LAB: String Patterns, Sorting & Grouping

Effort: 30 mins

The practice problems for this Lab will provide hands on experience with string patterns, sorting result sets and grouping result sets. You will also learn how to run SQL scripts to create several tables at once, as well as how to load data into tables from .csv files.

HR Database

We will be working on a sample HR database for this Lab. 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

To complete this lab you will utilize Db2 database service on IBM Cloud as you did for the previous lab. There are three parts to this lab:

I. Creating tables

II. Loading data into tables

III.Composing and running queries

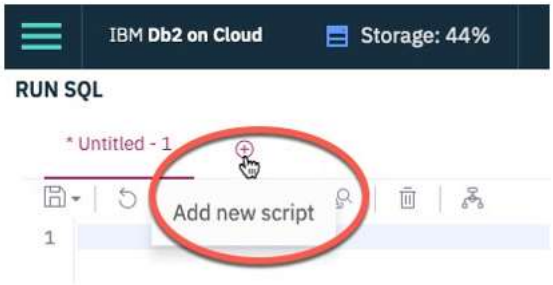
If you do not yet have access to Db2 on IBM Cloud, please refer to Lab Instructions in the Module/Week 1.

Rather than create each table manually by typing the DDL commands in the SQL editor, you will execute a script containing the create table commands for all the tables. Following step by step instructions are provided to perform this:

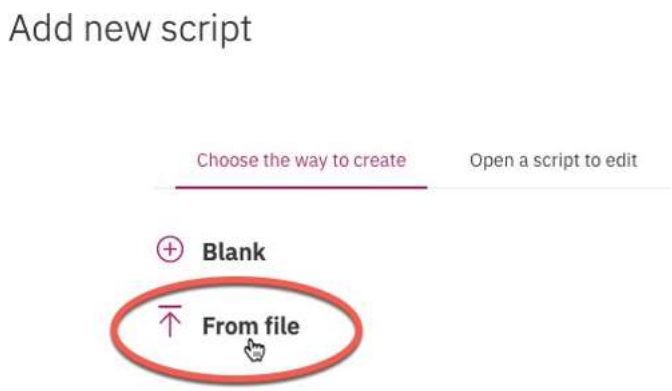
1) Download the script file **Script_Create_Tables.sql** provided on the Lab page

2) Login to IBM Cloud and go to the Resources Dashboard: https://cloud.ibm.com/resources where you can find the Db2 service that you created in a previous Lab. Click on the Db2-xx service. Next, open the Db2 Console by clicking on `Open Console` button. Go to the Run SQL page. The Run SQL tool enables you to run DDL and SQL statements.

3) Click on the `+` (Add New Script) icon



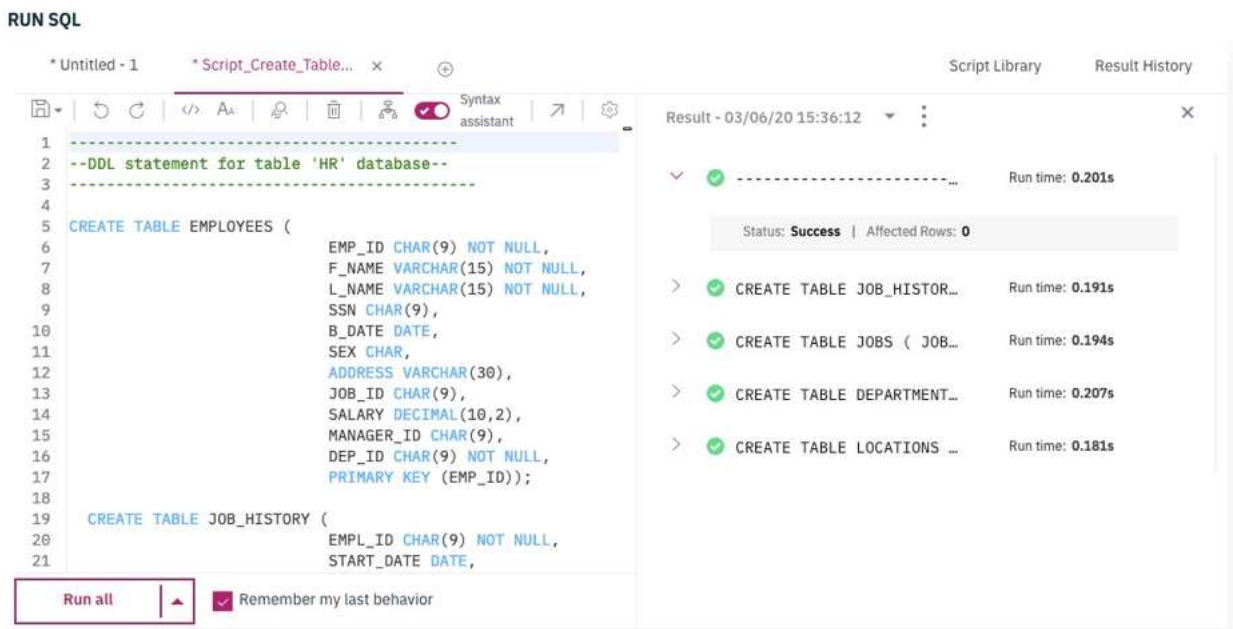
Click on `From File`



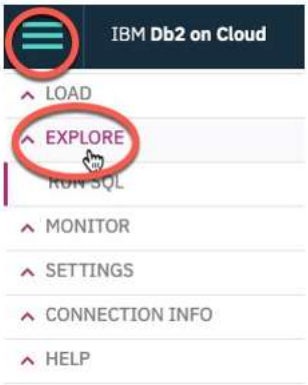
Locate the file Script_Create_Tables.sql that you downloaded to your computer earlier and open it.

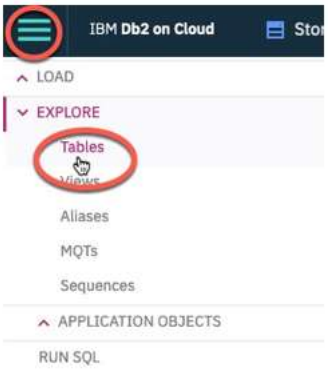
4) Once the statements are in the SQL Editor tool , you can run the queries against the database by selecting the `Run All` button.

5) On the right side of the SQL editor window you will see a Result section. Clicking on a query in the Result scetion will show the execution details of the job - whether it ran successfully, or had any errors or warnings. Ensure your queries ran successfully and created all the tables.

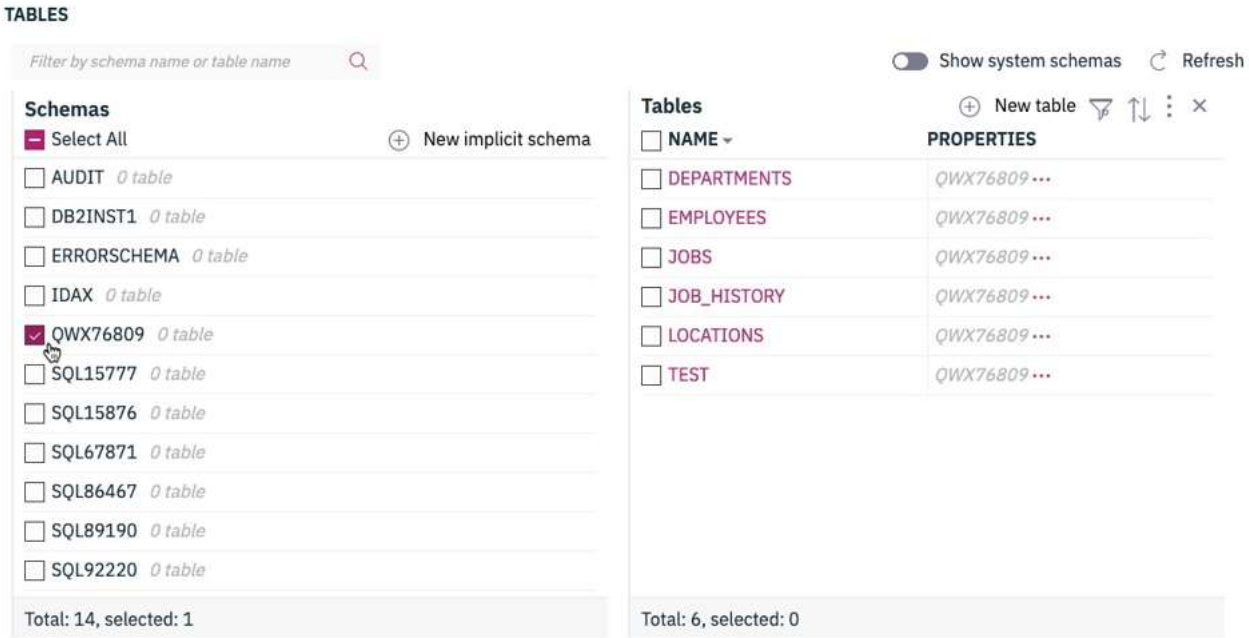


6) Now you can look at the tables you created. Navigate to the three bar menu icon, select Explore, then click on Tables.





Select the Schema corresponding to your Db2 userid. It is typically starts with 3 letters (not SQL) followed by 5 numbers (but will be different from the **QWX76809** example below). Then on the right side of the screen you should see the 5 newly created tables listed – DEPARTMENTS, EMPLOYEES, JOBS, JOB_HISTORY, and LOCATIONS (plus any other tables you may have created in previous labs e.g. INSTRUCTOR, TEST, etc.).



Click on any of the tables and you will see its SCHEMA definition (that is list of columns, their data types, etc).

Part II: LOADING DATA

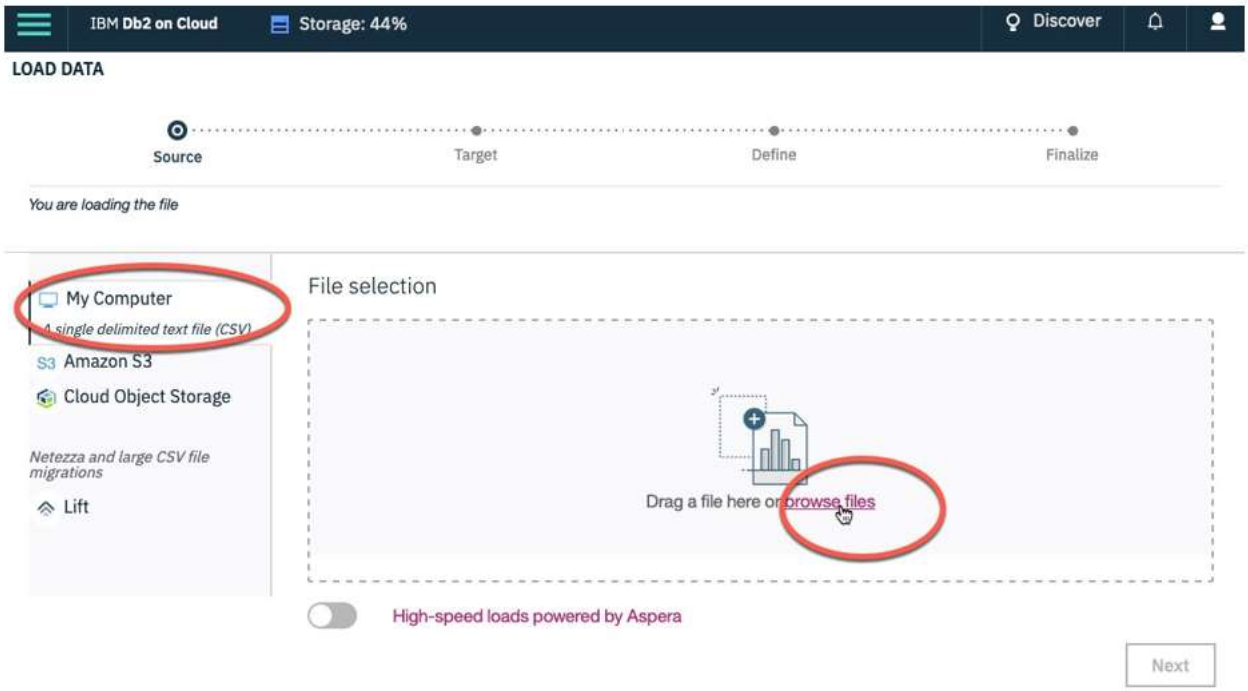
Now let us see how data can be loaded into Db2. We could manually insert each row into the table one by one but that would take a long time. Instead, Db2 (and almost every other database) allows you to Load data from .CSV files.

Please follow the steps below which explains the process of loading data into the tables we created earlier.

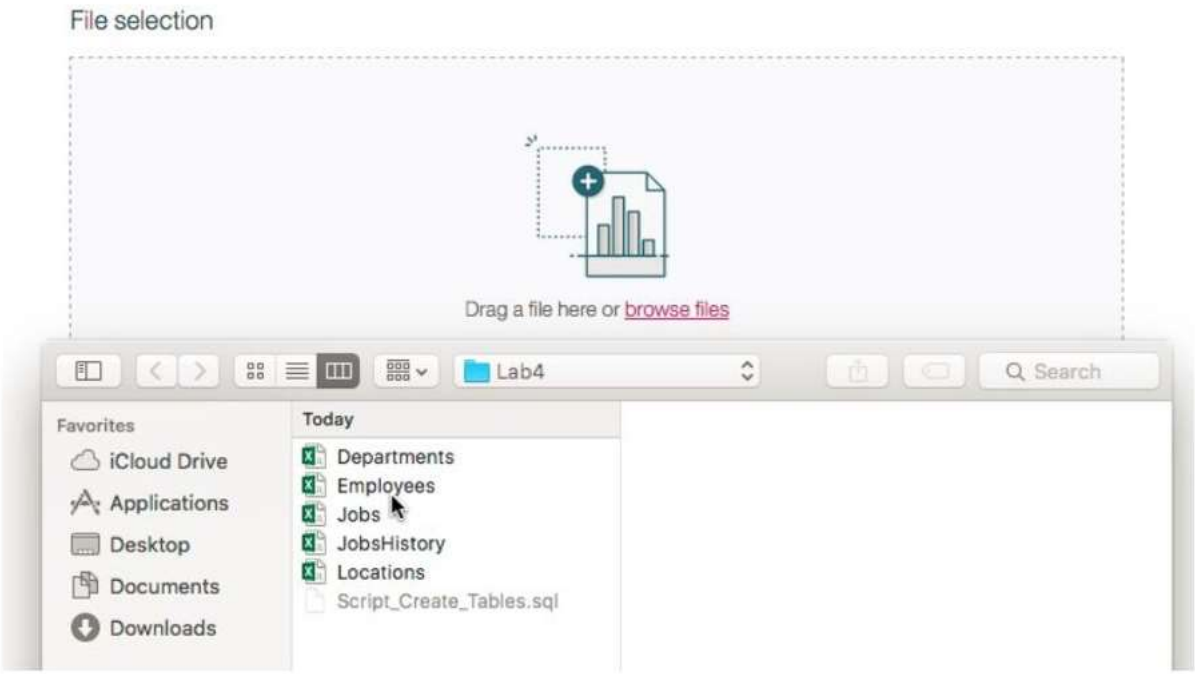
1) Download the 5 required data source files from the lab page in the course:
(Employees.csv,Departments.csv,Jobs.csv,JobsHistory.csv,Locations.csv) to your computer:

2) First let us learn how to load data into the Employees table that we created earlier. From the 3 bar menu icon, select Load then Load Data:

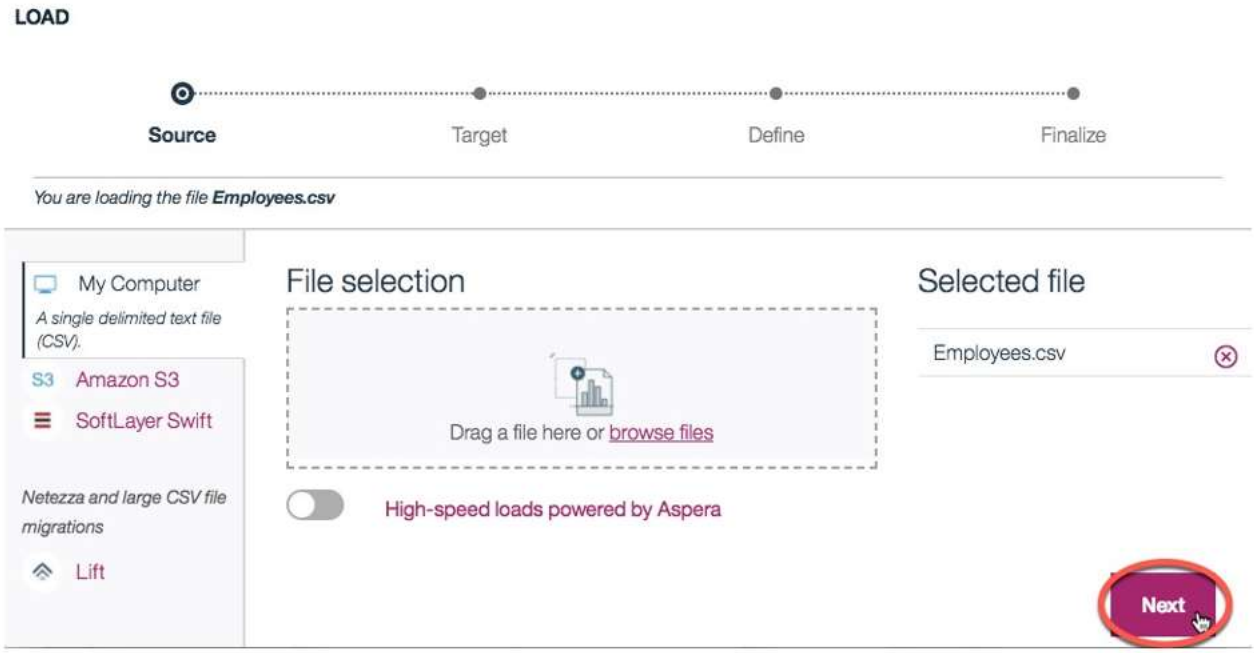
On the Load page that opens ensure My Computer is selected as the source. Click on the browse files link.



3) Choose the file `Emloyees.csv` that you downloaded to your computer and click Open.

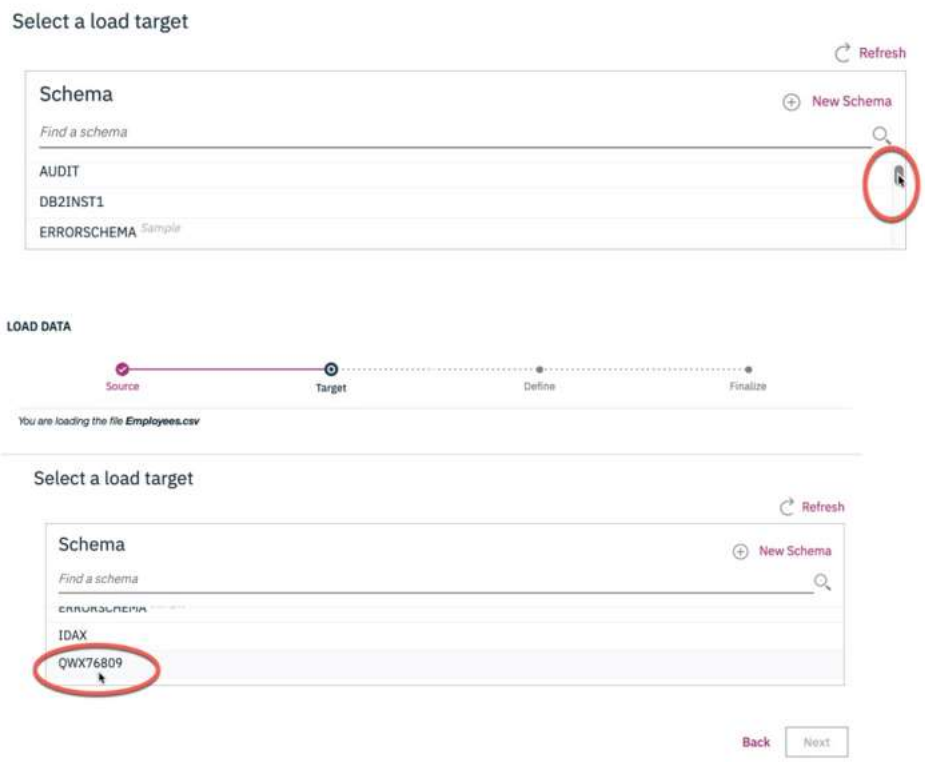


4) Once the File is selected click Next in the bottom right corner.

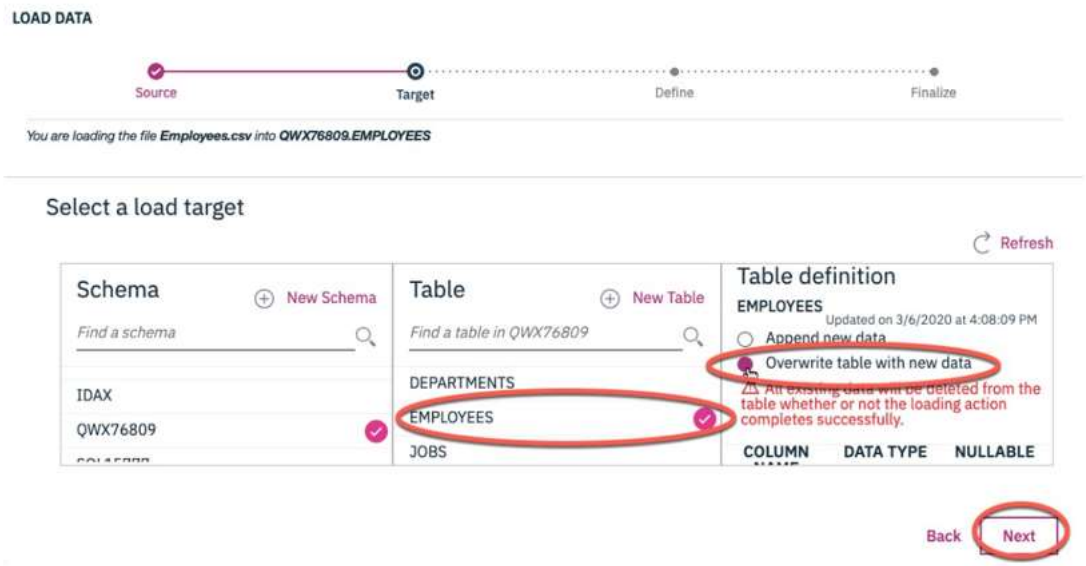


5) Select the schema for your Db2 Userid.

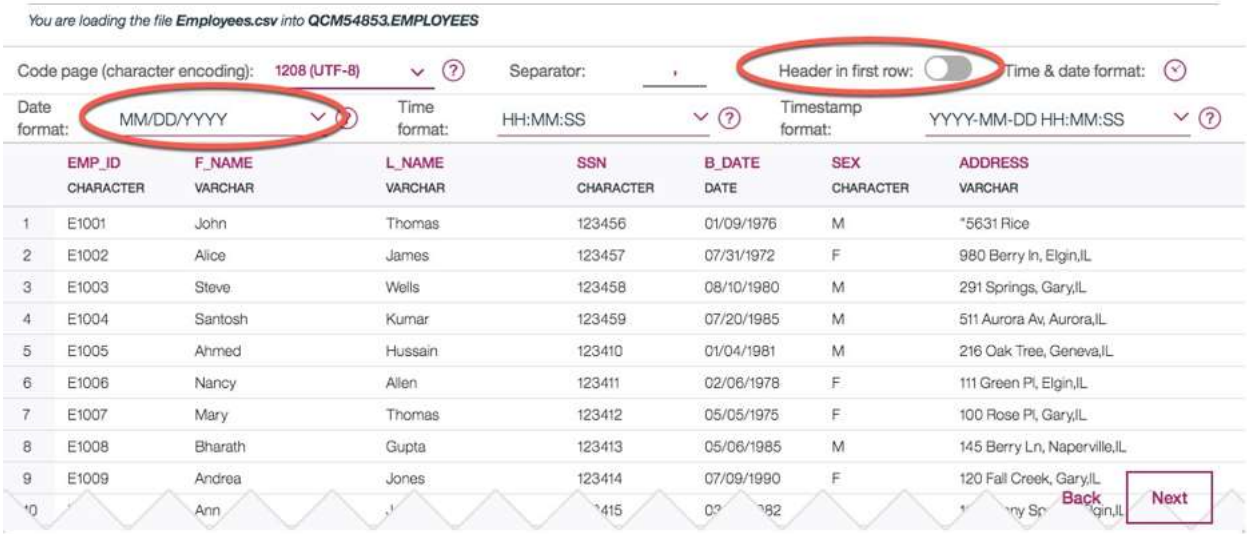
NOTE: if you only see 2-3 schemas and not your Db2 schema then scroll down in that list till you see the desired one in which you previously created the tables.



It will show all the tables that have been created in this Schema previously, including the Employees table. Select the EMPLOYEES table, and choose Overwrite table with new data then click `Next`.

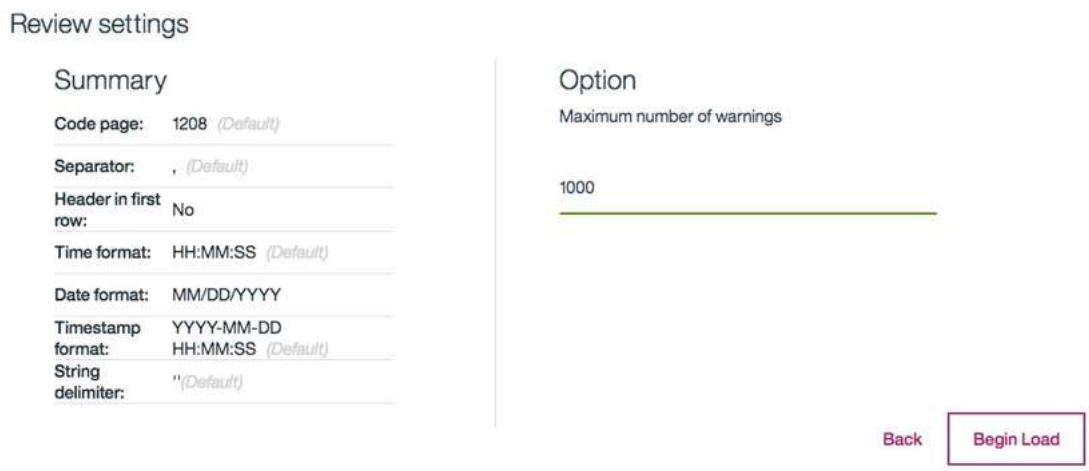


6) Since our source data files do not contain any rows with column labels, turn off the setting for Header in first row. Also, click on the down arrow next to Date format and choose `MM/DD/YYYY` since that is how the date is formatted in our source file.

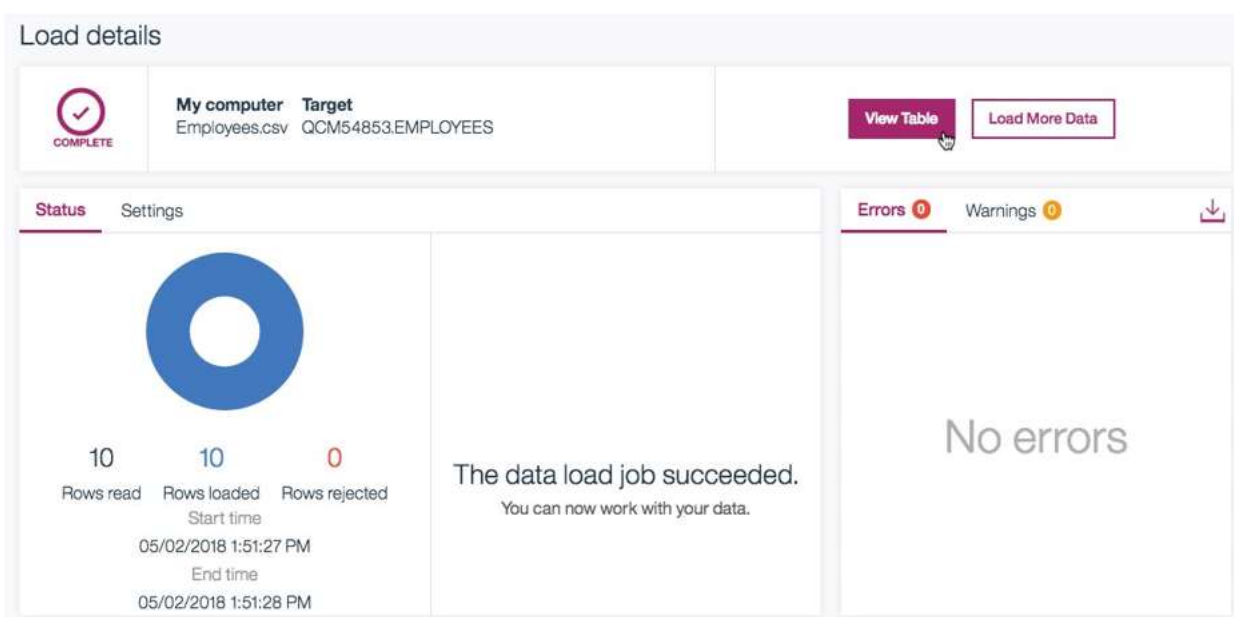


	EMP_ID CHARACTER	F_NAME VARCHAR	L_NAME VARCHAR	SSN CHARACTER	B_DATE DATE	SEX CHARACTER	ADDRESS VARCHAR
1	E1001	John	Thomas	123456	01/09/1976	M	*5631 Rice
2	E1002	Alice	James	123457	07/31/1972	F	980 Berry ln, Elgin,IL
3	E1003	Steve	Wells	123458	08/10/1980	M	291 Springs, Gary,IL
4	E1004	Santosh	Kumar	123459	07/20/1985	M	511 Aurora Av, Aurora,IL
5	E1005	Ahmed	Hussain	123410	01/04/1981	M	216 Oak Tree, Geneva,IL
6	E1006	Nancy	Allen	123411	02/06/1978	F	111 Green Pl, Elgin,IL
7	E1007	Mary	Thomas	123412	05/05/1975	F	100 Rose Pl, Gary,IL
8	E1008	Bharath	Gupta	123413	05/06/1985	M	145 Berry Ln, Naperville,IL
9	E1009	Andrea	Jones	123414	07/09/1990	F	120 Fall Creek, Gary,IL
10		Ann		415			

7) Click `Next`. Review the Load setting and click `Begin Load` in the top-right corner.



8) After Loading is complete you will notice that we were successful in loading all 10 rows of the Employees table. If there are any Errors or Warnings you can view them on this screen.



9) You can see the data that was loaded by clicking on the View Table. Alternatively you can go into the Explore page and page select the correct schema, then the EMPLOYEES table, and click `View Data`.

QCM54853.EMPLOYEES

Delete Table Export to CSV

	EMP_ID CHARACTER(9)	F_NAME VARCHAR(15)	L_NAME VARCHAR(15)	SSN CHARACTER(9)	B_DATE DATE	SEX CHARACTER(1)	ADDRESS VARCHAR(30)	JOB_ID CHARACTER(9)
1	E1001	John	Thomas	123456	1976-01-09	M	5631 Rice, OakPark,	100
2	E1002	Alice	James	123457	1972-07-31	F	980 Berry ln, Elgin,IL	200
3	E1003	Steve	Wells	123458	1980-08-10	M	291 Springs, Gary,IL	300
4	E1004	Santosh	Kumar	123459	1985-07-20	M	511 Aurora Av, Aurora	400
5	E1005	Ahmed	Hussain	123410	1981-01-04	M	216 Oak Tree, Geneva	500
6	E1006	Nancy	Allen	123411	1978-02-06	F	111 Green Pl, Elgin,IL	600
7	E1007	Mary	Thomas	123412	1975-05-05	F	100 Rose Pl, Gary,IL	650
8	E1008	Bharath	Gupta	123413	1985-05-06	M	145 Berry Ln, Naper	660
9	E1009	Andrea	Jones	123414	1990-07-09	F	120 Fall Creek, Gary,	234
10	E1010	Ann	Jacob	123415	1982-03-30	F	111 Britany Springs,E	220

10) Now its your turn to load the remaining 4 tables of the HR database – Locations, JobHistory, Jobs, and Departments. Please follow the steps above to load the data from the remaining source files.

Question 1: Were there any warnings loading data into the JOBS table? What can be done to resolve this?

Hint: View the data loaded into this table and pay close attention to the JOB_TITLE column.

Question 2: Did all rows from the source file load successfully in the DEPARTMENT table? If not, are you able to figure out why not?

Hint: Look at the warning. Also, note the Primary Key for this table.

Part III: COMPOSING AND RUNNING QUERIES

You created the tables for the HR database schema and also learned how to load data into these tables. Now try and work on a few advanced DML queries that were introduced in this module.

Follow these steps to create and run the queries indicated below

1) Navigate to the Run SQL tool in Db2 on Cloud

2) Compose query and run it.

3) Check the Logs created under the Results section. Looking at the contents of the Log explains whether the SQL statement ran successfully. Also look at the query results to ensure the output is what you expected.

Query 1: Retrieve all employees whose address is in Elgin,IL

Hint: Use the LIKE operator to find similar strings

Query 2: Retrieve all employees who were born during the 1970's.

Hint: Use the LIKE operator to find similar strings

Query 3: Retrieve all employees in department 5 whose salary is between 60000 and 70000 .

Hint: Use the keyword BETWEEN for this query

Query 4A: Retrieve a list of employees ordered by department ID.

Hint: Use the ORDER BY clause for this query

Query 4B: Retrieve a list of employees ordered in descending order by department ID and within each department ordered alphabetically in descending order by last name.

Query 5A: 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

Query 5B: For each department retrieve the number of employees in the department, and the average employees 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

Query 5C: Label the computed columns in the result set of Query 5B as `NUM_EMPLOYEES` and `AVG_SALARY`.

Hint: Use AS "LABEL_NAME" after the column name

Query 5D: In Query 5C order the result set by Average Salary.

Hint: Use ORDER BY after the GROUP BY

Query 5E: In Query 5D 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.

Note: WHERE clause is used for filtering the entire result set whereas the HAVING clause is used for filtering the result of the grouping

BONUS Query 6: Similar to 4B but instead of department ID use department name. 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 one out ... we'll cover working with multiple tables in the next lesson.

In this lab you learned how to work with string patterns, sorting result sets and grouping result sets.

Thank you for completing this lab! See solutions on the following page

Lab Solutions

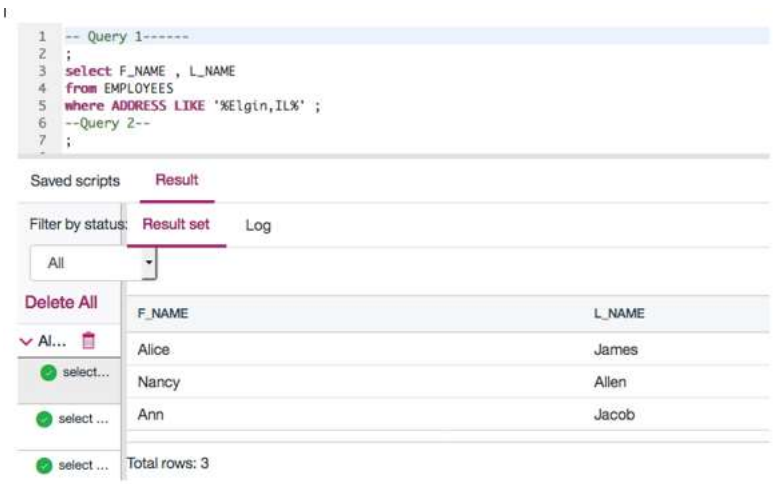
Please follow these steps to get the answers to the queries:

1) Navigate to the Run SQL page on Db2 on Cloud.

2) Download the script file(Module4_Queries.txt) or text files(Modules4_Queries.sql). Open the file with extension .sql in the editor

3) Run the queries. Looking at the contents of the Log explains that the SQL statement that we ran was successful. Here are the results for the queries:

Query 1: Output



Query 2: Output

RUN SQL

Run Script Edit Favorites New tab

```
--Query 2--
;
select F_NAME , L_NAME
from EMPLOYEES
where B_DATE LIKE '197%' ;
---Query3--
;
```

Saved scripts Result

Filter by status: Result set Log

All

Delete All

Al...

select ...

select...

select ...

select ...

F_NAME	L_NAME
John	Thomas
Alice	James
Nancy	Allen
Mary	Thomas

Total rows: 4

Query 3: Output

```
---Query3--
;
select *
from EMPLOYEES
where (SALARY BETWEEN 60000 and 70000)  and DEP_ID = 5 ;
--Query4--
;
```

Saved scripts Result

Filter by status: Result set Log

All

Delete All

All(5)...

select F_...

select F_...

select * f...

EMP_ID	F_NAME	L_NAME	SSN	B_DATE	SEX	ADDRESS	JOB_ID	SALARY	MANAGER_ID	DEP_ID
E1004	Santosh	Kumar	1234...	1985-07-20	M	511 Aurora ...	400	60000.00	30004	5
E1010	Ann	Jacob	12341...	1982-03-30	F	111 Britany ...	220	70000.00	30004	5

Total rows: 2

Query 4A: 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

Query 4B: Output

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

Saved scripts | Result

Filter by status: | Result set | Log

All

Delete All

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

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

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

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

All(1)...

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

Query 5A: Output

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

ved scripts | Result

er by status: | Result set | Log

All

lete All

l... select...

l... select ...

DEP_ID	2
2	3
5	4
7	3

Total rows: 3

Query 5B: Output

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

Saved scripts | Result

Filter by stat | Result set | Log

All

Delete All

Al

sel...

DEP_ID	2	3
2	3	86666.66666666666666666666666
5	4	65000.00000000000000000000000
7	3	66666.66666666666666666666666

Total rows: 3

Query 5C: Output

```
select DEP_ID, COUNT(*) AS "NUM_EMPLOYEES", AVG(SALARY) AS "AVG_SALARY"
from EMPLOYEES
group by DEP_ID;
```

ed scripts | Result

r by status: | Result set | Log

ll

ete All

select...

select ...

DEP_ID	NUM_EMPLOYEES	AVG_SALARY
2	3	86666.66666666666666666666666
5	4	65000.00000000000000000000000
7	3	66666.66666666666666666666666

Total rows: 3

Query 5D: Output

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

ed scripts | Result

r by status: | Result set | Log

ll

ete All

select...

select ...

DEP_ID	NUM_EMPLOYEES	AVG_SALARY
5	4	65000.00000000000000000000000
7	3	66666.66666666666666666666666
2	3	86666.66666666666666666666666

Total rows: 3

Query 5E: 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

select DEP_...

elect DEP_I...

DEP_ID	NUM_EMPLOYEES	
7	3	66666.6666666
2	3	86666.6666666

Total rows: 2

BONUS Query 6: Output

Note that in the Query below `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`.

```
--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: Result set Log

All

Delete All

All(5)...

select F_...

select F_...

select * fr...

select D...

select DE...

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

Author(s)

Rav Ahuja

Change log

Date	Version	Changed by	Change Description
2020-10-21	2.0	Malika Singla	Migrated Lab to Markdown and added to course repo in GitLab

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