DB0201EN-Week3-1-3-SQLmagic_SQlite

February 11, 2023

1 Accessing Databases with SQL Magic

Estimated time needed: **15** minutes

1.1 Objectives

After completing this lab you will be able to:

- Perform simplified database access using SQL "magic"

To communicate with SQL Databases from within a JupyterLab notebook, we can use the SQL "magic" provided by the ipython-sql **extension. "Magic" is JupyterLab's term for special commands that start with "%". Below, we'll use the** *load_ext* **magic to load the ipython-sql extension. In the lab environemnt provided in the course the ipython-sql extension is already installed and so is the ibm_db_sa driver.**

```
[1]: %load_ext sql
```

Here you will be creating and connecting to a new SQlite database SQLiteMagic.

The syntax for connecting to magic sql using sqllite is   %sql sqlite://DatabaseName

where DatabaseName will be your **.db** file

```
[2]: import csv, sqlite3

con = sqlite3.connect("SQLiteMagic.db")
cur = con.cursor()
```

```
[3]: %load_ext sql
```

```
The sql extension is already loaded. To reload it, use:
  %reload_ext sql
```

```
[4]: %sql sqlite:///SQLiteMagic.db
```

```
[4]: 'Connected: @SQLiteMagic.db'
```

For convenience, we can use %%sql (two %'s instead of one) at the top of a cell to indicate we want the entire cell to be treated as **SQL**. Let's use this to create a table and fill it with some test data for experimenting.

[5]:
```sql
%%sql

CREATE TABLE INTERNATIONAL_STUDENT_TEST_SCORES (
        country VARCHAR(50),
        first_name VARCHAR(50),
        last_name VARCHAR(50),
        test_score INT
);
INSERT INTO INTERNATIONAL_STUDENT_TEST_SCORES (country, first_name, last_name,
 ↪test_score)
VALUES
('United States', 'Marshall', 'Bernadot', 54),
('Ghana', 'Celinda', 'Malkin', 51),
('Ukraine', 'Guillermo', 'Furze', 53),
('Greece', 'Aharon', 'Tunnow', 48),
('Russia', 'Bail', 'Goodwin', 46),
('Poland', 'Cole', 'Winteringham', 49),
('Sweden', 'Emlyn', 'Erricker', 55),
('Russia', 'Cathee', 'Sivewright', 49),
('China', 'Barny', 'Ingerson', 57),
('Uganda', 'Sharla', 'Papaccio', 55),
('China', 'Stella', 'Youens', 51),
('Poland', 'Julio', 'Buesden', 48),
('United States', 'Tiffie', 'Cosely', 58),
('Poland', 'Auroora', 'Stiffell', 45),
('China', 'Clarita', 'Huet', 52),
('Poland', 'Shannon', 'Goulden', 45),
('Philippines', 'Emylee', 'Privost', 50),
('France', 'Madelina', 'Burk', 49),
('China', 'Saunderson', 'Root', 58),
('Indonesia', 'Bo', 'Waring', 55),
('China', 'Hollis', 'Domotor', 45),
('Russia', 'Robbie', 'Collip', 46),
('Philippines', 'Davon', 'Donisi', 46),
('China', 'Cristabel', 'Radeliffe', 48),
('China', 'Wallis', 'Bartleet', 58),
('Moldova', 'Arleen', 'Stailey', 38),
('Ireland', 'Mendel', 'Grumble', 58),
('China', 'Sallyann', 'Exley', 51),
('Mexico', 'Kain', 'Swaite', 46),
('Indonesia', 'Alonso', 'Bulteel', 45),
('Armenia', 'Anatol', 'Tankus', 51),
('Indonesia', 'Coralyn', 'Dawkins', 48),
('China', 'Deanne', 'Edwinson', 45),
```

```
('China', 'Georgiana', 'Epple', 51),
('Portugal', 'Bartlet', 'Breese', 56),
('Azerbaijan', 'Idalina', 'Lukash', 50),
('France', 'Livvie', 'Flory', 54),
('Malaysia', 'Nonie', 'Borit', 48),
('Indonesia', 'Clio', 'Mugg', 47),
('Brazil', 'Westley', 'Measor', 48),
('Philippines', 'Katrinka', 'Sibbert', 51),
('Poland', 'Valentia', 'Mounch', 50),
('Norway', 'Sheilah', 'Hedditch', 53),
('Papua New Guinea', 'Itch', 'Jubb', 50),
('Latvia', 'Stesha', 'Garnson', 53),
('Canada', 'Cristionna', 'Wadmore', 46),
('China', 'Lianna', 'Gatward', 43),
('Guatemala', 'Tanney', 'Vials', 48),
('France', 'Alma', 'Zavittieri', 44),
('China', 'Alvira', 'Tamas', 50),
('United States', 'Shanon', 'Peres', 45),
('Sweden', 'Maisey', 'Lynas', 53),
('Indonesia', 'Kip', 'Hothersall', 46),
('China', 'Cash', 'Landis', 48),
('Panama', 'Kennith', 'Digance', 45),
('China', 'Ulberto', 'Riggeard', 48),
('Switzerland', 'Judy', 'Gilligan', 49),
('Philippines', 'Tod', 'Trevaskus', 52),
('Brazil', 'Herold', 'Heggs', 44),
('Latvia', 'Verney', 'Note', 50),
('Poland', 'Temp', 'Ribey', 50),
('China', 'Conroy', 'Egdal', 48),
('Japan', 'Gabie', 'Alessandone', 47),
('Ukraine', 'Devlen', 'Chaperlin', 54),
('France', 'Babbette', 'Turner', 51),
('Czech Republic', 'Virgil', 'Scotney', 52),
('Tajikistan', 'Zorina', 'Bedow', 49),
('China', 'Aidan', 'Rudeyeard', 50),
('Ireland', 'Saunder', 'MacLice', 48),
('France', 'Waly', 'Brunstan', 53),
('China', 'Gisele', 'Enns', 52),
('Peru', 'Mina', 'Winchester', 48),
('Japan', 'Torie', 'MacShirrie', 50),
('Russia', 'Benjamen', 'Kenford', 51),
('China', 'Etan', 'Burn', 53),
('Russia', 'Merralee', 'Chaperlin', 38),
('Indonesia', 'Lanny', 'Malam', 49),
('Canada', 'Wilhelm', 'Deeprose', 54),
('Czech Republic', 'Lari', 'Hillhouse', 48),
('China', 'Ossie', 'Woodley', 52),
```

```
('Macedonia', 'April', 'Tyer', 50),
('Vietnam', 'Madelon', 'Dansey', 53),
('Ukraine', 'Korella', 'McNamee', 52),
('Jamaica', 'Linnea', 'Cannam', 43),
('China', 'Mart', 'Coling', 52),
('Indonesia', 'Marna', 'Causbey', 47),
('China', 'Berni', 'Daintier', 55),
('Poland', 'Cynthia', 'Hassell', 49),
('Canada', 'Carma', 'Schule', 49),
('Indonesia', 'Malia', 'Blight', 48),
('China', 'Paulo', 'Seivertsen', 47),
('Niger', 'Kaylee', 'Hearley', 54),
('Japan', 'Maure', 'Jandak', 46),
('Argentina', 'Foss', 'Feavers', 45),
('Venezuela', 'Ron', 'Leggitt', 60),
('Russia', 'Flint', 'Gokes', 40),
('China', 'Linet', 'Conelly', 52),
('Philippines', 'Nikolas', 'Birtwell', 57),
('Australia', 'Eduard', 'Leipelt', 53)
```

```
 * sqlite:///SQLiteMagic.db
Done.
99 rows affected.
```

[5]: []

Using Python Variables in your SQL Statements

You can use python variables in your SQL statements by adding a ":" prefix to your python variable names.

For example, if I have a python variable country with a value of "Canada", I can use this variable in a SQL query to find all the rows of students from Canada.

[6]:
```
country = "Canada"
%sql select * from INTERNATIONAL_STUDENT_TEST_SCORES where country = :country
```

```
 * sqlite:///SQLiteMagic.db
Done.
```

[6]:
```
[('Canada', 'Cristionna', 'Wadmore', 46),
 ('Canada', 'Wilhelm', 'Deeprose', 54),
 ('Canada', 'Carma', 'Schule', 49)]
```

Assigning the Results of Queries to Python Variables

You can use the normal python assignment syntax to assign the results of your queries to python variables.

For example, I have a SQL query to retrieve the distribution of test scores (i.e. how many students got each score). I can assign the result of this query to the variable `test_score_distribution` using the = operator.

```
[7]: test_score_distribution = %sql SELECT test_score as "Test_Score", count(*) as
     ↪"Frequency" from INTERNATIONAL_STUDENT_TEST_SCORES GROUP BY test_score;
     test_score_distribution
```

```
     * sqlite:///SQLiteMagic.db
    Done.
```

```
[7]: [(38, 2),
     (40, 1),
     (43, 2),
     (44, 2),
     (45, 8),
     (46, 7),
     (47, 4),
     (48, 14),
     (49, 8),
     (50, 10),
     (51, 8),
     (52, 8),
     (53, 8),
     (54, 5),
     (55, 4),
     (56, 1),
     (57, 2),
     (58, 4),
     (60, 1)]
```

Converting Query Results to DataFrames

You can easily convert a SQL query result to a pandas dataframe using the `DataFrame()` method. Dataframe objects are much more versatile than SQL query result objects. For example, we can easily graph our test score distribution after converting to a dataframe.

```
[8]: dataframe = test_score_distribution.DataFrame()

     %matplotlib inline
     # uncomment the following line if you get an module error saying seaborn not
     ↪found
     # !pip install seaborn==0.9.0
     import seaborn
```

```
plot = seaborn.barplot(x='Test_Score',y='Frequency', data=dataframe)
```
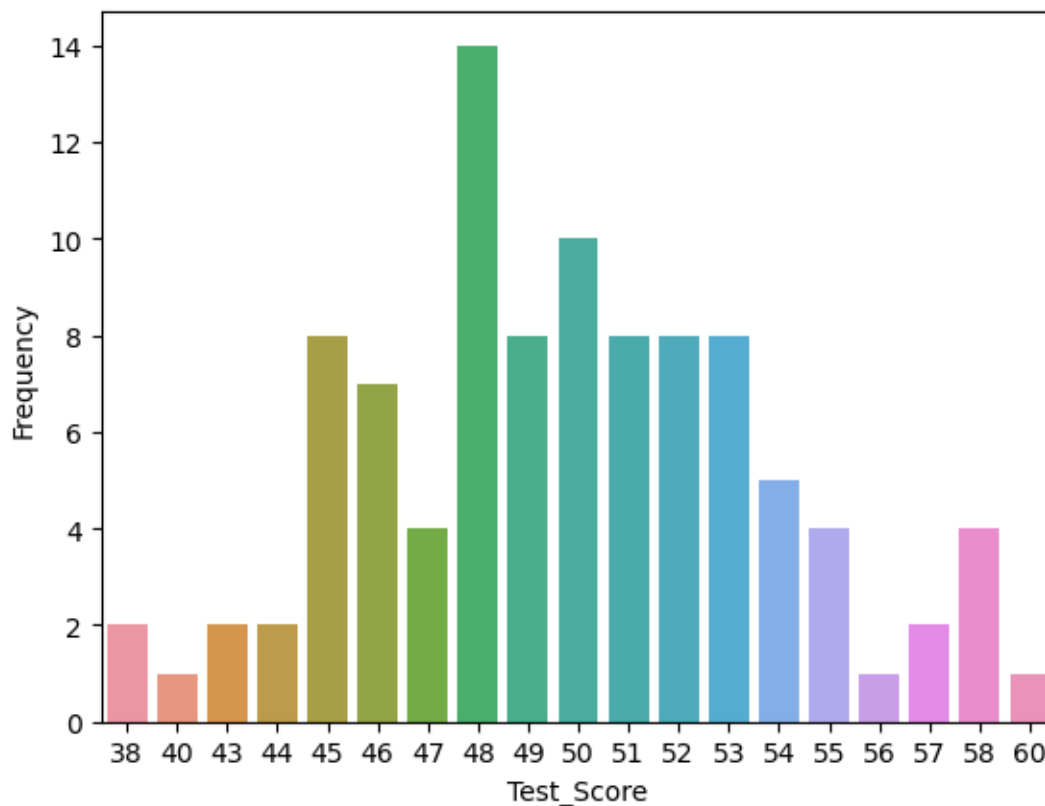

Now you know how to work with Db2 from within JupyterLab notebooks using SQL "magic"!

[9]:
```
%%sql

-- Feel free to experiment with the data set provided in this notebook for
  ↪practice:
SELECT country, first_name, last_name, test_score FROM
  ↪INTERNATIONAL_STUDENT_TEST_SCORES;
```

 * sqlite:///SQLiteMagic.db
Done.

[9]: [('United States', 'Marshall', 'Bernadot', 54),
  ('Ghana', 'Celinda', 'Malkin', 51),
  ('Ukraine', 'Guillermo', 'Furze', 53),
  ('Greece', 'Aharon', 'Tunnow', 48),
  ('Russia', 'Bail', 'Goodwin', 46),
  ('Poland', 'Cole', 'Winteringham', 49),

```

```
('Sweden', 'Emlyn', 'Erricker', 55),
('Russia', 'Cathee', 'Sivewright', 49),
('China', 'Barny', 'Ingerson', 57),
('Uganda', 'Sharla', 'Papaccio', 55),
('China', 'Stella', 'Youens', 51),
('Poland', 'Julio', 'Buesden', 48),
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('Poland', 'Auroora', 'Stiffell', 45),
('China', 'Clarita', 'Huet', 52),
('Poland', 'Shannon', 'Goulden', 45),
('Philippines', 'Emylee', 'Privost', 50),
('France', 'Madelina', 'Burk', 49),
('China', 'Saunderson', 'Root', 58),
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('Armenia', 'Anatol', 'Tankus', 51),
('Indonesia', 'Coralyn', 'Dawkins', 48),
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('Azerbaijan', 'Idalina', 'Lukash', 50),
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('Papua New Guinea', 'Itch', 'Jubb', 50),
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('Indonesia', 'Kip', 'Hothersall', 46),
```

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('Panama', 'Kennith', 'Digance', 45),
('China', 'Ulberto', 'Riggeard', 48),
('Switzerland', 'Judy', 'Gilligan', 49),
('Philippines', 'Tod', 'Trevaskus', 52),
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('Peru', 'Mina', 'Winchester', 48),
('Japan', 'Torie', 'MacShirrie', 50),
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('China', 'Ossie', 'Woodley', 52),
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('Vietnam', 'Madelon', 'Dansey', 53),
('Ukraine', 'Korella', 'McNamee', 52),
('Jamaica', 'Linnea', 'Cannam', 43),
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('Indonesia', 'Malia', 'Blight', 48),
('China', 'Paulo', 'Seivertsen', 47),
('Niger', 'Kaylee', 'Hearley', 54),
('Japan', 'Maure', 'Jandak', 46),
('Argentina', 'Foss', 'Feavers', 45),
('Venezuela', 'Ron', 'Leggitt', 60),
('Russia', 'Flint', 'Gokes', 40),
('China', 'Linet', 'Conelly', 52),
('Philippines', 'Nikolas', 'Birtwell', 57),
('Australia', 'Eduard', 'Leipelt', 53)]
```

1.2 Author

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1.3 Other Contributor(s)

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1.4 Change Log

Date (YYYY-MM-DD)	Version	Changed By	Change Description
2022-03-04	1.0	Lakshmi Holla	Created lab using sqlite3

##