Ex: dept , month – are less unique and summarizing the results are easy for grouping on these columns

Some other Restriction on Grouped Queries

No Summarized Results

```
Select salary, sum(salary) From
employee1 group by salary;
```

salary	sum(salary)
9000	9000
8000	8000
20000	20000
110123	110123
3000	3000
101000	101000
123456	123456
30400	30400

Accurate Summary Results

```
Select dept_name, joining_month,
sum(salary) From employee1 group
by dept_name, joining_month ;
```

dept_name	joining_month	sum(salary)
HR	1	29000
IT	1	8000
IT	3	233579
SALES	6	104000
IT	NULL	30400

Null Values in Grouping Columns

Null Values In Grouping Columns

- If joining month of few employees is unknown and NULL exists in the joining_month column, then the salary is still calculated to show aggregate summary of salaries for those NULL values of the joining_month column

```
Select dept_name , joining_month , sum(salary) From
employee1 group by dept_name , joining_month;
```

Output:

dept_name	joining_month	sum(salary)
HR	1	29000
IT	1	8000
IT	3	233579
SALES	6	104000
IT	NULL	30400

Shows the aggregate summary of salaries for those NULL values of the month.

Aggregation With Having Clause

Aggregation with Having Clause

- Find the department where the collective salary is more than 35000 each using aggregation with having clause as below:

```
Select joining_month, dept_name , sum(salary) From employee1
group by joining_month, dept_name  having sum(salary) > 35000;
```

Output:

joining_month	dept_name	sum(salary)
3	IT	233579
6	SALES	104000

Restriction on Grouped Search Condition

Restriction on Grouped Search Condition

- Having clause is used along with group-by clause in order to apply conditions for the grouped result set

- Having clause should be enclosed with grouped functions on columns that are issued in the Select query

Restriction on Grouped Search Condition

Conditions in having clause should always have at least one grouping function for comparison since it acts on grouped result set.

```
Select dept_name, joining_month, sum(salary), avg(salary) From
employee1
group by dept_name , joining_month having sum(salary) is not null;
```

Output:

dept_name	joining_month	sum(salary)	avg(salary)
HR	1	29000	14500.0000
IT	1	8000	8000.0000
IT	3	233579	116789.5000
SALES	6	104000	52000.0000
IT	NULL	30400	30400.0000

Null values and Grouped Search Condition

Null Values and Grouped Search Condition

If you want to find full salary details of employee along with the name and month they have joined, where the salary is not a null value

```
Select joining_month, emp_name , sum(salary) From employee1
group by joining_month having sum(salary) is not null;
```

Output:

joining_month	emp_name	sum(salary)
1	Oliver	9000
1	George	8000
1	Harry	20000
3	Jack	110123
6	Jacob	3000
6	Noah	101000
3	Charlie	123456
NULL	Robert	30400

salary details of employee along with the name and month they have joined, where the salary is not a null value

Having Without Group by

Having without Group by

Print one high level summary report of salary that is paid to all employees but not less than 299999. It benefits to quickly review on sum of salaries paid for all the employees in the company is exceeding 299999

```
Select sum(salary) From employee1 having sum(salary) > 299999;
```

Output:

sum(salary)
404979

The sum salary is 404979

Thank You