

Python (ii)

- Python + Psycopg2 (recap)
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❖ Python + Psycopg2 (recap)

psycopg2 is a Python module providing access to PostgreSQL DBs

Standard usage:

```
import psycopg2    # include the module definitions
try:
    connection = psycopg2.connect("dbname=Datatase")
    cursor = connection.cursor()
    cursor.execute("SQL Query")
    for tuple in cursor.fetchall():
        # do something with next tuple
    cursor.close()
    connection.close()
except:
    print("Database error")
```

These slides aim to give more details on how Pyscopg2 used in practice

❖ Python + Psycopg2 (recap) (cont)

connection

- handle giving authenticated access for a given user on a given DB
- provides creation of **cursor**s to interact with database

cursor

- pipeline between a Python program and a PostgreSQL DB
- send SQL statements down pipeline as strings
- read results up pipeline as Python (list of) tuples

❖ Python + Psycopg2 (recap) (cont)

Python vs PostgreSQL data types ...

Strings:

- in Python: written with `" ... "` or `' ... '`, including `\x`
- converted to SQL strings e.g. `"O'Reilly"` → `'O' 'Reilly'`
- Python supports `""" """` multi-line strings (useful for SQL queries)

Tuples:

- in Python: contain multiple heterogeneous values (cf. C `struct`)
- similar to PostgreSQL composite (tuple) types
- written as: `(val1, val2, ..., valn)` (note that `(val1)` is not a tuple)
- examples: `(1, 2, 3)`, `(1, "John", 3.14)`, `(1,)`,

❖ Examples

Example database: **beers2**

```
Beers( id:int, name:text, brewer:int )
```

```
Brewers( id:int, name:text, country:text )
```

```
Bars( id:int, name:text, addr:text, license:int )
```

```
Drinkers( id:int, name:text, addr:text, phone:text )
```

```
Likes( drinker:int, beer:int )
```

```
Sells( bar:int, beer:int, price:float )
```

```
Frequents( drinker:int, bar:int )
```

❖ Examples (cont)

Assume that the following code samples are wrapped in

```
import sys
import psycopg2
conn = None
try:
    conn = psycopg2.connect("dbname=beers2")
    ... example code ...
except psycopg2.Error as err:
    print("database error:", err)
finally:
    if (conn):
        conn.close()
    print("finished with database")
```

❖ Examples (cont)

Example: a list of brewers and their countries as **brewers.py**

```
cur = conn.cursor()
cur.execute("""
select name, country from Brewers order by name
""")
for tuple in cur.fetchall():
    name, country = tuple
    print(name + ", " + country)
```

```
$ python3 brewers.py
Brew Dog, Scotland
Bridge Road Brewers, Australia
Caledonian, Scotland
Carlton, Australia
Cascade, Australia
...
```

❖ Examples (cont)

Example: a list of brewers and their countries as **bfrom.py**

```
cur = conn.cursor()  
qry = "select name from Brewers where country = %s"  
country = sys.argv[1]  
cur.execute(qry, [country])  
for tuple in cur.fetchall():  
    print(tuple[0])
```

```
$ python3 bfrom.py Scotland  
Caledonian  
Brew Dog
```


❖ Examples (cont)

Example: print beers preceded by the brewer as **beers.py**

```
cur = conn.cursor()  
qry = """  
select b.name, r.name  
from   Brewers r join Beers b on (b.brewer=r.id)  
"""  
  
cur.execute(qry)  
for tuple in cur.fetchall():  
    print(tuple[1] + " " + tuple[0])
```

```
$ python3 beers.py  
Caledonian 80/-  
James Squire Amber Ale  
Sierra Nevada Bigfoot Barley Wine  
...
```

❖ Examples (cont)

Example: most expensive beer as **expensive.py**

```
cur = conn.cursor()
qry = """
select b.name, s.price
from   Beers b join Sells s on (b.id = s.beer)
where  s.price = (select max(price) from Sells)
"""

cur.execute(qry)
for tuple in cur.fetchall():
    print(tuple[0] + " @ " + str(tuple[1]))

$ python3 beers.py
Sink the Bismarck @ 25.0
```

❖ Examples (cont)

Example: list beers, bar+price where sold, average price as **beers1.py**

```
$ python3 beers1.py
...
New
    Australia Hotel @ 3.0
    Coogee Bay Hotel @ 2.25
    Lord Nelson @ 3.0
    Marble Bar @ 2.8
    Regent Hotel @ 2.2
    Royal Hotel @ 2.3
    Average @ 2.5916666666666667
Nirvana Pale Ale
    Not sold anywhere
Old
    Coogee Bay Hotel @ 2.5
    Marble Bar @ 2.9
    Royal Hotel @ 2.65
    Average @ 2.6833333333333333
Old Admiral
```

```
Lord Nelson @ 3.75  
Average @ 3.75
```

```
...
```

❖ Examples (cont)

```
cur = conn.cursor()
qry = "select id, name from Beers"
cur.execute(qry)
for tuple in cur.fetchall():
    q2 = """select b.name, s.price
            from Bars b join Sells s on (b.id=s.bar)
            where s.beer = %s"""
    print(tuple[1])
    cur.execute(q2, [tuple[0]])
    n, tot = 0, 0.0
    for t in cur.fetchall():
        print("\t"+t[0], "@", t[1])
        n = n + 1
        tot = tot + t[1]
    if n > 0:
        print("\tAverage @", tot/n)
    else:
        print("\tNot sold anywhere")
```


❖ Poor Usage of Python+SQL

Should generally avoid

```
cur.execute("select x,y from R")
for tup in cur.fetchall():
    q = "select * from S where id=%s"
    cur.execute(q, [tup[0]])
    for t in cur.fetchall():
        ... process t ...
```

More efficiently done as e.g.

```
qry = """
select *
from   R join S on (R.x = S.id)
"""

for tup in cur.fetchall():
    ... process tup ...
```

❖ Calling PostgreSQL functions

Two ways to call PostgreSQL functions

```
# using a standard function call from SQL
cur.execute("select * from brewer(5)")
t = cur.fetchone()
print(t[0])
```

```
# using special callproc() method
# parameters supplied as a list of values/vars
cur.callproc("brewer", [5])
t = cur.fetchone()
print(t[0])
```

brewer(int) returns text returns a brewer's name, given their id

❖ Other Psycopg2 Tricks

`cur.execute(SQL Statement)`

- clearly the SQL statement can be **SELECT**
- can also be **UPDATE** or **DELETE**
- can also be a meta-data statement, e.g.
 - **CREATE TABLE, DROP TABLE, CREATE VIEW, ...**

`cur.fetchmany(#tuples)`

- gets a list of the next ***#tuples*** tuples
- could replace PLpgSQL **LIMIT** in some contexts

For many more examples, see Psycopg2 documentation and tutorials

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