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# SQLite Python tutorial

This is a Python programming tutorial for the SQLite database. It covers the basics of SQLite programming with the Python language. You might also want to check the [Python tutorial](#), [SQLite tutorial](#) or [MySQL Python tutorial](#) or [PostgreSQL Python tutorial](#) on ZetCode.

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## Prerequisites

To work with this tutorial, we must have Python language, SQLite database, `pysqlite` language binding and the `sqlite3` command line tool installed on the system. If we have Python 2.5+ then we only need to install the `sqlite3` command line tool. Both the SQLite library and the `pysqlite` language binding are built into the Python language.

```
$ python
Python 2.7.3 (default, Jan 2 2013, 16:53:07)
[GCC 4.7.2] on linux2
Type "help", "copyright", "credits" or "license" for more information.
>>> import sqlite3
>>> sqlite3.version
'2.6.0'
>>> sqlite3.sqlite_version
'3.7.13'
```

In the shell, we launch the Python interactive interpreter. We can see the Python version. In our case it is Python 2.7.3. The `sqlite.version` is the version of the `pysqlite` (2.6.0), which is the binding of the Python language to the SQLite database. The `sqlite3.sqlite_version` gives us the version of the SQLite database library. In our case the version is 3.7.13.

Now we are going to use the `sqlite3` command line tool to create a new database.

```
$ sqlite3 test.db
SQLite version 3.7.13 2012-06-11 02:05:22
Enter ".help" for instructions
Enter SQL statements terminated with a ";"
```

We provide a parameter to the `sqlite3` tool; `test.db` is a database name. It is a file on

our disk. If it is present, it is opened. If not, it is created.

```
sqlite> .tables
sqlite> .exit
$ ls
test.db
```

The `.tables` command gives a list of tables in the `test.db` database. There are currently no tables. The `.exit` command terminates the interactive session of the `sqlite3` command line tool. The `ls` Unix command shows the contents of the current working directory. We can see the `test.db` file. All data will be stored in this single file.

## Version

In the first code example, we will get the version of the SQLite database.

```
#!/usr/bin/python
# -*- coding: utf-8 -*-

import sqlite3 as lite
import sys

con = None

try:
    con = lite.connect('test.db')

    cur = con.cursor()
    cur.execute('SELECT SQLITE_VERSION()')

    data = cur.fetchone()

    print "SQLite version: %s" % data

except lite.Error, e:

    print "Error %s:" % e.args[0]
    sys.exit(1)

finally:

    if con:
        con.close()
```

In the above Python script we connect to the previously created `test.db` database. We execute an SQL statement which returns the version of the SQLite database.

```
import sqlite3 as lite
```

The `sqlite3` module is used to work with the SQLite database.

```
con = None
```

We initialise the `con` variable to `None`. In case we could not create a connection to the database (for example the disk is full), we would not have a connection variable defined. This would lead to an error in the `finally` clause.

```
con = lite.connect('test.db')
```

Here we connect to the `test.db` database. The `connect()` method returns a connection object.

```
cur = con.cursor()
cur.execute('SELECT SQLITE_VERSION()')
```

From the connection, we get the cursor object. The cursor is used to traverse the records from the result set. We call the `execute()` method of the cursor and execute the SQL statement.

```
data = cur.fetchone()
```

We fetch the data. Since we retrieve only one record, we call the `fetchone()` method.

```
print "SQLite version: %s" % data
```

We print the data that we have retrieved to the console.

```
except lite.Error, e:

    print "Error %s:" % e.args[0]
    sys.exit(1)
```

In case of an exception, we print an error message and exit the script with an error code 1.

```
finally:

    if con:
        con.close()
```

In the final step, we release the resources.

In the second example, we again get the version of the SQLite database. This time we will use the `with` keyword.

```
#!/usr/bin/python
# -*- coding: utf-8 -*-

import sqlite3 as lite
import sys

con = lite.connect('test.db')
```

```
with con:

    cur = con.cursor()
    cur.execute('SELECT SQLITE_VERSION()')

    data = cur.fetchone()

    print "SQLite version: %s" % data
```

The script returns the current version of the SQLite database. With the use of the `with` keyword. The code is more compact.

```
with con:
```

With the `with` keyword, the Python interpreter automatically releases the resources. It also provides error handling.

## Inserting data

We will create a `Cars` table and insert several rows to it.

```
#!/usr/bin/python
# -*- coding: utf-8 -*-

import sqlite3 as lite
import sys

con = lite.connect('test.db')

with con:

    cur = con.cursor()
    cur.execute("CREATE TABLE Cars(Id INT, Name TEXT, Price INT)")
    cur.execute("INSERT INTO Cars VALUES(1,'Audi',52642)")
    cur.execute("INSERT INTO Cars VALUES(2,'Mercedes',57127)")
    cur.execute("INSERT INTO Cars VALUES(3,'Skoda',9000)")
    cur.execute("INSERT INTO Cars VALUES(4,'Volvo',29000)")
    cur.execute("INSERT INTO Cars VALUES(5,'Bentley',350000)")
    cur.execute("INSERT INTO Cars VALUES(6,'Citroen',21000)")
    cur.execute("INSERT INTO Cars VALUES(7,'Hummer',41400)")
    cur.execute("INSERT INTO Cars VALUES(8,'Volkswagen',21600)")
```

The above script creates a `Cars` table and inserts 8 rows into the table.

```
cur.execute("CREATE TABLE Cars(Id INT, Name TEXT, Price INT)")
```

This SQL statement creates a new `Cars` table. The table has three columns.

```
cur.execute("INSERT INTO Cars VALUES(1,'Audi',52642)")
cur.execute("INSERT INTO Cars VALUES(2,'Mercedes',57127)")
```

These two lines insert two cars into the table. Using the `with` keyword, the changes are

automatically committed. Otherwise, we would have to commit them manually.

```
sqlite> .mode column
sqlite> .headers on
```

We verify the written data with the `sqlite3` tool. First we modify the way the data is displayed in the console. We use the column mode and turn on the headers.

```
sqlite> SELECT * FROM Cars;
Id          Name          Price
-----
1           Audi          52642
2           Mercedes       57127
3           Skoda           9000
4           Volvo           29000
5           Bentley         350000
6           Citroen          21000
7           Hummer           41400
8           Volkswagen      21600
```

This is the data that we have written to the `Cars` table.

We are going to create the same table. This time using the convenience `executemany()` method.

```
#!/usr/bin/python
# -*- coding: utf-8 -*-

import sqlite3 as lite
import sys

cars = (
    (1, 'Audi', 52642),
    (2, 'Mercedes', 57127),
    (3, 'Skoda', 9000),
    (4, 'Volvo', 29000),
    (5, 'Bentley', 350000),
    (6, 'Hummer', 41400),
    (7, 'Volkswagen', 21600)
)

con = lite.connect('test.db')

with con:

    cur = con.cursor()

    cur.execute("DROP TABLE IF EXISTS Cars")
    cur.execute("CREATE TABLE Cars(Id INT, Name TEXT, Price INT)")
    cur.executemany("INSERT INTO Cars VALUES(?, ?, ?)", cars)
```

This script drops a Cars table if it exists and (re)creates it.

```
cur.execute("DROP TABLE IF EXISTS Cars")
cur.execute("CREATE TABLE Cars(Id INT, Name TEXT, Price INT)")
```

The first SQL statement drops the Cars table if it exists. The second SQL statement creates the Cars table.

```
cur.executemany("INSERT INTO Cars VALUES(?, ?, ?)", cars)
```

We insert 8 rows into the table using the convenience `executemany()` method. The first parameter of this method is a parameterized SQL statement. The second parameter is the data, in the form of tuple of tuples.

We provide another way to create our Cars table. We commit the changes manually and provide our own error handling.

```
#!/usr/bin/python
# -*- coding: utf-8 -*-

import sqlite3 as lite
import sys

try:
    con = lite.connect('test.db')

    cur = con.cursor()

    cur.executescript("""
        DROP TABLE IF EXISTS Cars;
        CREATE TABLE Cars(Id INT, Name TEXT, Price INT);
        INSERT INTO Cars VALUES(1,'Audi',52642);
        INSERT INTO Cars VALUES(2,'Mercedes',57127);
        INSERT INTO Cars VALUES(3,'Skoda',9000);
        INSERT INTO Cars VALUES(4,'Volvo',29000);
        INSERT INTO Cars VALUES(5,'Bentley',350000);
        INSERT INTO Cars VALUES(6,'Citroen',21000);
        INSERT INTO Cars VALUES(7,'Hummer',41400);
        INSERT INTO Cars VALUES(8,'Volkswagen',21600);
    """)

    con.commit()

except lite.Error, e:

    if con:
        con.rollback()

    print "Error %s:" % e.args[0]
    sys.exit(1)

finally:

    if con:
        con.close()
```

In the above script we (re)create the cars table using the `executescript()` method.

```
cur.executescript("""
    DROP TABLE IF EXISTS Cars;
    CREATE TABLE Cars(Id INT, Name TEXT, Price INT);
    INSERT INTO Cars VALUES(1,'Audi',52642);
    INSERT INTO Cars VALUES(2,'Mercedes',57127);
    ...
```

The `executescript()` method allows us to execute the whole SQL code in one step.

```
con.commit()
```

Without the `with` keyword, the changes must be committed using the `commit()` method.

```
except lite.Error, e:

    if con:
        con.rollback()

    print "Error %s:" % e.args[0]
    sys.exit(1)
```

In case of an error, the changes are rolled back and an error message is printed to the terminal.

## The last inserted row id

Sometimes, we need to determine the id of the last inserted row. In Python SQLite, we use the `lastrowid` attribute of the cursor object.

```
#!/usr/bin/python
# -*- coding: utf-8 -*-

import sqlite3 as lite
import sys

con = lite.connect(':memory:')

with con:

    cur = con.cursor()
    cur.execute("CREATE TABLE Friends(Id INTEGER PRIMARY KEY, Name TEXT);")
    cur.execute("INSERT INTO Friends(Name) VALUES ('Tom');")
    cur.execute("INSERT INTO Friends(Name) VALUES ('Rebecca');")
    cur.execute("INSERT INTO Friends(Name) VALUES ('Jim');")
    cur.execute("INSERT INTO Friends(Name) VALUES ('Robert');")

    lid = cur.lastrowid
    print "The last Id of the inserted row is %d" % lid
```

We create a Friends table in memory. The Id is automatically incremented.

```
cur.execute("CREATE TABLE Friends(Id INTEGER PRIMARY KEY, Name TEXT);")
```

In SQLite, INTEGER PRIMARY KEY column is auto incremented. There is also an AUTOINCREMENT keyword. When used in INTEGER PRIMARY KEY AUTOINCREMENT a slightly different algorithm for Id creation is used.

```
cur.execute("INSERT INTO Friends(Name) VALUES ('Tom');")
cur.execute("INSERT INTO Friends(Name) VALUES ('Rebecca');")
cur.execute("INSERT INTO Friends(Name) VALUES ('Jim');")
cur.execute("INSERT INTO Friends(Name) VALUES ('Robert');")
```

When using auto-increment, we have to explicitly state the column names, omitting the one that is auto-incremented. The four statements insert four rows into the `Friends` table.

```
lid = cur.lastrowid
```

Using the `lastrowid` we get the last inserted row id.

```
$ ./lastrow.py
```

The last Id of the inserted row is 4

We see the output of the script.

## Retrieving data

Now that we have inserted some data into the database, we want to fetch it back.

```
#!/usr/bin/python
# -*- coding: utf-8 -*-

import sqlite3 as lite
import sys

con = lite.connect('test.db')

with con:
    cur = con.cursor()
    cur.execute("SELECT * FROM Cars")

    rows = cur.fetchall()

    for row in rows:
        print row
```

In this example, we retrieve all data from the `cars` table.

```
cur.execute("SELECT * FROM Cars")
```



This SQL statement selects all data from the `cars` table.

```
rows = cur.fetchall()
```

The `fetchall()` method gets all records. It returns a result set. Technically, it is a tuple of tuples. Each of the inner tuples represent a row in the table.

```
for row in rows:
    print row
```

We print the data to the console, row by row.

```
$ ./retrieveall.py
(1, u'Audi', 52642)
(2, u'Mercedes', 57127)
(3, u'Skoda', 9000)
(4, u'Volvo', 29000)
(5, u'Bentley', 350000)
(6, u'Citroen', 21000)
(7, u'Hummer', 41400)
(8, u'Volkswagen', 21600)
```

This is the output of the example.

Returning all data at a time may not be feasible. We can fetch rows one by one.

```
#!/usr/bin/python
# -*- coding: utf-8 -*-

import sqlite3 as lite
import sys

con = lite.connect('test.db')

with con:

    cur = con.cursor()
    cur.execute("SELECT * FROM Cars")

    while True:

        row = cur.fetchone()

        if row == None:
            break

        print row[0], row[1], row[2]
```

In this script we connect to the database and fetch the rows of the `cars` table one by one.

```
while True:
```

We access the data from the while loop. When we read the last row, the loop is terminated.

```
row = cur.fetchone()
```

```
if row == None:
    break
```

The `fetchone()` method returns the next row from the table. If there is no more data left, it returns `None`. In this case we break the loop.

```
print row[0], row[1], row[2]
```

The data is returned in the form of a tuple. Here we select records from the tuple. The first is the Id, the second is the car name and the third is the price of the car.

```
$ ./retrieveonebyone.py
```

```
1 Audi 52642
2 Mercedes 57127
3 Skoda 9000
4 Volvo 29000
5 Bentley 350000
6 Citroen 21000
7 Hummer 41400
8 Volkswagen 21600
```

This is the output of the example.

## The dictionary cursor

The default cursor returns the data in a tuple of tuples. When we use a dictionary cursor, the data is sent in the form of Python dictionaries. This way we can refer to the data by their column names.

```
#!/usr/bin/python
# -*- coding: utf-8 -*-

import sqlite3 as lite

con = lite.connect('test.db')

with con:
    con.row_factory = lite.Row
    cur = con.cursor()
```

```
cur.execute("SELECT * FROM Cars")

rows = cur.fetchall()

for row in rows:
    print "%s %s %s" % (row["Id"], row["Name"], row["Price"])
```

In this example, we print the contents of the `Cars` table using the dictionary cursor.

```
con.row_factory = lite.Row
```

We select a dictionary cursor. Now we can access records by the names of columns.

```
for row in rows:
    print "%s %s %s" % (row["Id"], row["Name"], row["Price"])
```

The data is accessed by the column names.

## Parameterized queries

Now we will concern ourselves with parameterized queries. When we use parameterized queries, we use placeholders instead of directly writing the values into the statements. Parameterized queries increase security and performance.

The Python `sqlite3` module supports two types of placeholders: question marks and named placeholders.

```
#!/usr/bin/python
# -*- coding: utf-8 -*-

import sqlite3 as lite
import sys

uId = 1
uPrice = 62300

con = lite.connect('test.db')

with con:

    cur = con.cursor()

    cur.execute("UPDATE Cars SET Price=? WHERE Id=?", (uPrice, uId))
    con.commit()

    print "Number of rows updated: %d" % cur.rowcount
```

We update a price of one car. In this code example, we use the question mark placeholders.

```
cur.execute("UPDATE Cars SET Price=? WHERE Id=?", (uPrice, uId))
```

The question marks ? are placeholders for values. The values are added to the placeholders.

```
print "Number of rows updated: %d" % cur.rowcount
```

The `rowcount` property returns the number of updated rows. In our case one row was updated.

```
$ ./prepared.py
```

```
Number of rows updated: 1
```

Id	Name	Price
1	Audi	62300

The price of the car was updated.

The second example uses parameterized statements with named placeholders.

```
#!/usr/bin/python
# -*- coding: utf-8 -*-

import sqlite3 as lite
import sys

uId = 4

con = lite.connect('test.db')

with con:

    cur = con.cursor()

    cur.execute("SELECT Name, Price FROM Cars WHERE Id=:Id",
                {"Id": uId})
    con.commit()

    row = cur.fetchone()
    print row[0], row[1]
```

We select a name and a price of a car using named placeholders.

```
cur.execute("SELECT Name, Price FROM Cars WHERE Id=:Id",
            {"Id": uId})
```

The named placeholders start with a colon character.

## Inserting images

In this section, we are going to insert an image to the SQLite database. Note that some people argue against putting images into databases. Here we only show how to

do it. We do not dwell into technical issues of whether to save images in databases or not.

```
sqlite> CREATE TABLE Images(Id INTEGER PRIMARY KEY, Data BLOB);
```

For this example, we create a new table called Images. For the images, we use the BLOB data type, which stands for Binary Large Objects.

```
#!/usr/bin/python
# -*- coding: utf-8 -*-

import sqlite3 as lite
import sys

def readImage():

    try:
        fin = open("woman.jpg", "rb")
        img = fin.read()
        return img

    except IOError, e:

        print "Error %d: %s" % (e.args[0],e.args[1])
        sys.exit(1)

    finally:

        if fin:
            fin.close()

try:
    con = lite.connect('test.db')

    cur = con.cursor()
    data = readImage()
    binary = lite.Binary(data)
    cur.execute("INSERT INTO Images(Data) VALUES (?)", (binary,) )

    con.commit()

except lite.Error, e:

    if con:
        con.rollback()

    print "Error %s:" % e.args[0]
    sys.exit(1)

finally:

    if con:
        con.close()
```

In this script, we read an image from the current working directory and write it into

the Images table of the SQLite test.db database.

```
try:
    fin = open("woman.jpg", "rb")
    img = fin.read()
    return img
```

We read binary data from the filesystem. We have a JPG image called woman.jpg.

```
binary = lite.Binary(data)
```

The data is encoded using the SQLite Binary object.

```
cur.execute("INSERT INTO Images(Data) VALUES (?)", (binary,))
```

This SQL statement is used to insert the image into the database.

## Reading images

In this section, we are going to perform the reverse operation. We will read an image from the database table.

```
#!/usr/bin/python
# -*- coding: utf-8 -*-

import sqlite3 as lite
import sys

def writeImage(data):

    try:
        fout = open('woman2.jpg', 'wb')
        fout.write(data)

    except IOError, e:
        print "Error %d: %s" % (e.args[0], e.args[1])
        sys.exit(1)

    finally:
        if fout:
            fout.close()

try:
    con = lite.connect('test.db')

    cur = con.cursor()
    cur.execute("SELECT Data FROM Images LIMIT 1")
    data = cur.fetchone()[0]

    writeImage(data)
```

```
except lite.Error, e:

    print "Error %s:" % e.args[0]
    sys.exit(1)

finally:

    if con:
        con.close()
```

We read image data from the `Images` table and write it to another file, which we call `woman2.jpg`.

```
try:
    fout = open('woman2.jpg', 'wb')
    fout.write(data)
```

We open a binary file in a writing mode. The data from the database is written to the file.

```
cur.execute("SELECT Data FROM Images LIMIT 1")
data = cur.fetchone()[0]
```

These two lines select and fetch data from the `Images` table. We obtain the binary data from the first row.

## Metadata

Metadata is information about the data in the database. Metadata in a SQLite contains information about the tables and columns, in which we store data. Number of rows affected by an SQL statement is a metadata. Number of rows and columns returned in a result set belong to metadata as well.

Metadata in SQLite can be obtained using the `PRAGMA` command. SQLite objects may have attributes, which are metadata. Finally, we can also obtain specific metadata from querying the SQLite system `sqlite_master` table.

```
#!/usr/bin/python
# -*- coding: utf-8 -*-

import sqlite3 as lite
import sys

con = lite.connect('test.db')

with con:

    cur = con.cursor()

    cur.execute('PRAGMA table_info(Cars)')
```

```
data = cur.fetchall()

for d in data:
    print d[0], d[1], d[2]
```

In this example, we issue the `PRAGMA table_info(tableName)` command, to get some metadata info about our `Cars` table.

```
cur.execute('PRAGMA table_info(Cars)')
```

The `PRAGMA table_info(tableName)` command returns one row for each column in the `Cars` table. Columns in the result set include the column order number, column name, data type, whether or not the column can be `NULL`, and the default value for the column.

```
for d in data:
    print d[0], d[1], d[2]
```

From the provided information, we print the column order number, column name and column data type.

```
$ ./colnames1.py
0 Id INT
1 Name TEXT
2 Price INT
```

Output of the example.

Next we will print all rows from the `Cars` table with their column names.

```
#!/usr/bin/python
# -*- coding: utf-8 -*-

import sqlite3 as lite
import sys

con = lite.connect('test.db')

with con:

    cur = con.cursor()
    cur.execute('SELECT * FROM Cars')

    col_names = [cn[0] for cn in cur.description]

    rows = cur.fetchall()

    print "%s %-10s %s" % (col_names[0], col_names[1], col_names[2])

    for row in rows:
        print "%2s %-10s %s" % row
```



We print the contents of the `cars` table to the console. Now, we include the names of the columns too. The records are aligned with the column names.

```
col_names = [cn[0] for cn in cur.description]
```

We get the column names from the `description` property of the cursor object.

```
print "%s %-10s %s" % (col_names[0], col_names[1], col_names[2])
```

This line prints three column names of the `cars` table.

```
for row in rows:
    print "%2s %-10s %s" % row
```

We print the rows using the for loop. The data is aligned with the column names.

```
$ ./colnames2.py
```

	Id	Name	Price
	1	Audi	52642
	2	Mercedes	57127
	3	Skoda	9000
	4	Volvo	29000
	5	Bentley	350000
	6	Citroen	21000
	7	Hummer	41400
	8	Volkswagen	21600

Output.

In our last example related to the metadata, we will list all tables in the `test.db` database.

```
#!/usr/bin/python
# -*- coding: utf-8 -*-

import sqlite3 as lite
import sys

con = lite.connect('test.db')

with con:

    cur = con.cursor()
    cur.execute("SELECT name FROM sqlite_master WHERE type='table'")

    rows = cur.fetchall()

    for row in rows:
        print row[0]
```

The code example prints all available tables in the current database to the terminal.

```
cur.execute("SELECT name FROM sqlite_master WHERE type='table'")
```

The table names are stored inside the system `sqlite_master` table.

```
$ ./listtables.py
Images
sqlite_sequence
Salaries
Cars
```

These were the tables on my system.

## Export and import of data

We can dump data in an SQL format to create a simple backup of our database tables.

```
#!/usr/bin/python
# -*- coding: utf-8 -*-

import sqlite3 as lite
import sys

cars = (
    (1, 'Audi', 52643),
    (2, 'Mercedes', 57642),
    (3, 'Skoda', 9000),
    (4, 'Volvo', 29000),
    (5, 'Bentley', 350000),
    (6, 'Hummer', 41400),
    (7, 'Volkswagen', 21600)
)

def writeData(data):

    f = open('cars.sql', 'w')

    with f:
        f.write(data)

con = lite.connect(':memory:')

with con:

    cur = con.cursor()

    cur.execute("DROP TABLE IF EXISTS Cars")
    cur.execute("CREATE TABLE Cars(Id INT, Name TEXT, Price INT)")
    cur.executemany("INSERT INTO Cars VALUES(?, ?, ?)", cars)
    cur.execute("DELETE FROM Cars WHERE Price < 30000")

    data = '\n'.join(con.iterdump())
```

```
writeData(data)
```

In the above example, we recreate the `cars` table in the memory. We delete some rows from the table and dump the current state of the table into a `cars.sql` file. This file can serve as a current backup of the table.

```
def writeData(data):  
  
    f = open('cars.sql', 'w')  
  
    with f:  
        f.write(data)
```

The data from the table is being written to the file.

```
con = lite.connect(':memory:')
```

We create a temporary table in the memory.

```
cur.execute("DROP TABLE IF EXISTS Cars")  
cur.execute("CREATE TABLE Cars(Id INT, Name TEXT, Price INT)")  
cur.executemany("INSERT INTO Cars VALUES(?, ?, ?)", cars)  
cur.execute("DELETE FROM Cars WHERE Price < 30000")
```

These lines create a `Cars` table, insert values and delete rows, where the `Price` is less than 30000 units.

```
data = '\n'.join(con.iterdump())
```

The `con.iterdump()` returns an iterator to dump the database in an SQL text format. The built-in `join()` function takes the iterator and joins all the strings in the iterator separated by a new line. This data is written to the `cars.sql` file in the `writeData()` function.

```
$ cat cars.sql  
BEGIN TRANSACTION;  
CREATE TABLE Cars(Id INT, Name TEXT, Price INT);  
INSERT INTO "Cars" VALUES(1,'Audi',52643);  
INSERT INTO "Cars" VALUES(2,'Mercedes',57642);  
INSERT INTO "Cars" VALUES(5,'Bentley',350000);  
INSERT INTO "Cars" VALUES(6,'Hummer',41400);  
COMMIT;
```

The contents of the dumped in-memory `Cars` table.

Now we are going to perform a reverse operation. We will import the dumped table back into memory.

```
#!/usr/bin/python
# -*- coding: utf-8 -*-

import sqlite3 as lite
import sys

def readData():

    f = open('cars.sql', 'r')

    with f:
        data = f.read()
        return data

con = lite.connect(':memory:')

with con:

    cur = con.cursor()

    sql = readData()
    cur.executescript(sql)

    cur.execute("SELECT * FROM Cars")

    rows = cur.fetchall()

    for row in rows:
        print row
```

In this script, we read the contents of the `cars.sql` file and execute it. This will recreate the dumped table.

```
def readData():

    f = open('cars.sql', 'r')

    with f:
        data = f.read()
        return data
```

Inside the `readData()` method we read the contents of the `cars.sql` table.

```
cur.executescript(sql)
```

We call the `executescript()` method to launch the SQL script.

```
cur.execute("SELECT * FROM Cars")

rows = cur.fetchall()

for row in rows:
    print row
```

We verify the data.

```
$ ./import.py
(1, u'Audi', 52643)
(2, u'Mercedes', 57642)
(5, u'Bentley', 350000)
(6, u'Hummer', 41400)
```

The output shows that we have successfully recreated the saved Cars table.

## Transactions

A transaction is an atomic unit of database operations against the data in one or more databases. The effects of all the SQL statements in a transaction can be either all committed to the database or all rolled back.

In SQLite, any command other than the `SELECT` will start an implicit transaction. Also, within a transaction a command like `CREATE TABLE ...`, `VACUUM`, `PRAGMA`, will commit previous changes before executing.

Manual transactions are started with the `BEGIN TRANSACTION` statement and finished with the `COMMIT` or `ROLLBACK` statements.

SQLite supports three non-standard transaction levels: `DEFERRED`, `IMMEDIATE` and `EXCLUSIVE`. SQLite Python module also supports an autocommit mode, where all changes to the tables are immediately effective.

```
#!/usr/bin/python
# -*- coding: utf-8 -*-

import sqlite3 as lite
import sys

try:
    con = lite.connect('test.db')
    cur = con.cursor()
    cur.execute("DROP TABLE IF EXISTS Friends")
    cur.execute("CREATE TABLE Friends(Id INTEGER PRIMARY KEY, Name TEXT)")
    cur.execute("INSERT INTO Friends(Name) VALUES ('Tom')")
    cur.execute("INSERT INTO Friends(Name) VALUES ('Rebecca')")
    cur.execute("INSERT INTO Friends(Name) VALUES ('Jim')")
    cur.execute("INSERT INTO Friends(Name) VALUES ('Robert')")

    #con.commit()

except lite.Error, e:

    if con:
        con.rollback()
```

```
        print "Error %s:" % e.args[0]
        sys.exit(1)

    finally:

        if con:
            con.close()
```

We create a `Friends` table and try to fill it with data. However, as we will see, the data is not committed.

```
#con.commit()
```

The `commit()` method is commented. If we uncomment the line, the data will be written to the table.

```
sqlite> .tables
Cars          Friends      Images      Salaries     Temporary
```

```
sqlite> SELECT Count(Id) FROM Friends;
Count(Id)
-----
0
```

The table is created but the data is not written to the table.

In the second example we demonstrate that some commands implicitly commit previous changes to the database.

```
#!/usr/bin/python
# -*- coding: utf-8 -*-

import sqlite3 as lite
import sys

try:
    con = lite.connect('test.db')
    cur = con.cursor()
    cur.execute("DROP TABLE IF EXISTS Friends")
    cur.execute("CREATE TABLE Friends(Id INTEGER PRIMARY KEY, Name TEXT)")
    cur.execute("INSERT INTO Friends(Name) VALUES ('Tom')")
    cur.execute("INSERT INTO Friends(Name) VALUES ('Rebecca')")
    cur.execute("INSERT INTO Friends(Name) VALUES ('Jim')")
    cur.execute("INSERT INTO Friends(Name) VALUES ('Robert')")

    cur.execute("CREATE TABLE IF NOT EXISTS Temporary(Id INT)")

except lite.Error, e:

    if con:
        con.rollback()
```

```
        print "Error %s:" % e.args[0]
        sys.exit(1)

    finally:

        if con:
            con.close()
```

Again, we do not call the `commit()` command explicitly. But this time, the data is written to the Friends table.

```
cur.execute("CREATE TABLE IF NOT EXISTS Temporary(Id INT)")
```

This SQL statement will create a new table. It also commits the previous changes.

```
$ ./implcommit.py
```

```
sqlite> SELECT * FROM Friends;
```

Id	Name
1	Tom
2	Rebecca
3	Jim
4	Robert

The data has been written to the Friends table.

In the autocommit mode, an SQL statement is executed immediately.

```
#!/usr/bin/python
# -*- coding: utf-8 -*-

import sqlite3 as lite
import sys

try:
    con = lite.connect('test.db', isolation_level=None)
    cur = con.cursor()
    cur.execute("DROP TABLE IF EXISTS Friends")
    cur.execute("CREATE TABLE Friends(Id INTEGER PRIMARY KEY, Name TEXT)")
    cur.execute("INSERT INTO Friends(Name) VALUES ('Tom')")
    cur.execute("INSERT INTO Friends(Name) VALUES ('Rebecca')")
    cur.execute("INSERT INTO Friends(Name) VALUES ('Jim')")
    cur.execute("INSERT INTO Friends(Name) VALUES ('Robert')")

except lite.Error, e:

    print "Error %s:" % e.args[0]
    sys.exit(1)
```

```
finally:  
    if con:  
        con.close()
```

In this example, we connect to the database in the autocommit mode.

```
con = lite.connect('test.db', isolation_level=None)
```

We have an autocommit mode, when we set the `isolation_level` to `None`.

```
$ ./autocommit.py
```

```
sqlite> SELECT * FROM Friends;
```

Id	Name
1	Tom
2	Rebecca
3	Jim
4	Robert

The data was successfully committed to the `Friends` table.

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