SQL in Python

⏪ Recap

- Subquery
- Aggregation
- Grouping
- Joining

> I know she's around 5'5" (65") or 5'7" (67"). She has red hair and she drives a Tesla Model S.

```sql
select id
from drivers_license
where hair_color = "red"
and car_make = "Tesla"
and car_model = "Model S"
and height between 65 and 67
```

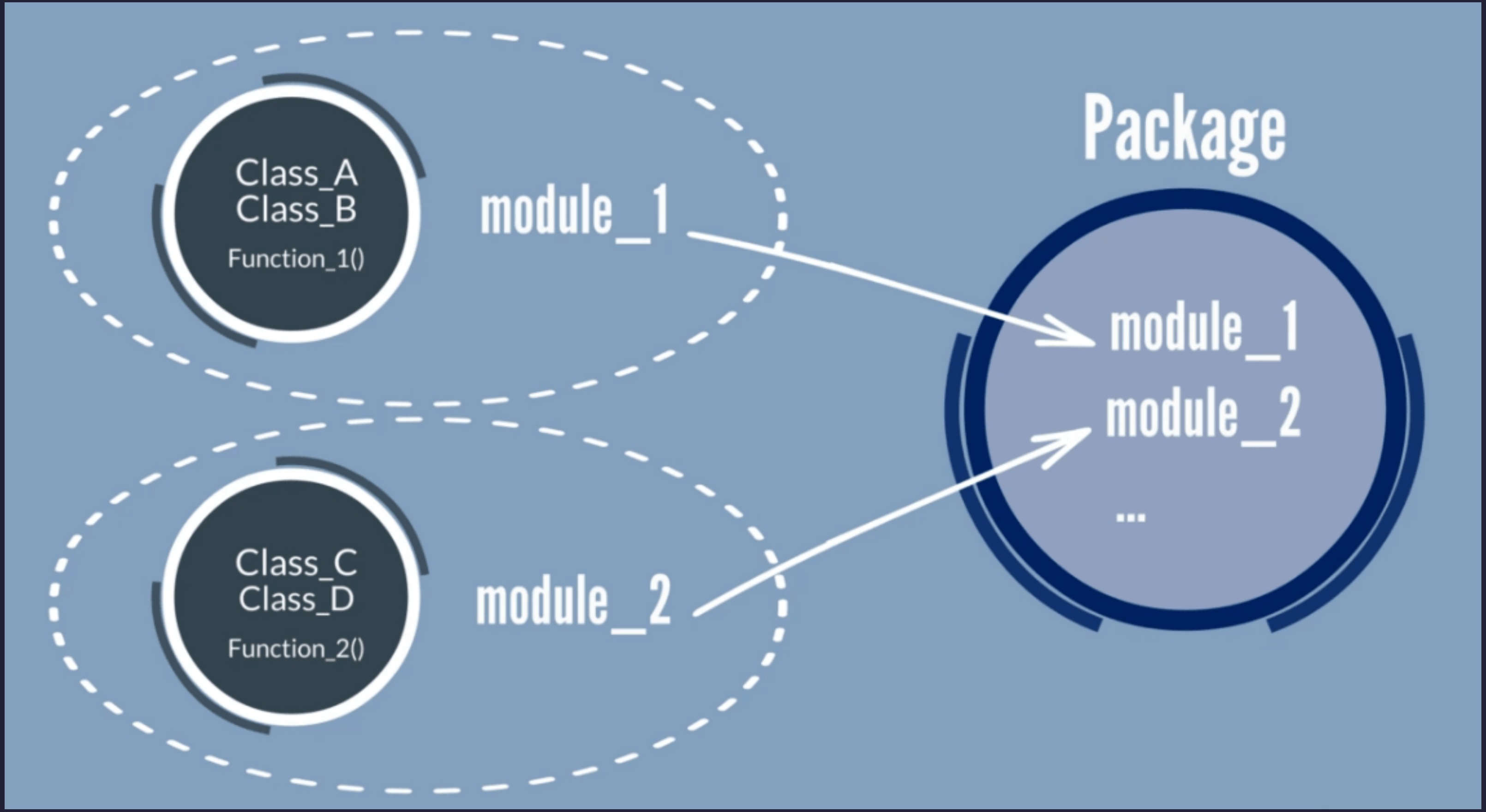
> I know that she attended the SQL Symphony Concert 3 times in December 2017.

```sql
select person_id
from facebook_event_checkin
where event_name like "%SQL Symphony Concert%"
and date between 20170101 and 20171231
group by person_id
having count(*)=3
```

```sql
-- Subquery
select *
from person
where license_id in (...)
and id in (...)
```

Packages

functions < modules < packages = libraries



Built-in functions: ready to use

- `print()`
- `type()`
- `len()`
- `range()`
- `input()`

…

https://docs.python.org/3/library/functions.html

Built-in modules: import required

- `math`
- `random`
- `datetime`
- `os`
- `sqlite3`

…

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https://docs.python.org/3/py-modindex.html

`math`

https://docs.python.org/3/library/math.html

`import` module

```python
import math

print(math.pi)
print(math.sqrt(4))
print(math.pow(2, 3))
print(math.floor(3.14))
print(math.ceil(3.14))
print(math.factorial(5))
```

`from` module `import` functions, variables, etc.

```python
from math import pi, sqrt

print(pi)
print(sqrt(4))
```

`as` to give alias

```python
import math as m

print(m.pi)

print(m.sqrt(4))
```

Install third party packages

- Python Package Index (PyPI; https://pypi.org/)
- `pip install <package_name>`
- `!pip install <package_name>` on Jupyter Notebook

`sqlite3`

a Python library that provides a SQL interface to the SQLite database engine

https://docs.python.org/3/library/sqlite3.html

SQLite

Lightweight disk-based database that doesn’t require a separate server process

Pros:

- no need to install a database server
- no need to configure a database
- no need to worry about access control

Cons:

- not suitable for large-scale applications
- not suitable for client-server applications
- not suitable for multi-user applications

Working with databases in Python (DB-API 2.0)

1. Connect to a database (`connect()`)
2. Execute a query (`execute()`)
3. Get query results (`fetchone()` , `fetchmany(n)` , `fetchall()`)
4. Close connection (`close()`)

Connect to a database

- `connect()`: create a connection object that enables access to a database
    - `connect('name.db')`: create or load a database file in the current directory

```python
import sqlite3

conn = sqlite3.connect('harrypoter.db')
```

Execute a query (DQL)

- `execute()`: execute a query

```
conn.execute("SELECT * FROM students")
```

Get query results

- `fetchone()`: fetch the next row of a query result set, returning a single tuple, or `None` when no more data is available
- `fetchmany(n)`: fetch the next n rows of a query result, returning a list of tuples, or an empty list when no more data is available
- `fetchall()`: fetch all (remaining) rows of a query result, returning a list of tuples

```
one_record = conn.execute("SELECT * FROM students").fetchone()

five_records = conn.execute("SELECT * FROM students").fetchmany(5)

all_records = conn.execute("SELECT * FROM students").fetchall()
```

`tuple`

`list` : mutable

`tuple` : immutable

```python
# list
cities = ["Montreal", "Toronto", "Vancouver", "Detroit"]
print(type(cities))
cities[0] = "New York"

# tuple
cities = ("Montreal", "Toronto", "Vancouver", "Detroit")
print(type(cities))
cities[0] = "New York" # TypeError: 'tuple' object does not support item assignment
```

Execute a query (DDL)

```
query = """
    CREATE TABLE students (
        id INTEGER PRIMARY KEY,
        name TEXT,
        house TEXT,
        age INTEGER
    )
"""
conn.execute(query)
```

Execute a query (DML)

```
query = """
    INSERT INTO students (id, name, house, age)
    VALUES (1, 'Harry Potter', 'Gryffindor', 11)
"""

conn.execute(query)
```

Quotes inside quotes

```
# Error
conn.execute("SELECT * FROM students WHERE first_name = "Harry"")

# Double quotes for outer string
conn.execute("SELECT * FROM students WHERE first_name = 'Harry'")

# Single quotes for outer string
conn.execute('SELECT * FROM students WHERE first_name = "Harry"')

# Escape quotes with escape character (\)
conn.execute("SELECT * FROM students WHERE first_name = \"Harry\"")
```

Commit and close

- `commit()`: commit the current transactions
- `close()`: close the database connection

```
conn.commit()
conn.close()
```

💻 Query `harrypotter.db` with SQL in Pandas

- connect to `harrypotter.db` using `sqlite3`
- execute queries to answer the following questions:
    - List the name of students who are born after 1980
    - What is the name of the oldest student?
- print query results

💻 Query `harrypotter.db` with SQL in Pandas (solution)

```
import sqlite3
import pandas as pd

conn = sqlite3.connect('harrypotter.db')

query1 = "SELECT * FROM students WHERE birthyear > 1980"
query2 = "SELECT * FROM students ORDER BY birthyear LIMIT 1"

print(conn.execute(query1).fetchall())
print(conn.execute(query2).fetchall())
```