Working with SQLite in Python

Based on https://docs.python.org/3/library/sqlite3.html (https://docs.python.org/3/library/sqlite3.html)

In [1]:

```
import sqlite3
```

In [2]:

```
con = sqlite3.connect(":memory:")
```

In [3]:

```
?sqlite3.connect
```

This is a Connection object that represents the database.

`:memory:` is a special name to create a temporary database.

In [4]:

```
con
```

Out[4]:

```
<sqlite3.Connection at 0x7f815049eb70>
```

In [5]:

```
# cursor object, which has `execute()` method to perform SQL commands
cur = con.cursor()
```

In [6]:

```
cur
```

Out[6]:

```
<sqlite3.Cursor at 0x7f81405db7a0>
```

In [7]:

```
cur.execute('''
CREATE TABLE department (
    dept_id    CHAR(5),
    dept_name  VARCHAR(20) NOT NULL,
    building   VARCHAR(15),
    budget     NUMERIC(12,2),
    PRIMARY KEY (dept_id)
);
''')
```

Out[7]:

```
<sqlite3.Cursor at 0x7f81405db7a0>
```

In [8]:

```
cur.execute('''
INSERT INTO department
VALUES ('CS', 'Computer Science', 'Jack Cole', 1500000.00),
       ('CHEM', 'Chemistry', 'Purdie',200000.00),
       ('MATH','Maths and Stats', 'Maths', 900000.00),
       ('PHYS', 'Phys and Astro', 'Physics', 1500000.00);
''')
```

Out[8]:

```
<sqlite3.Cursor at 0x7f81405db7a0>
```

In [9]:

```
for dept in cur.execute('SELECT * FROM department'):
    print(dept)
```

```
('CS', 'Computer Science', 'Jack Cole', 1500000)
('CHEM', 'Chemistry', 'Purdie', 200000)
('MATH', 'Maths and Stats', 'Maths', 900000)
('PHYS', 'Phys and Astro', 'Physics', 1500000)
```

In [10]:

```
a=cur.execute('SELECT * FROM department')
```

In [11]:

```
depts=[x for x in a]
```

In [12]:

```
depts
```

Out[12]:

```
[('CS', 'Computer Science', 'Jack Cole', 1500000),
 ('CHEM', 'Chemistry', 'Purdie', 200000),
 ('MATH', 'Maths and Stats', 'Maths', 900000),
 ('PHYS', 'Phys and Astro', 'Physics', 1500000)]
```

In [13]:

```
depts[0]
```

Out[13]:

```
('CS', 'Computer Science', 'Jack Cole', 1500000)
```

In [14]:

```
2*depts[0][3]
```

Out[14]:

```
3000000
```

In [15]:

```
type(depts[1][3])
```

Out[15]:

```
int
```

Try now to have budget with some non-zero digits after the decimal point and re-run the notebook. What happens?

Also, try to execute some SQL commmand twice. What happens?

In [16]:

```
cur.execute('''
CREATE TABLE instructor (
    instr_id    CHAR (5),
    instr_name  VARCHAR(20) NOT NULL,
    dept_id     VARCHAR(5),
    salary      NUMERIC (8,2),
    PRIMARY KEY (instr_id),
    FOREIGN KEY (dept_id) REFERENCES department);
''')
```

Out[16]:

```
<sqlite3.Cursor at 0x7f81405db7a0>
```

In [17]:

```
cur.execute('''
CREATE TABLE student (
    stud_id   CHAR(5),
    name      VARCHAR(20) NOT NULL,
    dept_id   VARCHAR(20),
    tot_cred  NUMERIC(3,0) DEFAULT 0,
    PRIMARY KEY (stud_id),
    FOREIGN KEY (dept_id) REFERENCES department);
''')
```

Out[17]:

```
<sqlite3.Cursor at 0x7f81405db7a0>
```

In [18]:

```
cur.execute('''
INSERT INTO instructor
VALUES ('45797', 'Bob', 'CS', 28000),
       ('23541', 'Javier', 'CS', 33600),
       ('22418', 'Karolina', 'CS', 27000),
       ('34123', 'Layla', 'MATH', 27000),
       ('12355', 'Petro', 'MATH', 32000),
       ('52412', 'Jan', 'MATH', 29300),
       ('21357', 'Isaac', 'CHEM', 37500),
       ('13842', 'Ali', 'CHEM', 34900),
       ('23456', 'Alice', 'PHYS', 29500),
       ('45638', 'Sana', 'PHYS', 31500);
''')
```

Out[18]:

```
<sqlite3.Cursor at 0x7f81405db7a0>
```

In [19]:

```
cur.execute('''
INSERT INTO student
VALUES ('64545', 'Abdul', 'MATH', 180),
       ('78778', 'Martha', 'MATH', 90),
       ('99680', 'Eliot', 'CHEM', 90),
       ('78621', 'Bartosz', 'CHEM', 90),
       ('67868', 'Elias', 'CS', 90),
       ('87690', 'Joao', 'CS', 90),
       ('79879', 'Robert', 'CS', 90),
       ('90780', 'Julia', 'CS', 120),
       ('89675', 'Eilidh', 'PHYS', 120),
       ('96544', 'Sarah', 'PHYS', 180);
''')
```

Out[19]:

```
<sqlite3.Cursor at 0x7f81405db7a0>
```

Obligatory XKCD: https://xkcd.com/327/ (https://xkcd.com/327/)

In [20]:

```
for row in cur.execute('SELECT * FROM student'):
    print(row)
```

```
('64545', 'Abdul', 'MATH', 180)
('78778', 'Martha', 'MATH', 90)
('99680', 'Eliot', 'CHEM', 90)
('78621', 'Bartosz', 'CHEM', 90)
('67868', 'Elias', 'CS', 90)
('87690', 'Joao', 'CS', 90)
('79879', 'Robert', 'CS', 90)
('90780', 'Julia', 'CS', 120)
('89675', 'Eilidh', 'PHYS', 120)
('96544', 'Sarah', 'PHYS', 180)
```

In [21]:

```
name = "Robert'; DROP TABLE student;--"
```

In [22]:

```
command = "SELECT * FROM student WHERE name = '%s'" % name
```

In [23]:

```
command
```

Out[23]:

```
"SELECT * FROM student WHERE name = 'Robert'; DROP TABLE student;--'"
```

In [24]:

```
cur.executescript(command)
```

Out[24]:

```
<sqlite3.Cursor at 0x7f81405db7a0>
```

In [25]:

```
for row in cur.execute('SELECT * FROM student'):
    print(row)
```

```
---------------------------------------------------------------------------
OperationalError                          Traceback (most recent call
 last)
<ipython-input-25-e35e6177d8e6> in <module>
----> 1 for row in cur.execute('SELECT * FROM student'):
      2     print(row)

OperationalError: no such table: student
```

Oops! Lets restore the table before we continue.

In [26]:

```
cur.execute('''
CREATE TABLE student (
    stud_id   CHAR(5),
    name      VARCHAR(20) NOT NULL,
    dept_id   VARCHAR(20),
    tot_cred  NUMERIC(3,0) DEFAULT 0,
    PRIMARY KEY (stud_id),
    FOREIGN KEY (dept_id) REFERENCES department);
''')
```

Out[26]:

```
<sqlite3.Cursor at 0x7f81405db7a0>
```

In [27]:

```
cur.execute('''
INSERT INTO student
VALUES ('64545', 'Abdul', 'MATH', 180),
       ('78778', 'Martha', 'MATH', 90),
       ('99680', 'Eliot', 'CHEM', 90),
       ('78621', 'Bartosz', 'CHEM', 90),
       ('67868', 'Elias', 'CS', 90),
       ('87690', 'Joao', 'CS', 90),
       ('79879', 'Robert', 'CS', 90),
       ('90780', 'Julia', 'CS', 120),
       ('89675', 'Eilidh', 'PHYS', 120),
       ('96544', 'Sarah', 'PHYS', 180);
''')
```

Out[27]:

```
<sqlite3.Cursor at 0x7f81405db7a0>
```

This is how to do it using paremeter substitution

- qmark style

In [28]:

```
cur.execute("INSERT INTO student VALUES (?, ?, ?, ?)", ('87650', 'Naomi', 'CS', 90))
```

Out[28]:

```
<sqlite3.Cursor at 0x7f81405db7a0>
```

- named style

In [29]:

```
cur.execute("SELECT * FROM student WHERE dept_id=:dept", {"dept": "CS"})
```

Out[29]:

```
<sqlite3.Cursor at 0x7f81405db7a0>
```

In [30]:

```
cur.fetchall()
```

Out[30]:

```
[('67868', 'Elias', 'CS', 90),
 ('87690', 'Joao', 'CS', 90),
 ('79879', 'Robert', 'CS', 90),
 ('90780', 'Julia', 'CS', 120),
 ('87650', 'Naomi', 'CS', 90)]
```

Further reading: https://doi.org/10.1371/journal.pcbi.1007007 (https://doi.org/10.1371/journal.pcbi.1007007)