Hands-on Lab : String Patterns, Sorting and Grouping

Estimated time needed: 35 minutes

In this lab, you will go through some SQL practice problems that will provide hands-on experience with string patterns, sorting result sets and grouping result sets.

Software Used in this Lab

In this lab, you will use an IBM Db2 Database. Db2 is a Relational Database Management System (RDBMS) from IBM, designed to store, analyze and retrieve data efficiently.

To complete this lab you will utilize a Db2 database service on IBM Cloud. If you did not already complete this lab task earlier in this module, you will not yet have access to Db2 on IBM Cloud, and you will need to follow the lab below first:

- Hands-on Lab : Sign up for IBM Cloud, Create Db2 service instance and Get started with the Db2 console

Database Used in this Lab

The database used in this lab is an internal database. You will be working on a sample HR database. This HR database schema consists of 5 tables called **EMPLOYEES**, **JOB_HISTORY**, **JOBS**, **DEPARTMENTS** and **LOCATIONS**. Each table has a few rows of sample data. The following diagram shows the tables for the HR database:

SAMPLE HR DATABASE TABLES

EMPLOYEES

EMP_ID	F_NAME	L_NAME	SSN	B_DATE	SEX	ADDRESS	JOB_ID	SALARY	MANAGER_ID	DEP_ID
E1001	John	Thomas	123456	1976-01-09	M	5631 Rice, OakPark,IL	100	100000	30001	2
E1002	Alice	James	123457	1972-07-31	F	980 Berry ln, Elgin,IL	200	80000	30002	5
E1003	Steve	Wells	123458	1980-08-10	M	291 Springs, Gary,IL	300	50000	30002	5

JOB_HISTORY

EMPL_ID	START_DATE	JOBS_ID	DEPT_ID
E1001	2000-01-30	100	2
E1002	2010-08-16	200	5
E1003	2016-08-10	300	5

JOBS

JOB_IDENT	JOB_TITLE	MIN_SALARY	MAX_SALARY
100	Sr. Architect	60000	100000
200	Sr.SoftwareDeveloper	60000	80000
300	Jr.SoftwareDeveloper	40000	60000

DEPARTMENTS

DEPT_ID_DEP	DEP_NAME	MANAGER_ID	LOC_ID
2	Architect Group	30001	L0001
5	Software Development	30002	L0002
7	Design Team	30003	L0003
5	Software	30004	L0004

LOCATIONS

LOCT_ID	DEP_ID_LOC
L0001	2
L0002	5
L0003	7

NOTE: This lab requires you to have all 5 of these tables of the HR database populated with sample data on Db2. If you didn't complete the earlier lab in this module, you won't have the tables above populated with sample data on Db2, so you will need to go through the lab below first:

- Hands-on Lab : Create tables using SQL scripts and Load data into tables

Objectives

After completing this lab, you will be able to:

- Simplify a SELECT statement by using string patterns, ranges, or sets of values
- Sort the result set in either ascending or descending order and identify which column to use for the sorting order
- Eliminate duplicates from a result set and further restrict a result set

Instructions

When you approach the exercises in this lab, follow the instructions to run the queries on Db2:

- Go to the Resource List of IBM Cloud by logging in where you can find the Db2 service instance that you created in a previous lab under **Services** section. Click on the **Db2-xx service**. Next, open the Db2 Console by clicking on **Open Console** button. Click on the 3-bar menu icon in the top left corner and go to the **Run SQL** page. The Run SQL tool enables you to run SQL statements.
    - If needed, follow Hands-on Lab : Sign up for IBM Cloud, Create Db2 service instance and Get started with the Db2 console

Exercise 1: String Patterns

In this exercise, you will go through some SQL problems on String Patterns.

1. Problem:

> *Retrieve all employees whose address is in Elgin,IL.*

▼ Hint

> Use the LIKE operator to find similar strings.

▼ Solution

```
SELECT F_NAME , L_NAME
FROM EMPLOYEES
WHERE ADDRESS LIKE '%Elgin,IL%';
```

▼ Output

```
1 -- Query 1------
2 ;
3 select F_NAME , L_NAME
4 from EMPLOYEES
5 where ADDRESS LIKE '%Elgin,IL%' ;
6 --Query 2--
7 ;
```

Saved scripts | Result

Filter by status: | Result set | Log

All

Delete All

F_NAME	L_NAME
Alice	James
Nancy	Allen
Ann	Jacob

Al...

select...

select ...

select ...

Total rows: 3

2. Problem:

> *Retrieve all employees who were born during the 1970's.*

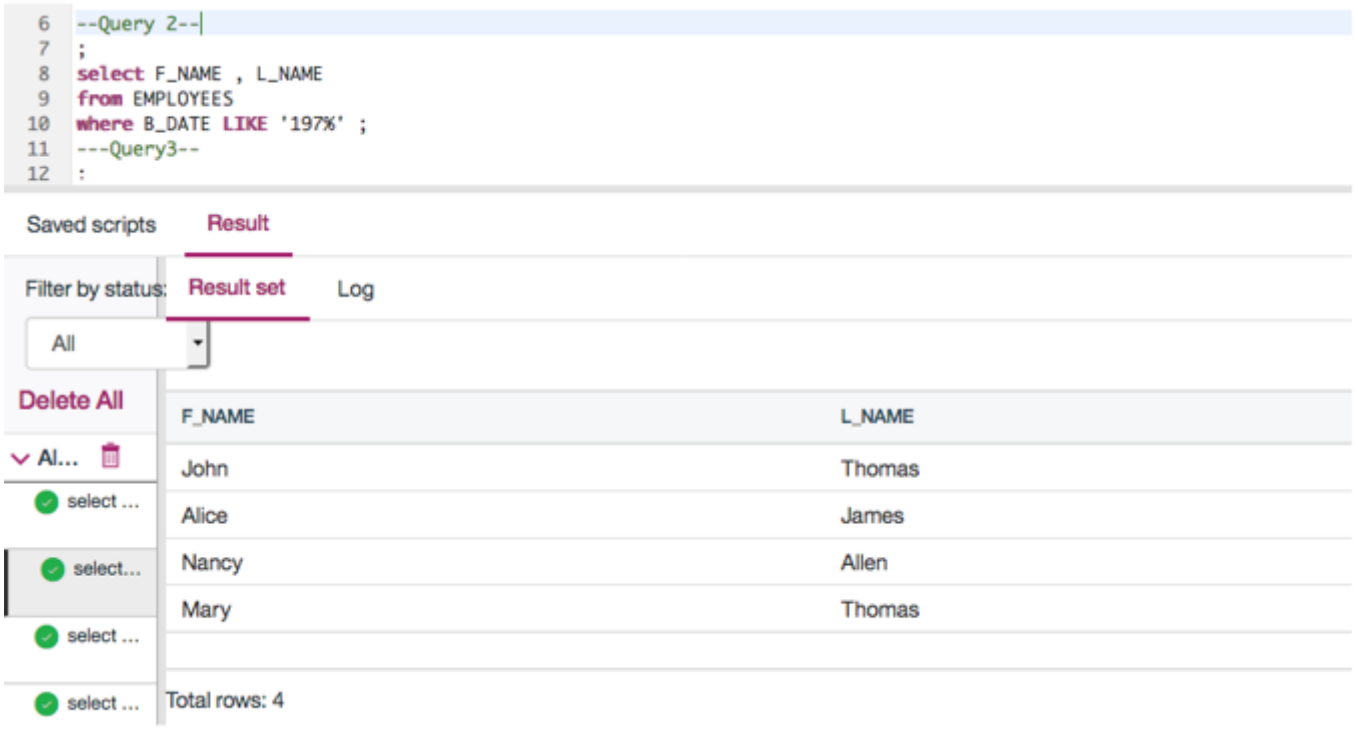
▼ Hint

> Use the LIKE operator to find similar strings.

▼ Solution

```
SELECT F_NAME , L_NAME
FROM EMPLOYEES
WHERE B_DATE LIKE '197%';
```

▼ Output



3. Problem:

> *Retrieve all employees in department 5 whose salary is between 60000 and 70000.*

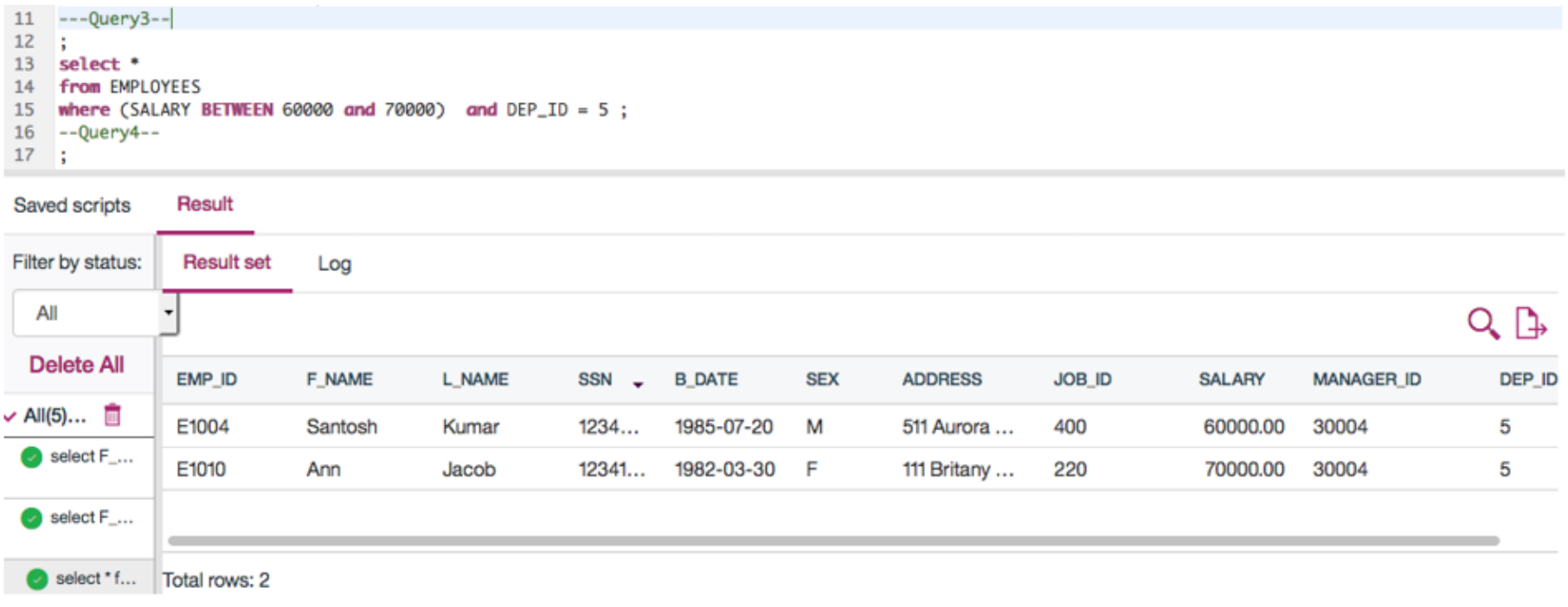
▼ Hint

> Use the keyword BETWEEN for this SQL problem.

▼ Solution

```
SELECT *
FROM EMPLOYEES
WHERE (SALARY BETWEEN 60000 AND 70000) AND DEP_ID = 5;
```

▼ Output



Exercise 2: Sorting

In this exercise, you will go through some SQL problems on Sorting.

1. Problem:

> *Retrieve a list of employees ordered by department ID.*

▼ Hint

> Use the ORDER BY clause for this SQL problem. By default, the ORDER BY clause sorts the records in ascending order.

▼ Solution

```
SELECT F_NAME, L_NAME, DEP_ID
FROM EMPLOYEES
ORDER BY DEP_ID;
```

▼ Output

```
select F_NAME, L_NAME, DEP_ID
from EMPLOYEES
order by DEP_ID;
```

ed scripts **Result**

r by status: **Result set** Log

All

elete All

(1)… select F_…

(1)… select F_…

(1)… select F_…

(1)… select F_…

F_NAME	L_NAME	DEP_ID
John	Thomas	2
Ahmed	Hussain	2
Nancy	Allen	2
Alice	James	5
Steve	Wells	5
Santosh	Kumar	5
Ann	Jacob	5
Mary	Thomas	7
Bharath	Gupta	7
Andrea	Jones	7

Total rows: 10

2. Problem:

> *Retrieve a list of employees ordered in descending order by department ID and within each department ordered alphabetically in descending order by last name.*

▼ Hint

> Use the ORDER BY clause with DESC for this SQL problem.

▼ Solution

```
SELECT F_NAME, L_NAME, DEP_ID
FROM EMPLOYEES
ORDER BY DEP_ID DESC, L_NAME DESC;
```

▼ Output

```
1 select F_NAME, L_NAME, DEP_ID
2 from EMPLOYEES
3 order by DEP_ID desc, L_NAME desc;
```

Saved scripts | Result

Filter by status: All

Delete All

All(1)... select F_...

All(1)... select F_...

All(1)... select F_...

All(1)... select F_...

Result set | Log

F_NAME	L_NAME	DEP_ID
Mary	Thomas	7
Andrea	Jones	7
Bharath	Gupta	7
Steve	Wells	5
Santosh	Kumar	5
Alice	James	5
Ann	Jacob	5
John	Thomas	2
Ahmed	Hussain	2
Nancy	Allen	2

Total rows: 10

3. (Optional) Problem:

> *In SQL problem 2 (Exercise 2 Problem 2), use department name instead of department ID. Retrieve a list of employees ordered by department name, and within each department ordered alphabetically in descending order by last name.*

▼ Hint

> Department name is in the DEPARTMENTS table. So your query will need to retrieve data from more than one table. Don't worry if you are not able to figure this SQL problem out. We'll cover working with multiple tables in the lecture **Working with Multiple Tables**.

▼ Solution

```
SELECT D.DEP_NAME , E.F_NAME, E.L_NAME
FROM EMPLOYEES as E, DEPARTMENTS as D
WHERE E.DEP_ID = D.DEPT_ID_DEP
ORDER BY D.DEP_NAME, E.L_NAME DESC;
```

> In the SQL Query above, `D` and `E` are aliases for the table names. Once you define an alias like `D` in your query, you can simply write `D.COLUMN_NAME` rather than the full form `DEPARTMENTS.COLUMN_NAME`.

▼ Output

```
--Query4--
;
select D.DEP_NAME , E.F_NAME, E.L_NAME
from EMPLOYEES as E, DEPARTMENTS as D
where E.DEP_ID = D.DEPT_ID_DEP
order by D.DEP_NAME, E.L_NAME desc ;
--Query5--
```

Saved scripts | Result

Filter by status: All

Delete All

All(5)...

- select F_...
- select F_...
- select * fr...
- select D....
- select DE...

Result set | Log

DEP_NAME	F_NAME	L_NAME
Architect Group	John	Thomas
Architect Group	Ahmed	Hussain
Architect Group	Nancy	Allen
Design Team	Mary	Thomas
Design Team	Andrea	Jones
Design Team	Bharath	Gupta
Software Group	Steve	Wells
Software Group	Santosh	Kumar
Software Group	Alice	James
Software Group	Ann	Jacob

Total rows: 10

Exercise 3: Grouping

In this exercise, you will go through some SQL problems on Grouping.

NOTE: The SQL problems in this exercise involve usage of SQL Aggregate functions AVG and COUNT. COUNT has been covered earlier. AVG is a function that can be used to calculate the Average or Mean of all values of a specified column in the result set. For example, to retrieve the average salary for all employees in the EMPLOYEES table, issue the query: `SELECT AVG(SALARY) FROM EMPLOYEES;`. You will learn more about AVG and other aggregate functions later in the lecture **Built-in Database Functions**.

1. Problem:

> *For each department ID retrieve the number of employees in the department.*

▼ Hint

> Use COUNT(*) to retrieve the total count of a column, and then GROUP BY.

▼ Solution

```
SELECT DEP_ID, COUNT(*)
FROM EMPLOYEES
GROUP BY DEP_ID;
```

▼ Output

```
select DEP_ID, COUNT(*)
from EMPLOYEES
group by DEP_ID;
```

ved scripts Result

er by status: Result set Log

All

lete All

DEP_ID	2
2	3
5	4
7	3

Total rows: 3

2. Problem:

> *For each department retrieve the number of employees in the department, and the average employee salary in the department..*

▼ Hint

> Use COUNT(*) to retrieve the total count of a column, and AVG() function to compute average salaries, and then GROUP BY.

▼ Solution

```
SELECT DEP_ID, COUNT(*), AVG(SALARY)
FROM EMPLOYEES
GROUP BY DEP_ID;
```

▼ Output

```
1 select DEP_ID, COUNT(*), AVG(SALARY)
2 from EMPLOYEES
3 group by DEP_ID;
```

Saved scripts Result

Filter by stat Result set Log

All

Delete All

DEP_ID	2	3
2	3	86666.666666666666666666666666
5	4	65000.000000000000000000000000
7	3	66666.666666666666666666666666

Total rows: 3

3. Problem:

> *Label the computed columns in the result set of SQL problem 2 (Exercise 3 Problem 2) as NUM_EMPLOYEES and AVG_SALARY.*

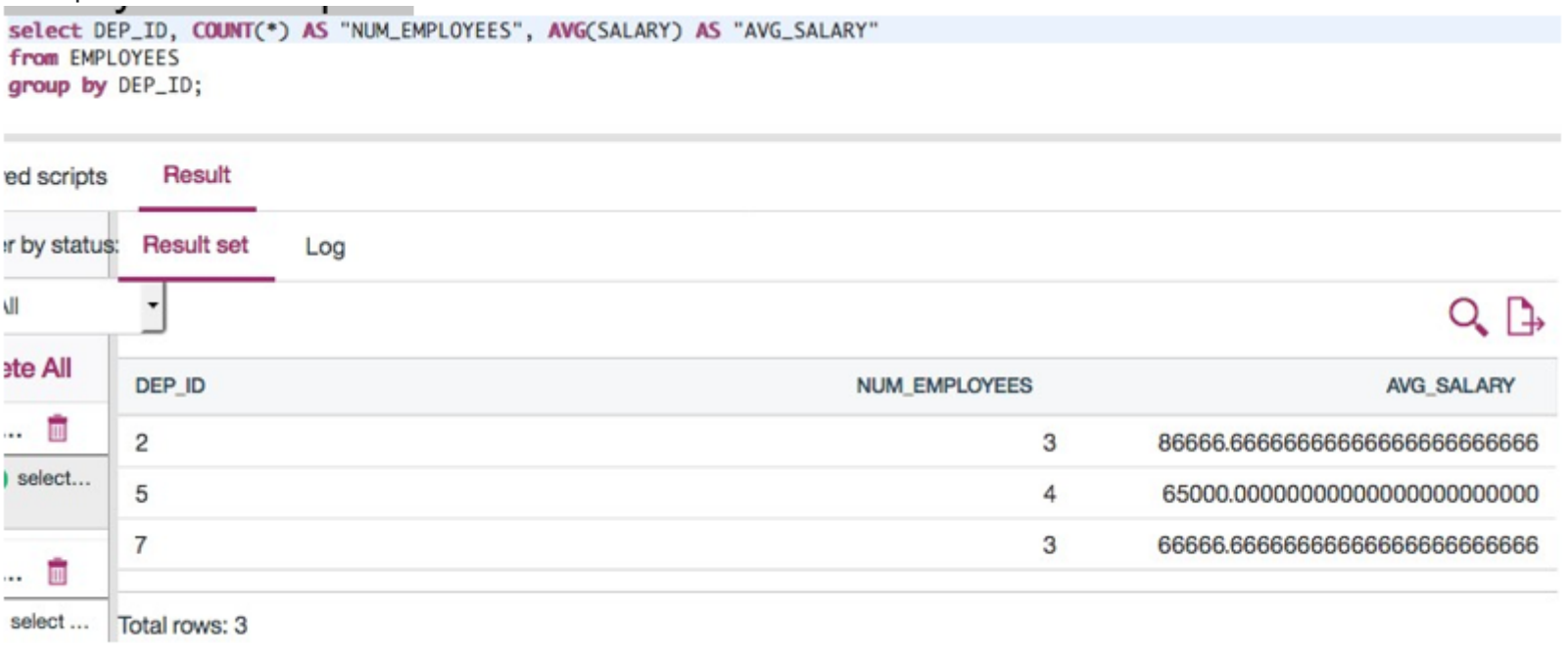
▼ Hint

> Use SQL Aliases: `column_name AS alias_name`. For example, AVG(SALARY) AS "AVG_SALARY".

▼ Solution

```
SELECT DEP_ID, COUNT(*) AS "NUM_EMPLOYEES", AVG(SALARY) AS "AVG_SALARY"
FROM EMPLOYEES
GROUP BY DEP_ID;
```

▼ Output



4. Problem:

> *In SQL problem 3 (Exercise 3 Problem 3), order the result set by Average Salary..*

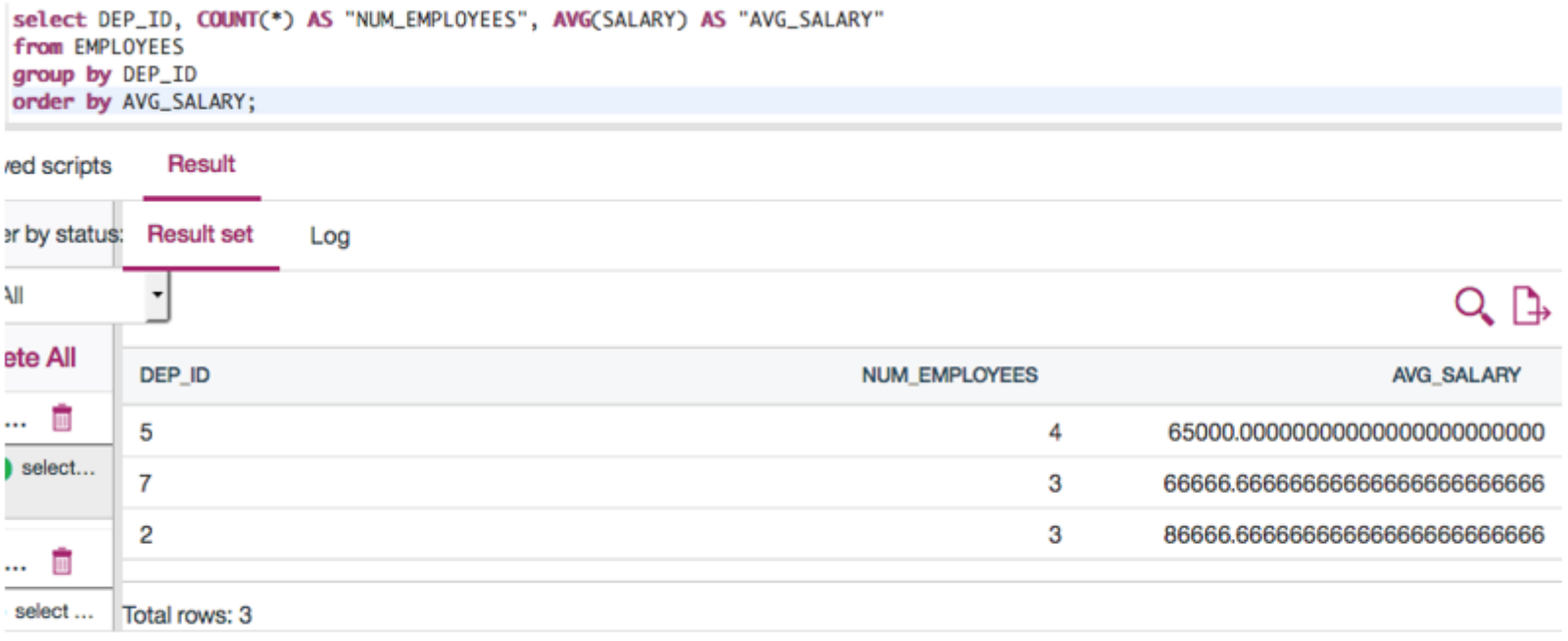
▼ Hint

> Use ORDER BY after the GROUP BY.

▼ Solution

```
SELECT DEP_ID, COUNT(*) AS "NUM_EMPLOYEES", AVG(SALARY) AS "AVG_SALARY"
FROM EMPLOYEES
GROUP BY DEP_ID
ORDER BY AVG_SALARY;
```

▼ Output



5. Problem:

> *In SQL problem 4 (Exercise 3 Problem 4), limit the result to departments with fewer than 4 employees.*

▼ Hint

> Use HAVING after the GROUP BY, and use the count() function in the HAVING clause instead of the column label.

▼ Solution

```
SELECT DEP_ID, COUNT(*) AS "NUM_EMPLOYEES", AVG(SALARY) AS "AVG_SALARY"
FROM EMPLOYEES
GROUP BY DEP_ID
HAVING count(*) < 4
ORDER BY AVG_SALARY;
```

▼ Output

```
select DEP_ID, COUNT(*) AS "NUM_EMPLOYEES", AVG(SALARY) AS "AVG_SALARY"
from EMPLOYEES
group by DEP_ID
having count(*) < 4
order by AVG_SALARY;
```

d scripts Result

by status: Result set Log

Delete All

DEP_ID	NUM_EMPLOYEES	
7	3	66666.6666666
2	3	86666.6666666

Total rows: 2

Solution Script

If you would like to run all the solution queries of the SQL problems of this lab with a script, download the script below. Upload the script to the Db2 console and run. Follow Hands-on Lab : Create tables using SQL scripts and Load data into tables on how to upload a script to Db2 console and run it.

- StringPattern-Sorting-Grouping_Solution_Script.sql

Congratulations! You have completed this lab, and you are ready for the next topic.

Author(s)

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Other Contributor(s)

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Changelog

Date	Version	Changed by	Change Description
2020-12-24	2.1	Steve Ryan	ID Reviewed
2020-12-08	2.0	Sandip Saha Joy	Created revised version from DB0201EN
2020	1.0	Rav Ahuja	Created initial version