Aggregate Functions and Grouping in SQL

Submitted by: Shalini T

Introduction

Aggregate functions and grouping in SQL are essential tools for summarizing and analyzing large sets of data. They allow us to perform calculations on multiple rows of a table's column and return a single summarized value. Grouping, on the other hand, organizes data into meaningful sets, enabling deeper analysis and insights.

Objective of the Task

The objective of this task is to understand and practice the use of aggregate functions such as COUNT, SUM, AVG, MAX, MIN, along with the GROUP BY and HAVING clauses to summarize and categorize data effectively.

Tools Used

- MySQL Workbench for executing SQL queries
- Company Database containing the Employees table

Dataset Overview

The dataset used for this task is the Employees table with the following structure:

Column Name	Data Type	Description
emp_id	INT	Employee ID (Primary Key)
name	VARCHAR(50)	Employee Name
department	VARCHAR(50)	Department Name
salary	DECIMAL(10,2)	Employee Salary
email	VARCHAR(100)	Unique Email Address
joining_date	DATE	Date of Joining

Aggregate Functions in SQL

Aggregate functions in SQL perform a calculation on a set of values and return a single value. Some of the commonly used aggregate functions are:

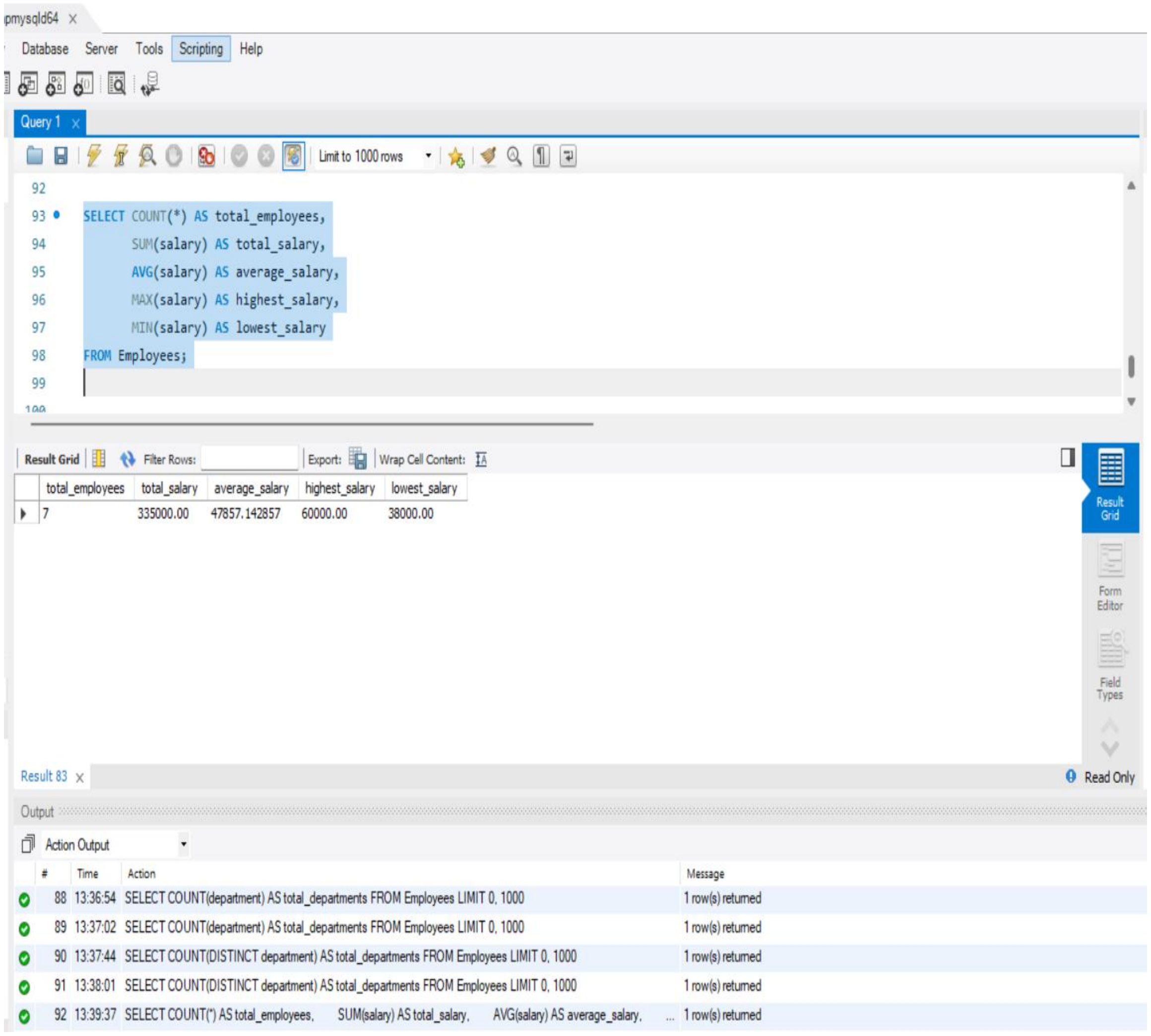
COUNT: Counts the number of rows.

SUM: Calculates the total sum of a numeric column.

AVG: Returns the average value of a numeric column.

MAX: Finds the highest value in a column.

MIN: Finds the lowest value in a column.



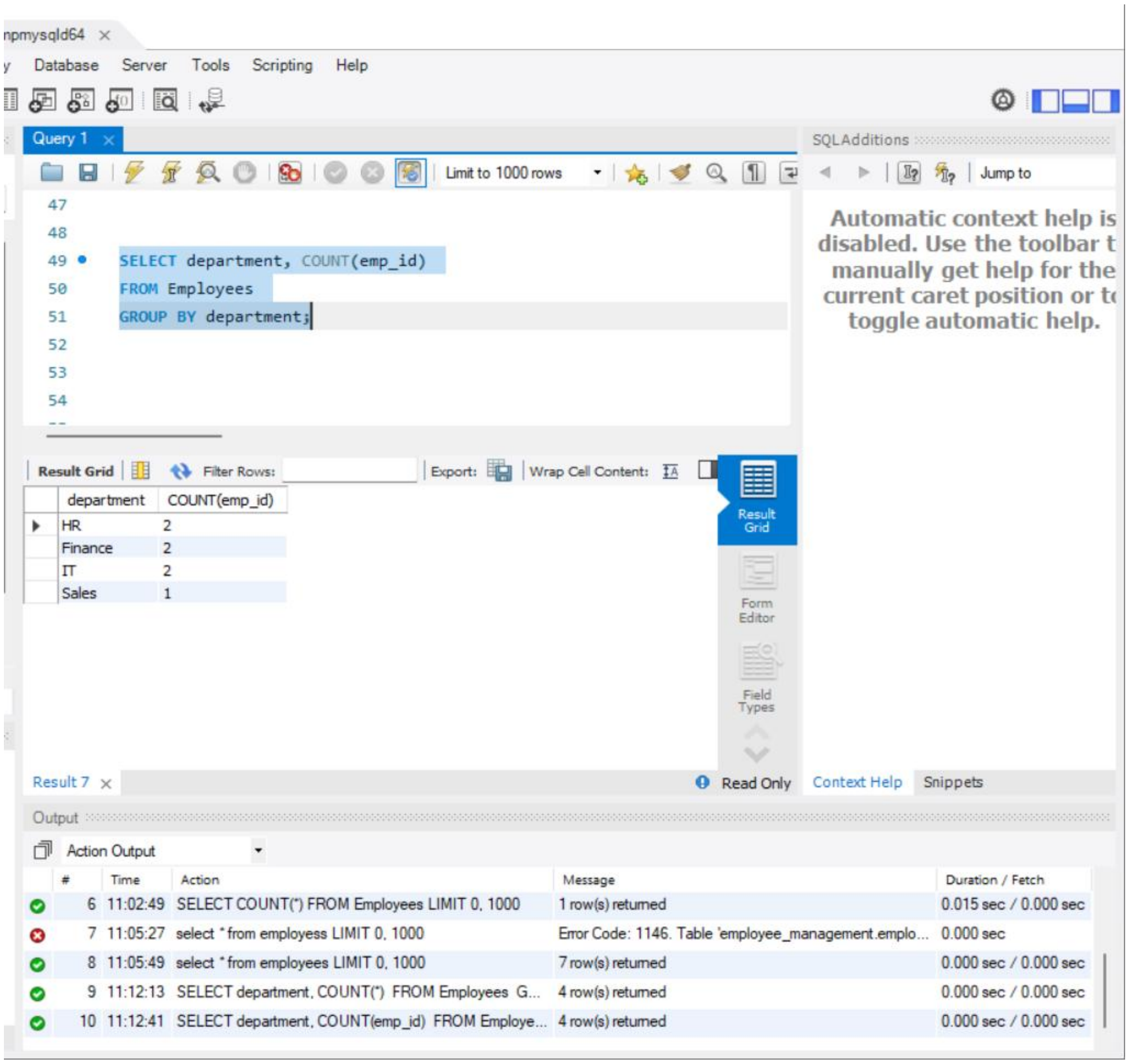
```
SELECT COUNT(*) AS total_employees,
       SUM(salary) AS total_salary,
       AVG(salary) AS average_salary,
       MAX(salary) AS highest_salary,
       MIN(salary) AS lowest_salary
FROM Employees;
```

total_employees	total_salary	average_salary	highest_salary	lowest_salary
7	335000.00	47857.142857	60000.00	38000.00

#	Time	Action	Message
88	13:36:54	SELECT COUNT(department) AS total_departments FROM Employees LIMIT 0, 1000	1 row(s) returned
89	13:37:02	SELECT COUNT(department) AS total_departments FROM Employees LIMIT 0, 1000	1 row(s) returned
90	13:37:44	SELECT COUNT(DISTINCT department) AS total_departments FROM Employees LIMIT 0, 1000	1 row(s) returned
91	13:38:01	SELECT COUNT(DISTINCT department) AS total_departments FROM Employees LIMIT 0, 1000	1 row(s) returned
92	13:39:37	SELECT COUNT(*) AS total_employees, SUM(salary) AS total_salary, AVG(salary) AS average_salary, ...	1 row(s) returned

GROUP BY Clause

The GROUP BY clause groups rows that have the same values in specified columns into aggregated data. It is often used with aggregate functions to produce summarized results.



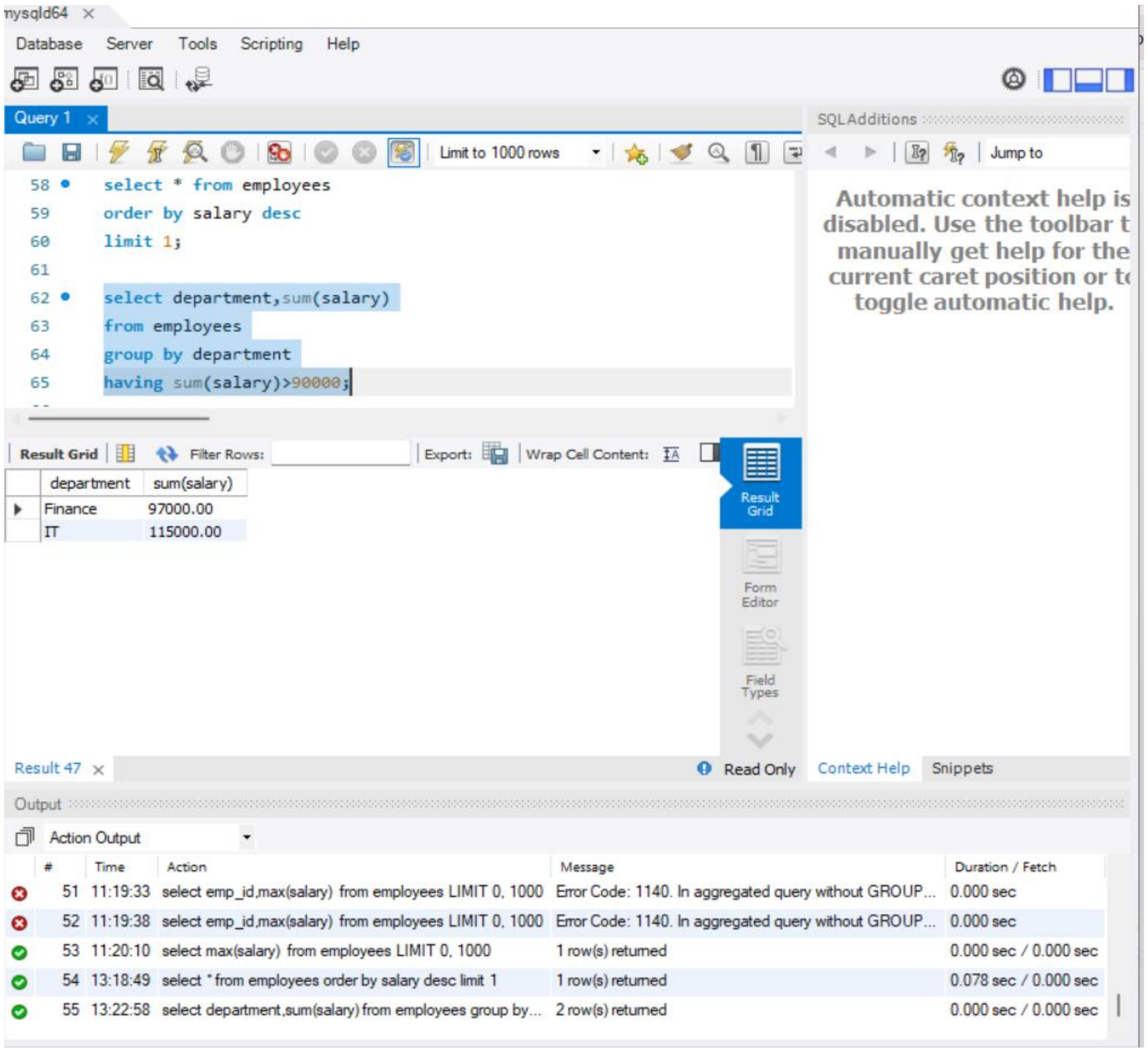
```
SELECT department, COUNT(emp_id)
FROM Employees
GROUP BY department;
```

department	COUNT(emp_id)
HR	2
Finance	2
IT	2
Sales	1

	#	Time	Action	Message	Duration / Fetch
✓	6	11:02:49	SELECT COUNT(*) FROM Employees LIMIT 0, 1000	1 row(s) returned	0.015 sec / 0.000 sec
✗	7	11:05:27	select * from employess LIMIT 0, 1000	Error Code: 1146. Table 'employee_management.emplo...	0.000 sec
✓	8	11:05:49	select * from employees LIMIT 0, 1000	7 row(s) returned	0.000 sec / 0.000 sec
✓	9	11:12:13	SELECT department, COUNT(*) FROM Employees G...	4 row(s) returned	0.000 sec / 0.000 sec
✓	10	11:12:41	SELECT department, COUNT(emp_id) FROM Employe...	4 row(s) returned	0.000 sec / 0.000 sec

HAVING Clause

The HAVING clause is used to filter records after the GROUP BY operation has been applied. It is similar to the WHERE clause, but WHERE filters rows before grouping, whereas HAVING filters after grouping.



```
select * from employees
order by salary desc
limit 1;

select department,sum(salary)
from employees
group by department
having sum(salary)>90000;
```

Automatic context help is disabled. Use the toolbar t manually get help for the current caret position or t toggle automatic help.

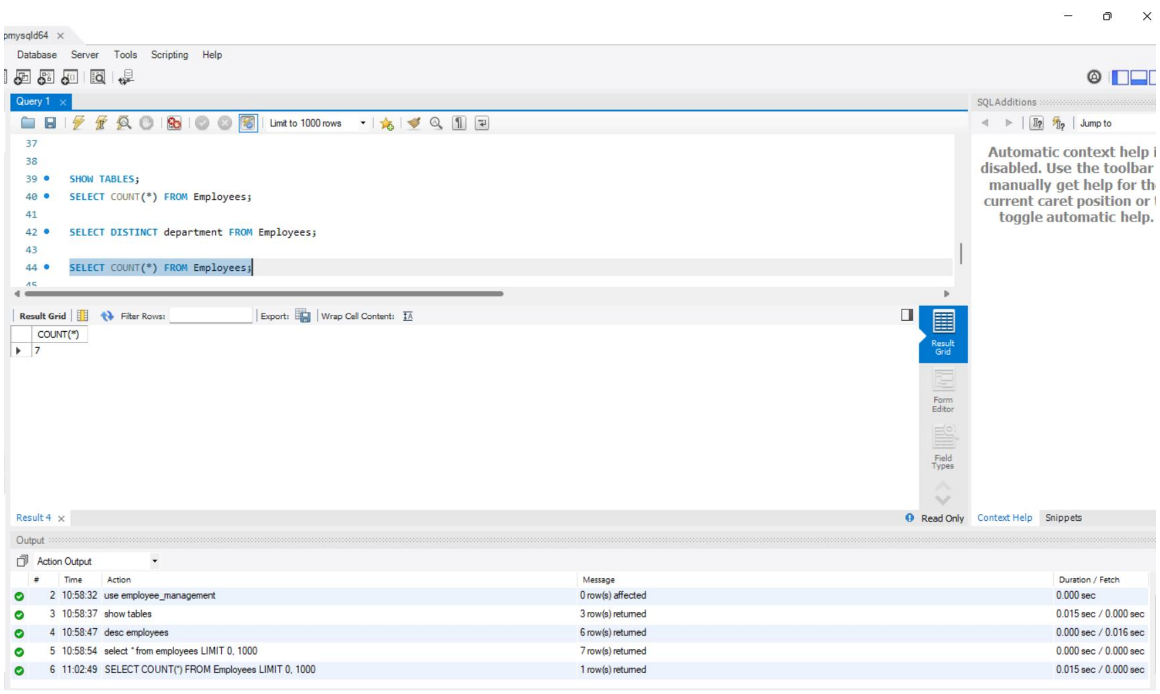
department	sum(salary)
Finance	97000.00
IT	115000.00

```
#   Time      Action                                                   Message                                         Duration / Fetch
51  11:19:33  select emp_id,max(salary) from employees LIMIT 0, 1000   Error Code: 1140. In aggregated query without GROUP...  0.000 sec
52  11:19:38  select emp_id,max(salary) from employees LIMIT 0, 1000   Error Code: 1140. In aggregated query without GROUP...  0.000 sec
53  11:20:10  select max(salary) from employees LIMIT 0, 1000          1 row(s) returned                               0.000 sec / 0.000 sec
54  13:18:49  select * from employees order by salary desc limit 1     1 row(s) returned                               0.078 sec / 0.000 sec
55  13:22:58  select department,sum(salary) from employees group by... 2 row(s) returned                               0.000 sec / 0.000 sec
```

Count Total Employees

SELECT COUNT(*) AS total_employees FROM Employees;

Counts the total number of employees in the company.



```
SHOW TABLES;
SELECT COUNT(*) FROM Employees;

SELECT DISTINCT department FROM Employees;

SELECT COUNT(*) FROM Employees;
```

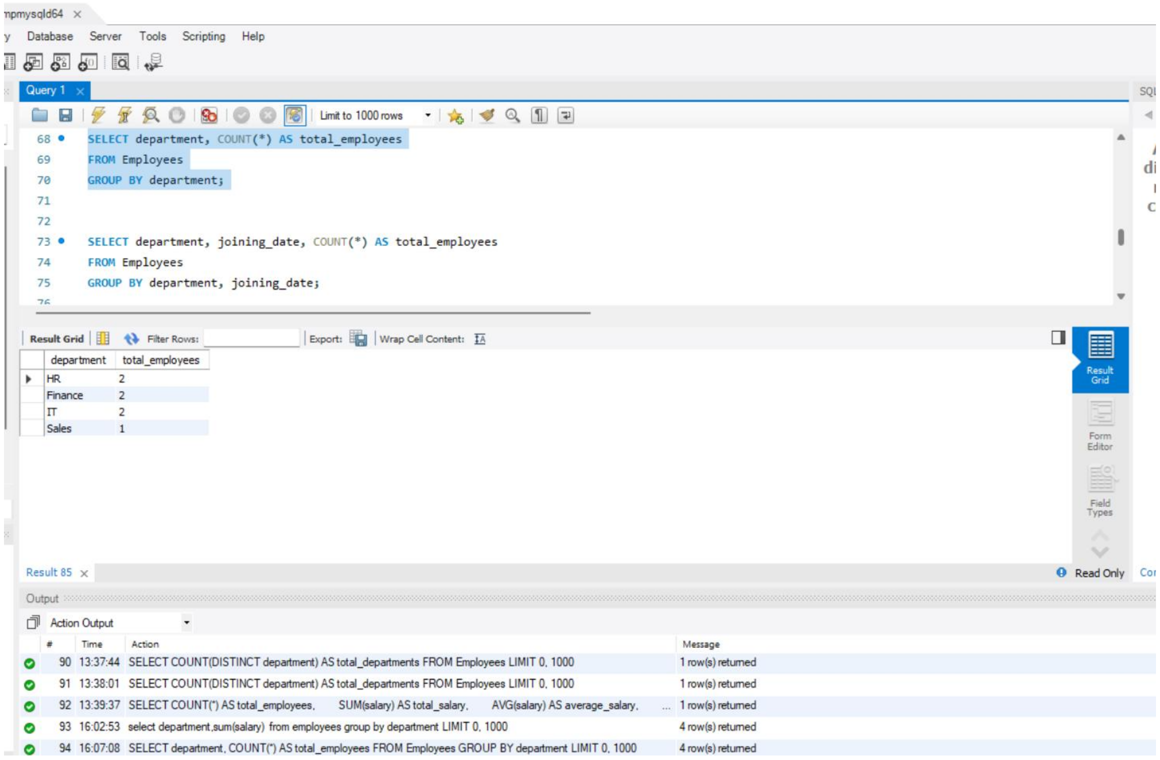
```
COUNT(*)
7
```

```
#  Time      Action                                            Message             Duration / Fetch
2  10:58:32  use employee_management                           0 row(s) affected   0.000 sec
3  10:58:37  show tables                                       3 row(s) returned   0.015 sec / 0.000 sec
4  10:58:47  desc employees                                    6 row(s) returned   0.000 sec / 0.016 sec
5  10:58:54  select * from employees LIMIT 0, 1000             7 row(s) returned   0.000 sec / 0.000 sec
6  11:02:49  SELECT COUNT(*) FROM Employees LIMIT 0, 1000      1 row(s) returned   0.015 sec / 0.000 sec
```

Employees Per Department

SELECT department, COUNT(*) AS total_employees FROM Employees GROUP BY department;

Shows how many employees are there in each department.



```
SELECT department, COUNT(*) AS total_employees
FROM Employees
GROUP BY department;


SELECT department, joining_date, COUNT(*) AS total_employees
FROM Employees
GROUP BY department, joining_date;
```

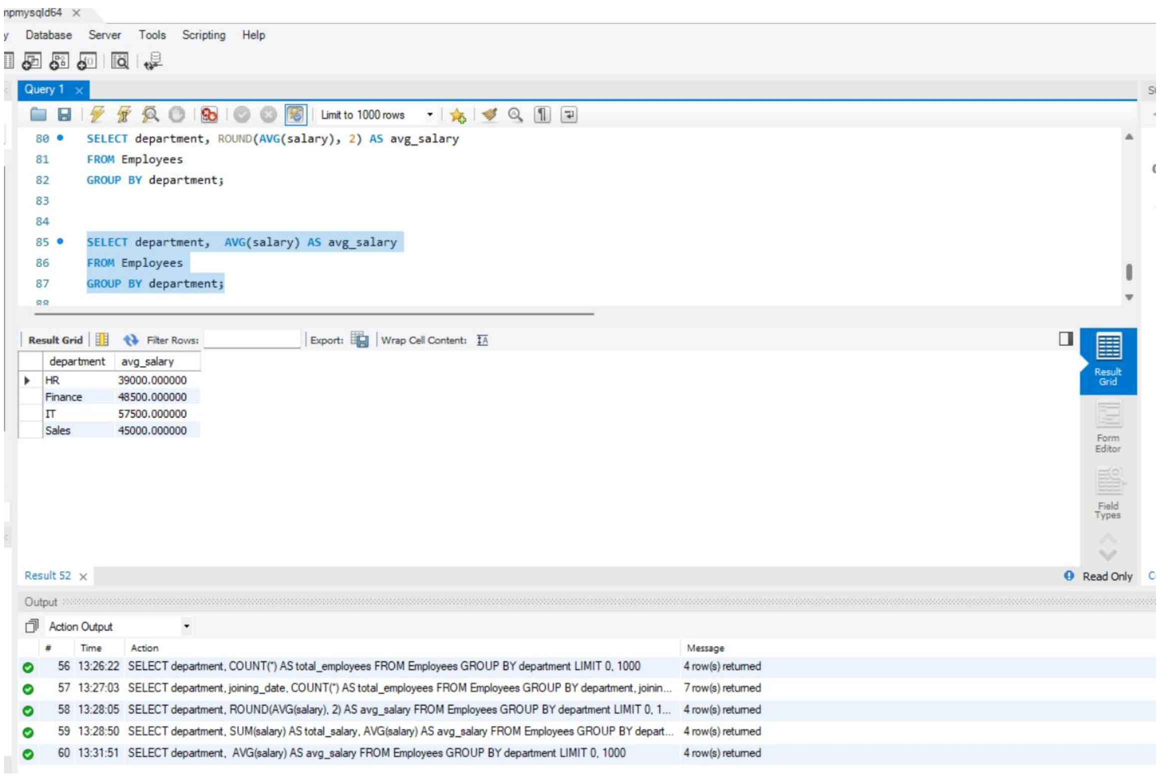
```
department  total_employees
HR          2
Finance     2
IT          2
Sales       1
```

```
#   Time      Action                                                                                   Message
90  13:37:44  SELECT COUNT(DISTINCT department) AS total_departments FROM Employees LIMIT 0, 1000        1 row(s) returned
91  13:38:01  SELECT COUNT(DISTINCT department) AS total_departments FROM Employees LIMIT 0, 1000        1 row(s) returned
92  13:39:37  SELECT COUNT(*) AS total_employees,     SUM(salary) AS total_salary,     AVG(salary) AS average_salary,  ...  1 row(s) returned
93  16:02:53  select department,sum(salary)  from employees group by department LIMIT 0, 1000           4 row(s) returned
94  16:07:08  SELECT department, COUNT(*) AS total_employees FROM Employees GROUP BY department LIMIT 0, 1000   4 row(s) returned
```

Average Salary by Department

SELECT department, AVG(salary) AS avg_salary FROM Employees GROUP BY department;

Calculates the average salary for each department.



```
SELECT department, ROUND(AVG(salary), 2) AS avg_salary
FROM Employees
GROUP BY department;


SELECT department,  AVG(salary) AS avg_salary
FROM Employees
GROUP BY department;
```

department	avg_salary
HR	39000.000000
Finance	48500.000000
IT	57500.000000
Sales	45000.000000

```
#   Time      Action                                                                                          Message
56  13:26:22  SELECT department, COUNT(*) AS total_employees FROM Employees GROUP BY department LIMIT 0, 1000   4 row(s) returned
57  13:27:03  SELECT department, joining_date, COUNT(*) AS total_employees FROM Employees GROUP BY department, joinin...   7 row(s) returned
58  13:28:05  SELECT department, ROUND(AVG(salary), 2) AS avg_salary FROM Employees GROUP BY department LIMIT 0, 1...   4 row(s) returned
59  13:28:50  SELECT department, SUM(salary) AS total_salary, AVG(salary) AS avg_salary FROM Employees GROUP BY depart...   4 row(s) returned
60  13:31:51  SELECT department,  AVG(salary) AS avg_salary FROM Employees GROUP BY department LIMIT 0, 1000   4 row(s) returned
```

Departments with More Than One Employee

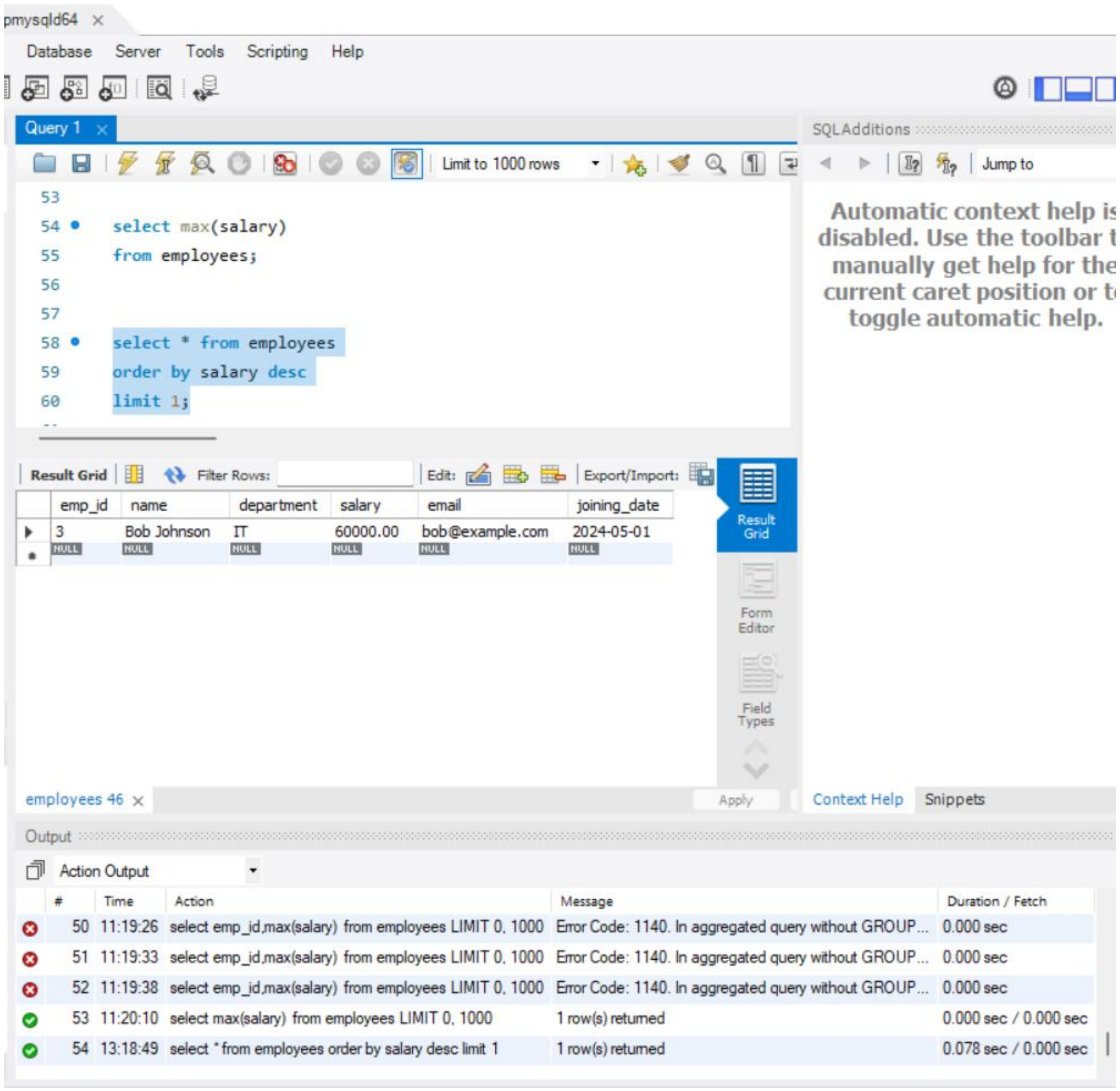
SELECT department, COUNT(*) AS total FROM Employees GROUP BY department HAVING total > 1;

Displays only those departments having more than one employee.

Highest Salary Employee

SELECT name, salary FROM Employees WHERE salary = (SELECT MAX(salary) FROM Employees);

Finds the employee(s) with the highest salary.



```
select max(salary)
from employees;


select * from employees
order by salary desc
limit 1;
```

Automatic context help is disabled. Use the toolbar t manually get help for the current caret position or t toggle automatic help.

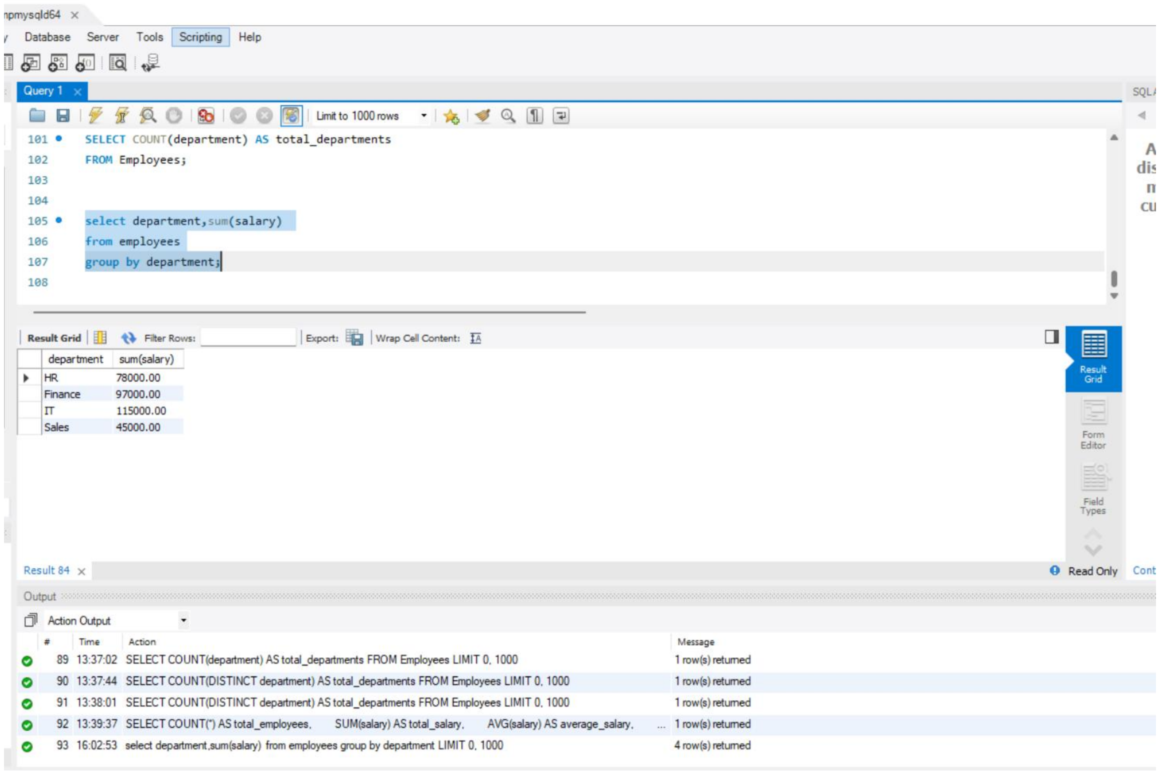
	emp_id	name	department	salary	email	joining_date
▶	3	Bob Johnson	IT	60000.00	bob@example.com	2024-05-01
*	NULL	NULL	NULL	NULL	NULL	NULL

```
    #   Time      Action                                               Message                                                Duration / Fetch
✖  50  11:19:26  select emp_id,max(salary) from employees LIMIT 0, 1000  Error Code: 1140. In aggregated query without GROUP...  0.000 sec
✖  51  11:19:33  select emp_id,max(salary) from employees LIMIT 0, 1000  Error Code: 1140. In aggregated query without GROUP...  0.000 sec
✖  52  11:19:38  select emp_id,max(salary) from employees LIMIT 0, 1000  Error Code: 1140. In aggregated query without GROUP...  0.000 sec
✓  53  11:20:10  select max(salary) from employees LIMIT 0, 1000         1 row(s) returned                                      0.000 sec / 0.000 sec
✓  54  13:18:49  select * from employees order by salary desc limit 1    1 row(s) returned                                      0.078 sec / 0.000 sec
```

Total Salary by Department

SELECT department, SUM(salary) FROM Employees GROUP BY department;

Calculates the total salary expenditure for each department.



```
SELECT COUNT(department) AS total_departments
FROM Employees;


select department,sum(salary)
from employees
group by department;
```

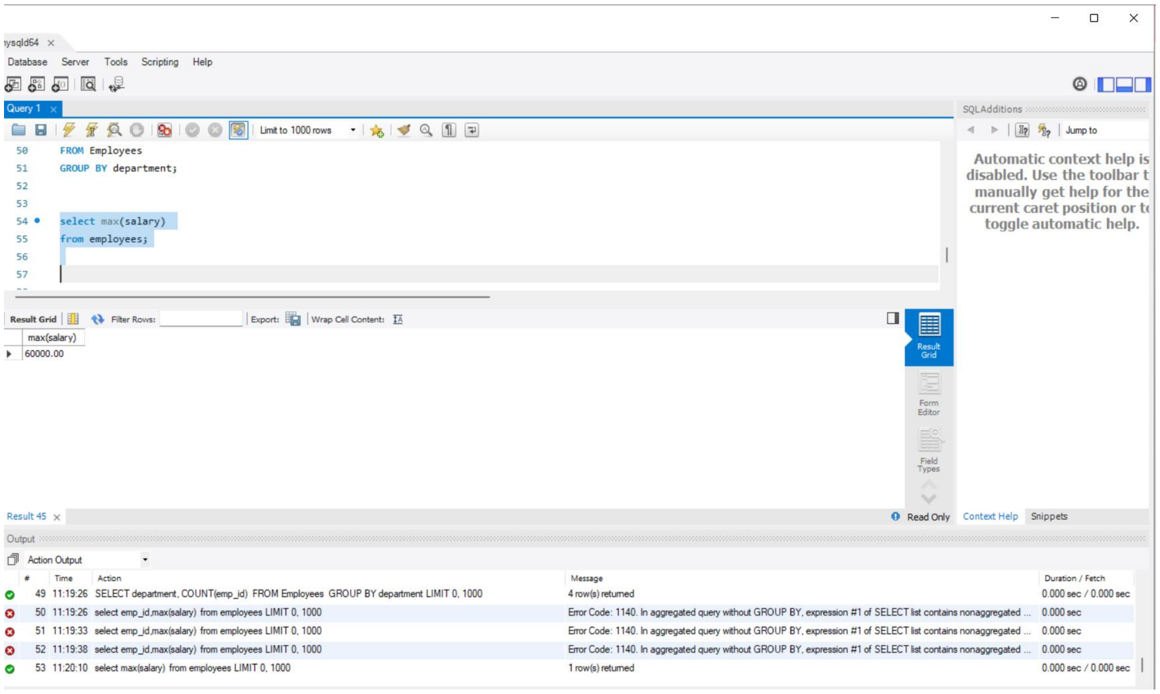
department	sum(salary)
HR	78000.00
Finance	97000.00
IT	115000.00
Sales	45000.00

```
#   Time      Action                                                                              Message
89  13:37:02  SELECT COUNT(department) AS total_departments FROM Employees LIMIT 0, 1000          1 row(s) returned
90  13:37:44  SELECT COUNT(DISTINCT department) AS total_departments FROM Employees LIMIT 0, 1000 1 row(s) returned
91  13:38:01  SELECT COUNT(DISTINCT department) AS total_departments FROM Employees LIMIT 0, 1000 1 row(s) returned
92  13:39:37  SELECT COUNT(*) AS total_employees,   SUM(salary) AS total_salary,   AVG(salary) AS average_salary,   ...  1 row(s) returned
93  16:02:53  select department,sum(salary) from employees group by department LIMIT 0, 1000     4 row(s) returned
```

MAX()

- **Query to find highest salary:**

SELECT name, salary FROM Employees WHERE salary = (SELECT MAX(salary) FROM Employees);



```
FROM Employees
GROUP BY department;


select max(salary)
from employees;
```

max(salary)
60000.00

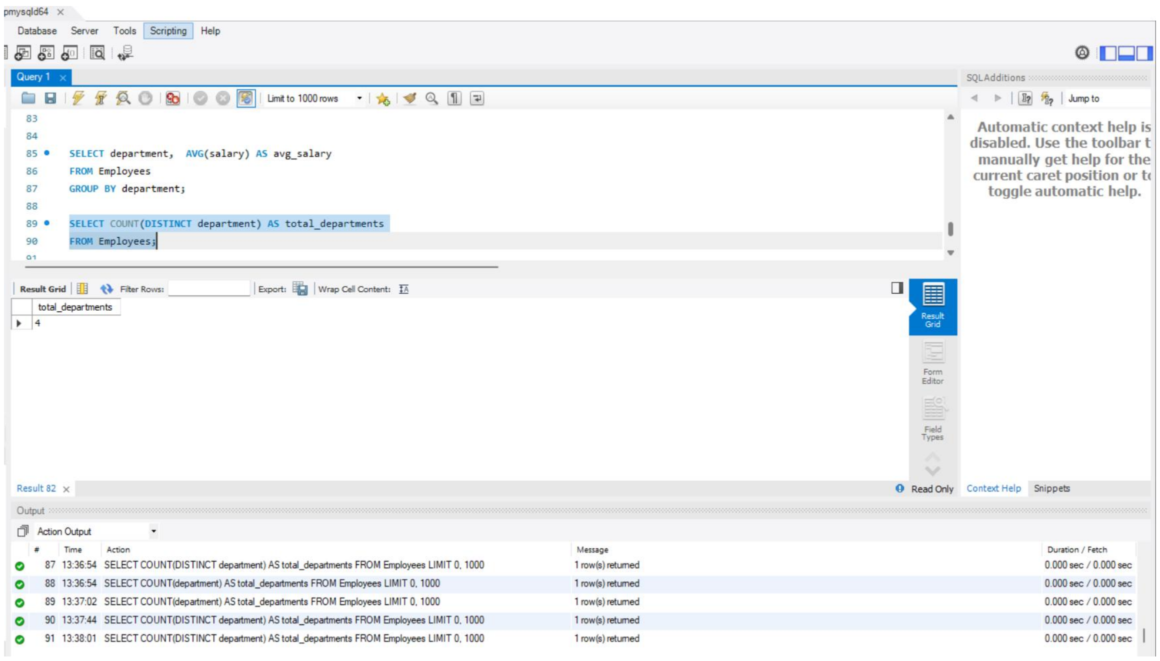
Automatic context help is disabled. Use the toolbar t manually get help for the current caret position or t toggle automatic help.

```
#   Time      Action                                                                    Message                                                                                         Duration / Fetch
49  11:19:26  SELECT department, COUNT(emp_id) FROM Employees GROUP BY department LIMIT 0, 1000  4 row(s) returned                                                               0.000 sec / 0.000 sec
50  11:19:26  select emp_id,max(salary) from employees LIMIT 0, 1000                   Error Code: 1140. In aggregated query without GROUP BY, expression #1 of SELECT list contains nonaggregated ...  0.000 sec
51  11:19:33  select emp_id,max(salary) from employees LIMIT 0, 1000                   Error Code: 1140. In aggregated query without GROUP BY, expression #1 of SELECT list contains nonaggregated ...  0.000 sec
52  11:19:38  select emp_id,max(salary) from employees LIMIT 0, 1000                   Error Code: 1140. In aggregated query without GROUP BY, expression #1 of SELECT list contains nonaggregated ...  0.000 sec
53  11:20:10  select max(salary) from employees LIMIT 0, 1000                          1 row(s) returned                                                                                0.000 sec / 0.000 sec
```

Count Distinct Departments

SELECT COUNT(DISTINCT department) AS unique_departments FROM Employees;

Counts the total number of distinct departments in the company.



```
SELECT department,  AVG(salary) AS avg_salary
FROM Employees
GROUP BY department;

SELECT COUNT(DISTINCT department) AS total_departments
FROM Employees;
```

Automatic context help is disabled. Use the toolbar t manually get help for the current caret position or t toggle automatic help.

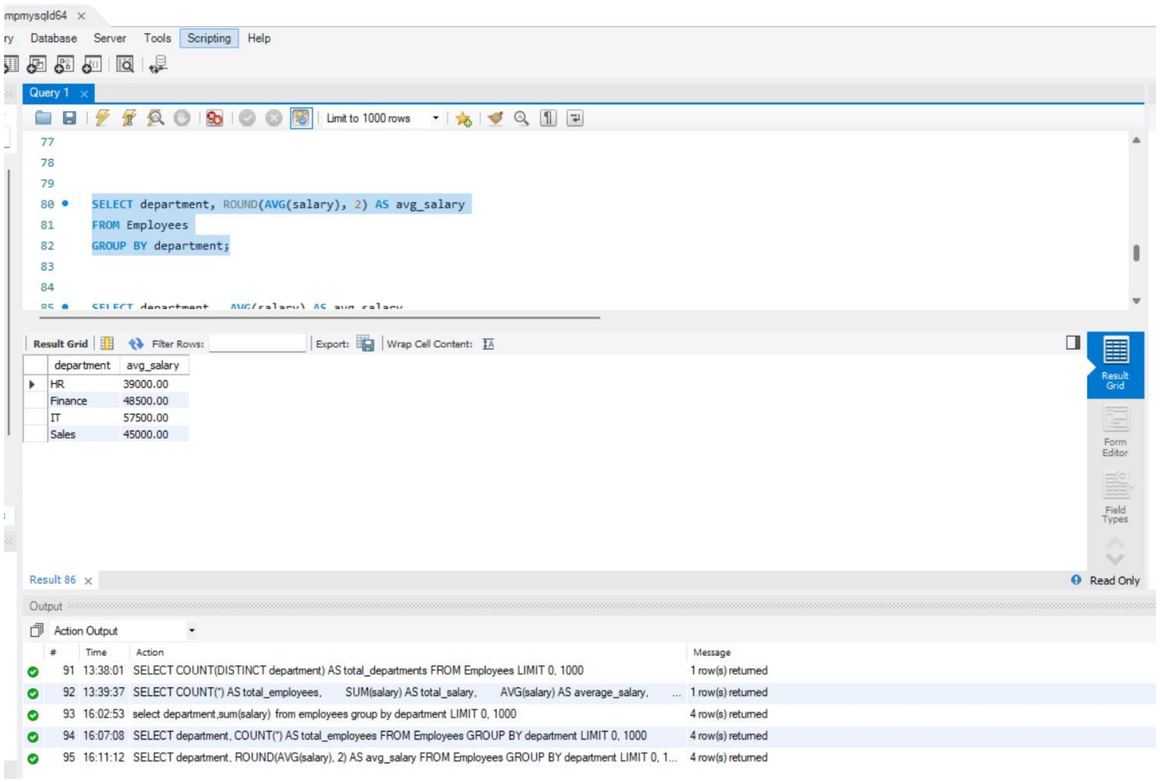
total_departments
4

```
#   Time      Action                                                                        Message            Duration / Fetch
87  13:36:54  SELECT COUNT(DISTINCT department) AS total_departments FROM Employees LIMIT 0, 1000  1 row(s) returned  0.000 sec / 0.000 sec
88  13:36:54  SELECT COUNT(department) AS total_departments FROM Employees LIMIT 0, 1000           1 row(s) returned  0.000 sec / 0.000 sec
89  13:37:02  SELECT COUNT(department) AS total_departments FROM Employees LIMIT 0, 1000           1 row(s) returned  0.000 sec / 0.000 sec
90  13:37:44  SELECT COUNT(DISTINCT department) AS total_departments FROM Employees LIMIT 0, 1000  1 row(s) returned  0.000 sec / 0.000 sec
91  13:38:01  SELECT COUNT(DISTINCT department) AS total_departments FROM Employees LIMIT 0, 1000  1 row(s) returned  0.000 sec / 0.000 sec
```

Rounded Average Salary

SELECT department, ROUND(AVG(salary), 2) AS rounded_avg FROM Employees GROUP BY department;

Rounds the average salary to 2 decimal places for better readability.



```
SELECT department, ROUND(AVG(salary), 2) AS avg_salary
FROM Employees
GROUP BY department;
```

```
department  avg_salary
HR          39000.00
Finance     48500.00
IT          57500.00
Sales       45000.00
```

```
#   Time      Action                                                                                          Message
91  13:38:01  SELECT COUNT(DISTINCT department) AS total_departments FROM Employees LIMIT 0, 1000            1 row(s) returned
92  13:39:37  SELECT COUNT(*) AS total_employees,     SUM(salary) AS total_salary,     AVG(salary) AS average_salary,  ...  1 row(s) returned
93  16:02:53  select department,sum(salary)  from employees group by department LIMIT 0, 1000                4 row(s) returned
94  16:07:08  SELECT department, COUNT(*) AS total_employees FROM Employees GROUP BY department LIMIT 0, 1000  4 row(s) returned
95  16:11:12  SELECT department, ROUND(AVG(salary), 2) AS avg_salary FROM Employees GROUP BY department LIMIT 0, 1...  4 row(s) returned
```

Conclusion

Through this task, I learned how to use aggregate functions along with GROUP BY and HAVING clauses to summarize and analyze data effectively. These concepts are essential for generating meaningful insights from large datasets in real-world applications.