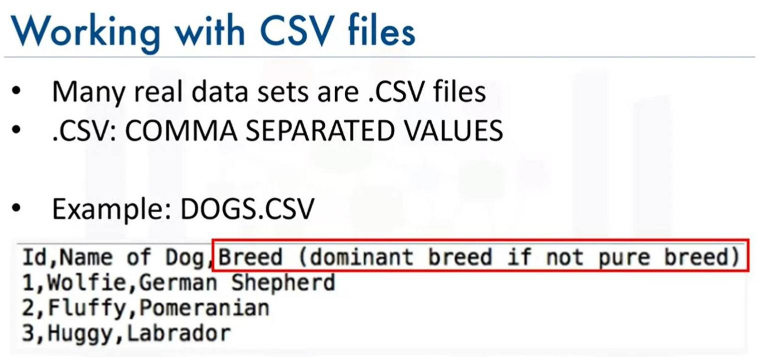
Module 5 - Working with real-world data sets and built-in SQL functions

In this assignment, you will be working with multiple real world datasets for the city of Chicago. You will be asked questions that will help you understand the data just as you would in the real wold. You will be assessed on the correctness of your SQL queries and results.

Learning Objectives

- Demonstrate effective use of formulating SQL queries
- Demonstrate skill in retrieving SQL query results and analyzing data
- Demonstrate use of invoking SQL queries from Jupyter notebooks using Python

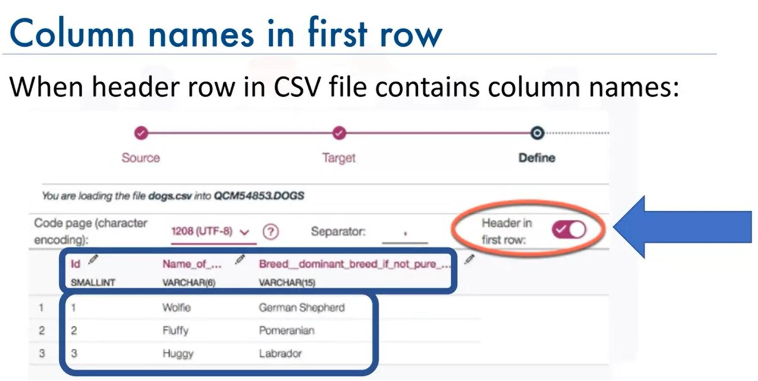
1. Working with Real World Datasets



Working with CSV files

- Many real data sets are .CSV files
- .CSV: COMMA SEPARATED VALUES
- Example: DOGS.CSV

```
Id,Name of Dog,Breed (dominant breed if not pure breed)
1,Wolfie,German Shepherd
2,Fluffy,Pomeranian
3,Huggy,Labrador
```



Column names in first row

When header row in CSV file contains column names:

You are loading the file dogs.csv into QCM54853.DOGS

Code page (character encoding): 1208 (UTF-8)   Separator: ,   Header in first row: ●

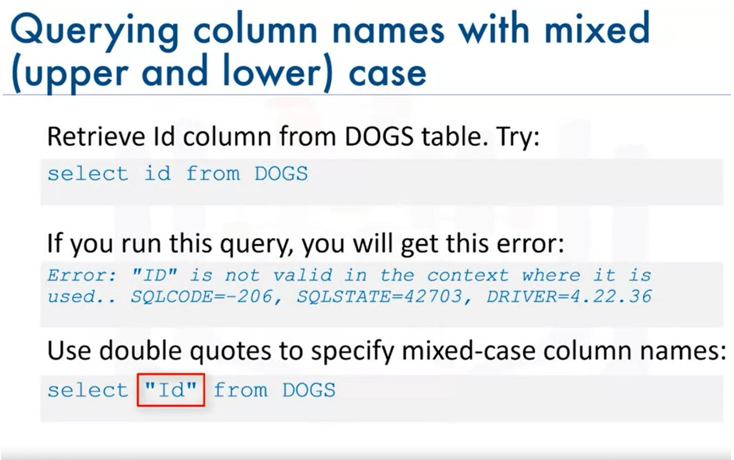
Id SMALLINT	Name_of_... VARCHAR(6)	Breed_dominant_breed_if_not_pure_... VARCHAR(15)
1	Wolfie	German Shepherd
2	Fluffy	Pomeranian
3	Huggy	Labrador

In this video, we'll give you a few hints and tips for working with Real World Data-sets. Many of the real world data sets are made available as .CSV files. These are text files which contain data values typically separated by commas. In some cases, a different separator such as a semicolon may be used.

For this video, we will use an example of a file called DOGS.CSV. Although this is a fictional data set that contains names of dogs and their breeds, we will use it to illustrate concepts that you will then apply to real datasets. Sample contents of the DOGS.CSV file are shown here. The first row in the table in many cases contains attribute labels which map to column names in a table. In DOGS.CSV, the first row contains the name of three attributes.

- Id is the name of the first attribute and the subsequent rows contain Id values of 1, 2, and 3.
- The name of the dog is the second attribute. In this case the dog names Wolfie, Fluffy, and Huggy are the values.
- The third attribute is called breed, either the dominant breed or pure breed name. It has values of German Shepherd, ...

As we've just seen, CSV files can have the first or a header row that contains the names of the attributes. If you're loading the data into the database using the visual load tool in the database console, ensure the header in first row is enabled. This will map the attribute names in the first row of the CSV file into column names in the database table, and the rest of the rows into the data rows in the table, as shown here. Note that the default column names may not always be database or query friendly, and if that is the case, you may want to edit them before the table is created.



Querying column names with mixed (upper and lower) case

Retrieve Id column from DOGS table. Try:

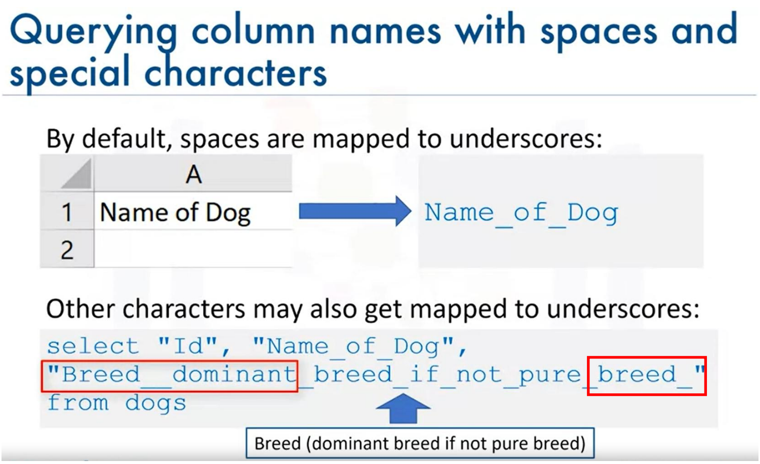
```
select id from DOGS
```

If you run this query, you will get this error:

```
Error: "ID" is not valid in the context where it is
used.. SQLCODE=-206, SQLSTATE=42703, DRIVER=4.22.36
```

Use double quotes to specify mixed-case column names:

```
select "Id" from DOGS
```



Querying column names with spaces and special characters

By default, spaces are mapped to underscores:

	A
1	Name of Dog
2	

Name_of_Dog

Other characters may also get mapped to underscores:

```
select "Id", "Name_of_Dog",
"Breed__dominant_breed_if_not_pure_breed_"
from dogs
```

Breed (dominant breed if not pure breed)

Now, let's talk about querying column names that are **lower or mixed case**, that is, a combination of upper and lowercase. Let's assume we loaded the DOGS.CSV file using the default column names from the CSV. If we try to retrieve the contents of the *Id* column using the query, select id from DOGS, we'll get an error as shown indicating the id is not valid. This is because the database parser assumes uppercase names by default. Whereas when we loaded the CSV file into the database it had the Id column name in mixed case i.e an uppercase I and a lowercase d. In this case, to select data from a column with a mixed case name, we need to specify the column name in its correct case within double quotes as follows. Select "Id" from DOGS. Ensure you use double quotes around the column name and not single quotes.

Next, we'll cover querying column names that **have spaces and other characters**. In a CSV file, if the name of the

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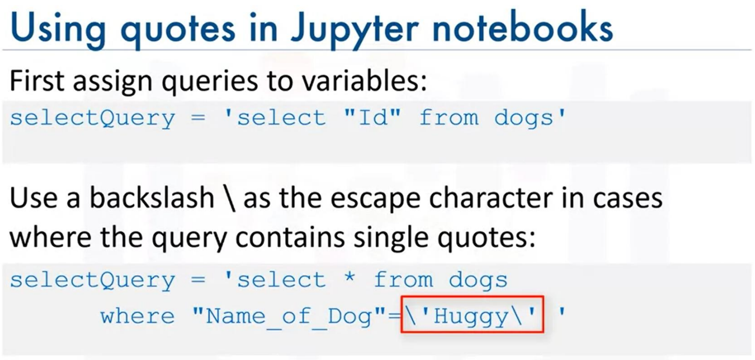
column contain spaces, by default the database may map them to underscores. For example, in the name of dog column, there are spaces in between the three words. The database may change it to Name_of_Dog.
Other special characters like parentheses or brackets may also get mapped to underscores. Therefore, when you write a query ensure you use proper case formatting within quotes and substitute special characters to underscores as shown in this example.

Select "Id," "Name_of_Dog," "Breed__dominant_breed_if_not_pure_breed_" from dogs.

Please note the underscores separating the words within double quotes. Also note the double underscore between breed and dominant as shown. Finally, it's also important to note the trailing underscore after the word breed near the end of the query. This is used in place of the closing bracket.



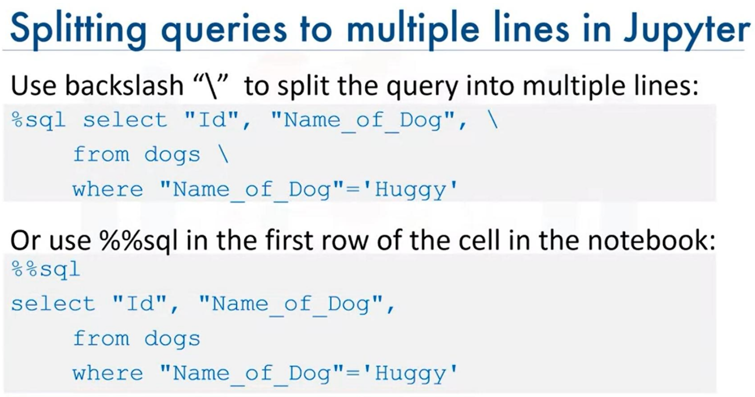
Using quotes in Jupyter notebooks

First assign queries to variables:

```
selectQuery = 'select "Id" from dogs'
```

Use a backslash \ as the escape character in cases where the query contains single quotes:

```
selectQuery = 'select * from dogs
       where "Name_of_Dog"=\'Huggy\' '
```



Splitting queries to multiple lines in Jupyter

Use backslash “\” to split the query into multiple lines:

```
%sql select "Id", "Name_of_Dog", \
     from dogs \
     where "Name_of_Dog"='Huggy'
```

Or use %%sql in the first row of the cell in the notebook:

```
%%sql
select "Id", "Name_of_Dog",
     from dogs
     where "Name_of_Dog"='Huggy'
```

When using quotes in Jupyter notebooks, you may be issuing queries in a notebook by first assigning them to Python variables. In such cases, if your query contains double quotes for example, to specify a mixed case column name, you could differentiate the quotes by using single quotes for the Python variable to enclose this SQL query and double quotes for the column names. For example, selectQuery ='select "Id" from dogs'.
Now, what if you need to specify single quotes within the query, for example, to specify a value in the where clause? In this case you can use backslash as the escape character as follows,

selectQuery = 'select * from dogs where "Name_of_Dog"=\'Huggy\' '

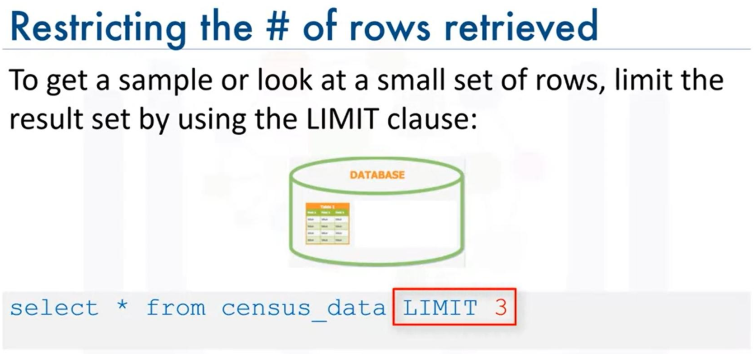
If you have very long queries such as join queries or nested queries, it may be useful to split the query into multiple lines for improved readability. In Python notebooks, you can use the backslash character to indicate continuation to the next row as shown in this example.

```
%sql select "Id," Name_of_Dog," \
   from dogs \
   where"Name_of_Dog" = 'Huggy'
```

It would be helpful at this point to take a moment to review the special characters as shown. Please keep in mind that you might get an error if you split the query into multiple lines in a Python notebook without the backslash. When using SQL magic, you can use the double percent SQL in the first line of the cell in Jupyter Notebooks. It implies that the rest of the content of the cell is to be interpreted by SQL magic. For example

```
%% sql
select "Id", "Name_of_dog",
   from dogs,
   where "Name_of_dog” = 'Huggy'
```

Again, please note the special characters as shown. When using %% sql the backslash is not needed at the end of each line.



Restricting the # of rows retrieved

To get a sample or look at a small set of rows, limit the result set by using the LIMIT clause:

```
select * from census_data LIMIT 3
```

At this point you might be asking, how would you restrict the number of rows retrieved? It's a good question because a table may contain thousands or even millions of rows, and you may only want to see some sample data or look at just a few rows to see what kind of data the table contains.

You may be tempted to just do select * from tablename to retrieve the results in a Pandas dataframe and do a head function on it. But, doing so may take a long time for a query to run. Instead, you can restrict the results set by using the limit clause.

For example, use the following query to retrieve just the first three rows in a table called census data.

Select * from census_data limit 3

In this video we looked at some considerations and tips for working with real-world datasets.

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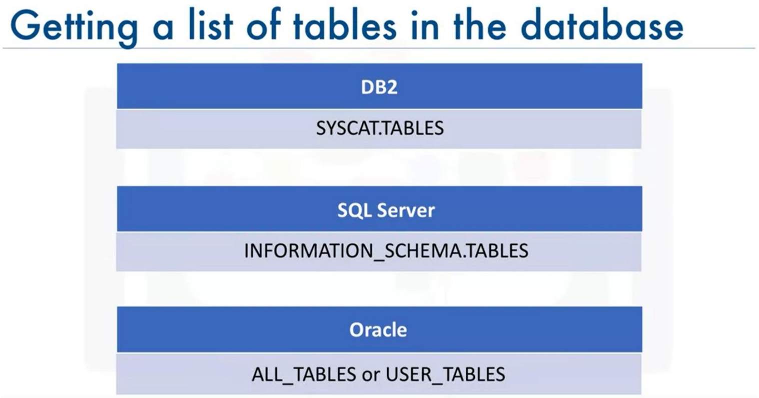
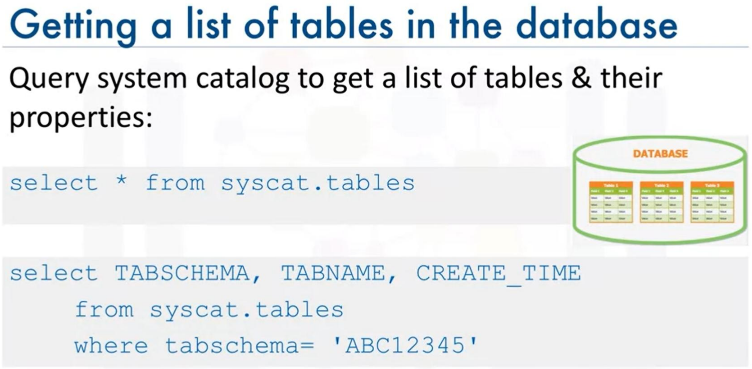
2. Getting Table and Column Details



Getting a list of tables in the database



Getting a list of tables in the database

Query system catalog to get a list of tables & their properties:

```
select * from syscat.tables
```

```
select TABSCHEMA, TABNAME, CREATE_TIME
    from syscat.tables
    where tabschema= 'ABC12345'
```

In this video, we'll look at how to get information about tables and their columns in a database. Now how would you get a list of tables in the database? Sometimes your database may contain several tables, and you may not remember the correct name. For example, you may wonder whether the table is called dog, dogs or four legged mammals. Database systems typically contain system or catalog tables, from where you can query the list of tables and get their properties.

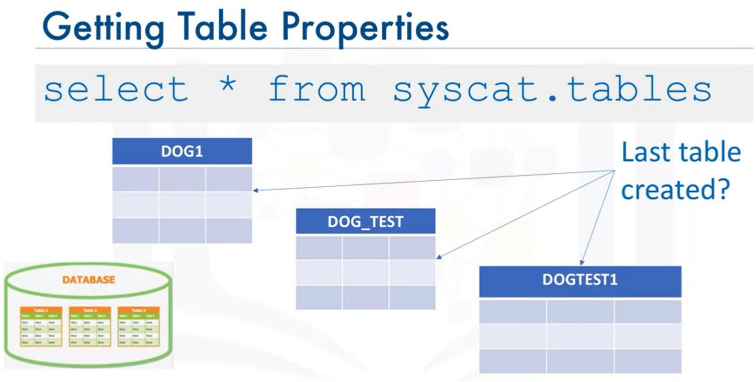
- In DB2 this catalog is called SYSCAT.TABLES.
- In SQL Server, it's INFORMATION_SCHEMA_TABLES,
- and in Oracle it's ALL_TABLES or USER_TABLES.

To get a list of tables in a DB2 database, you can run the following query. Select * from syscat.tables

This select statement will return too many tables including system tables, so it's better to filter the result as shown here.

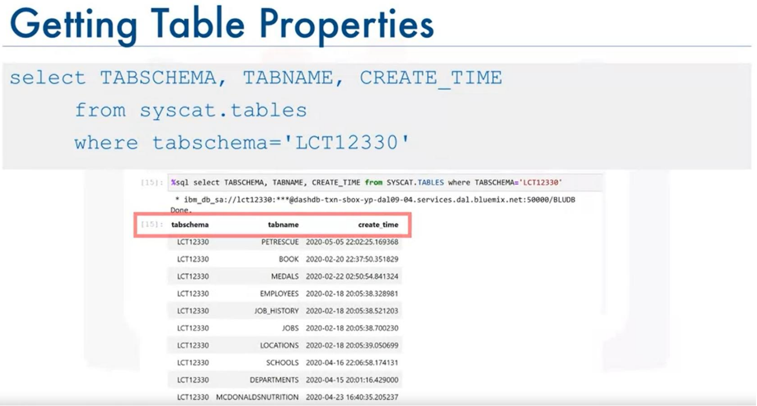
Select tabschema, tabname, create_time from syscat.tables where tabschema='ABC12345'

Please ensure that you replace ABC12345 with your own DB2 username.



Getting Table Properties

```
select * from syscat.tables
```



Getting Table Properties

```
select TABSCHEMA, TABNAME, CREATE_TIME
    from syscat.tables
    where tabschema='LCT12330'
```

```
[15]: %sql select TABSCHEMA, TABNAME, CREATE_TIME from SYSCAT.TABLES where TABSCHEMA='LCT12330'
 * ibm_db_sa://lct12330:***@dashdb-txn-sbox-yp-dal09-04.services.dal.bluemix.net:50000/BLUDB
Done.
[15]: tabschema            tabname                 create_time
      LCT12330            PETRESCUE  2020-05-05 22:02:25.169368
      LCT12330                 BOOK  2020-02-20 22:37:50.351829
      LCT12330               MEDALS  2020-02-22 02:50:54.841324
      LCT12330            EMPLOYEES  2020-02-18 20:05:38.328981
      LCT12330          JOB_HISTORY  2020-02-18 20:05:38.521203
      LCT12330                 JOBS  2020-02-18 20:05:38.700230
      LCT12330            LOCATIONS  2020-02-18 20:05:39.050699
      LCT12330              SCHOOLS  2020-04-16 22:06:58.174131
      LCT12330          DEPARTMENTS  2020-04-15 20:01:16.429000
      LCT12330   MCDONALDSNUTRITION  2020-04-23 16:40:35.205237
```

When you do a select * from syscat tables, you get all the properties of the tables. Sometimes we're interested in specific properties such as creation time. Let's say you've created several tables with similar names. For example, dog1, dog_test, dog test one and so on. But, you want to check which of these tables was the last one you created; to do so, you can issue a query like

select tabschema, tabname, create_time from syscat.tables where a tabschema='LCT12330'

The output will contain the schema name, table name, and creation time for all tables in your schema.

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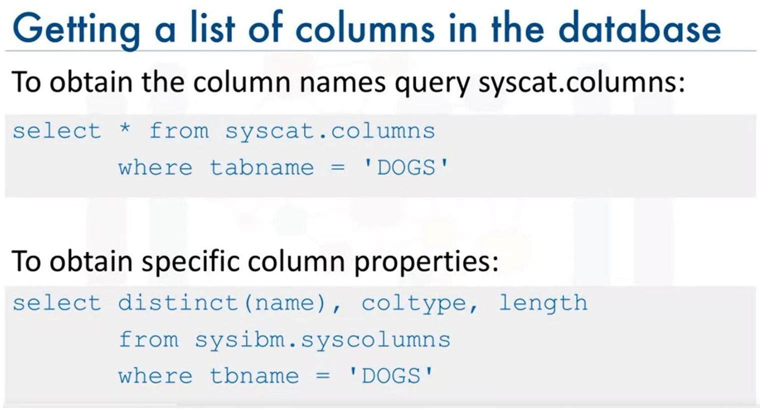


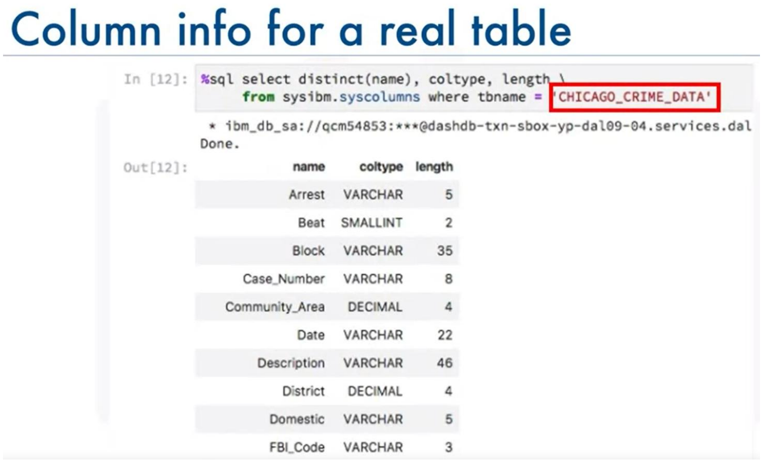
Getting a list of columns in the database

To obtain the column names query syscat.columns:

```
select * from syscat.columns
       where tabname = 'DOGS'
```

To obtain specific column properties:

```
select distinct(name), coltype, length
       from sysibm.syscolumns
       where tbname = 'DOGS'
```



Column info for a real table

```
In [12]: %sql select distinct(name), coltype, length \
              from sysibm.syscolumns where tbname = 'CHICAGO_CRIME_DATA'

          * ibm_db_sa://qcm54853:***@dashdb-txn-sbox-yp-dal09-04.services.dal
         Done.

Out[12]:            name    coltype  length
                  Arrest    VARCHAR       5
                    Beat   SMALLINT       2
                   Block    VARCHAR      35
             Case_Number    VARCHAR       8
          Community_Area    DECIMAL       4
                    Date    VARCHAR      22
             Description    VARCHAR      46
                District    DECIMAL       4
                Domestic    VARCHAR       5
                FBI_Code    VARCHAR       3
```

Next, let's talk about how to get a list of columns in a table. If you can't recall the exact name of a column for example, whether it had any lowercase characters or an underscore in its name, in DB2 you can issue a query like the one shown here.

select * from syscat.columns where tabname='DOGS'

For your information, in my SQL, you can simply run the command show columns from DOGS, or you may want to know specific properties like the datatype and length of the datatype. In DB2, you can issue a statement like:

select distinct(name), coltype, length from sysibm.syscolumns where tbname='DOGS'

Here we look at the results of retrieving column properties, for a real table called Chicago_Crime_Data from a Jupyter notebook. Notice in the output, you can tell certain column names show different cases. For example, the column titled *Arrest* has an uppercase A, and the rest of the characters are lowercase. So, keep in mind that when you refer to this column in your query, not only must you enclose the word Arrest within double quotes, you must also preserve the correct case inside the quotes.

In this video, we saw how to retrieve table and column information.

总结：