



INTRODUCTION TO DATABASES IN PYTHON

Calculating Values in a Query



Math Operators

- addition +
- subtraction -
- multiplication *
- division /
- modulus %
- Work differently on different data types



Calculating Difference

```
In [1]: stmt = select([census.columns.age,  
....:                 (census.columns.pop2008-  
....:                 census.columns.pop2000).label('pop_change')  
....: ])
```

```
In [2]: stmt = stmt.group_by(census.columns.age)
```

```
In [3]: stmt = stmt.order_by(desc('pop_change'))
```

```
In [4]: stmt = stmt.limit(5)
```

```
In [5]: results = connection.execute(stmt).fetchall()
```

```
In [6]: print(results)
```

```
Out[6]: [(61, 52672), (85, 51901), (54, 50808), (58, 45575), (60,  
44915)]
```



Case Statement

- Used to treat data differently based on a condition
- Accepts a list of conditions to match and a column to return if the condition matches
- The list of conditions ends with an else clause to determine what to do when a record doesn't match any prior conditions



Case Example

```
In [1]: from sqlalchemy import case
```

```
In [2]: stmt = select([
...:     func.sum(
...:         case([
...:             (census.columns.state == 'New York',
...:              census.columns.pop2008)
...:         ], else_=0))])
```

```
In [3]: results = connection.execute(stmt).fetchall()
```

```
In [4]: print(results)
```

```
Out[4]: [(19465159,)]
```



Cast Statement

- Converts data to another type
- Useful for converting
 - integers to floats for division
 - strings to dates and times
- Accepts a column or expression and the target Type



Percentage Example

```
In [1]: from sqlalchemy import case, cast, Float
```

```
In [2]: stmt = select([
...:     (func.sum(
...:         case([
...:             (census.columns.state == 'New York',
...:             census.columns.pop2008)
...:         ], else_=0)) /
...:     cast(func.sum(census.columns.pop2008),
...:         Float) * 100).label('ny_percent')])
```

```
In [3]: results = connection.execute(stmt).fetchall()
```

```
In [4]: print(results)
```

```
Out[4]: [(Decimal('6.4267619765'),)]
```



INTRODUCTION TO DATABASES IN PYTHON

Let's practice!



INTRODUCTION TO DATABASES IN PYTHON

SQL Relationships



Relationships

- Allow us to avoid duplicate data
- Make it easy to change things in one place
- Useful to break out information from a table we don't need very often



Relationships

Census

state	sex	age	pop2000	pop2008
New York	F	0	120355	122194
New York	F	1	118219	119661
New York	F	2	119577	116413

State_Fact

name	abbreviation	type
New York	NY	state
Washington DC	DC	capitol
Washington	WA	state



Automatic Joins

```
In [1]: stmt = select([census.columns.pop2008,
....:                  state_fact.columns.abbreviation])

In [2]: results = connection.execute(stmt).fetchall()

In [3]: print(results)
Out[3]: [(95012, u'IL'),
(95012, u'NJ'),
(95012, u'ND'),
(95012, u'OR'),
(95012, u'DC'),
(95012, u'WI'),
...]
```

Join

- Accepts a Table and an optional expression that explains how the two tables are related
- The expression is not needed if the relationship is predefined and available via reflection
- Comes immediately after the `select()` clause and prior to any `where()`, `order_by` or `group_by()` clauses



Select_from

- Used to replace the default, derived FROM clause with a join
- Wraps the join() clause



Select_from Example

```
In [1]: stmt = select([func.sum(census.columns.pop2000)])
```

```
In [2]: stmt = stmt.select_from(census.join(state_fact))
```

```
In [3]: stmt = stmt.where(state_fact.columns.circuit_court  
                        == '10')
```

```
In [4]: result = connection.execute(stmt).scalar()
```

```
In [5]: print(result)
```

```
Out[5]: 14945252
```

Joining Tables without Predefined Relationship

- Join accepts a Table and an optional expression that explains how the two tables are related
- Will only join on data that match between the two columns
- Avoid joining on columns of different types



Select_from Example

```
In [1]: stmt = select([func.sum(census.columns.pop2000)])
```

```
In [2]: stmt = stmt.select_from(  
...:     census.join(state_fact, census.columns.state  
...:     == state_fact.columns.name))
```

```
In [3]: stmt = stmt.where(  
...:     state_fact.columns.census_division_name ==  
...:     'East South Central')
```

```
In [4]: result = connection.execute(stmt).scalar()
```

```
In [5]: print(result)
```

```
Out[5]: 16982311
```



INTRODUCTION TO DATABASES IN PYTHON

Let's practice!



INTRODUCTION TO DATABASES IN PYTHON

Working with Hierarchical Tables



Hierarchical Tables

- Contain a relationship with themselves
- Commonly found in:
 - Organizational
 - Geographic
 - Network
 - Graph



Hierarchical Tables - Example

Employees

id	name	job	manager
1	Johnson	Admin	6
2	Harding	Manager	9
3	Taft	Sales I	2
4	Hoover	Sales I	2



Hierarchical Tables - alias()

- Requires a way to view the table via multiple names
- Creates a unique reference that we can use



Querying Hierarchical Data

```
In [1]: managers = employees.alias()

In [2]: stmt = select(
...:     [managers.columns.name.label('manager'),
...:     employees.columns.name.label('employee')])

In [3]: stmt = stmt.select_from(employees.join(
...:     managers, managers.columns.id ==
...:     employees.columns.manager)

In [4]: stmt = stmt.order_by(managers.columns.name)

In [5]: print(connection.execute(stmt).fetchall())
Out[5]: [(u'FILLMORE', u'GRANT'),
(u'FILLMORE', u'ADAMS'),
(u'HARDING', u'TAFT'), ...]
```



Group_by and Func

- It's important to target `group_by()` at the right alias
- Be careful with what you perform functions on
- If you don't find yourself using both the alias and the table name for a query, don't create the alias at all



Querying Hierarchical Data

```
In [1]: managers = employees.alias()

In [2]: stmt = select([managers.columns.name,
...:                  func.sum(employees.columns.sal)])

In [3]: stmt = stmt.select_from(employees.join(
...:     managers, managers.columns.id ==
...:     employees.columns.manager)

In [4]: stmt = stmt.group_by(managers.columns.name)

In [5]: print(connection.execute(stmt).fetchall())
Out[5]: [(u'FILLMORE', Decimal('96000.00')),
(u'GARFIELD', Decimal('83500.00')),
(u'HARDING', Decimal('52000.00')),
(u'JACKSON', Decimal('197000.00'))]
```



INTRODUCTION TO DATABASES IN PYTHON

Let's practice!



INTRODUCTION TO DATABASES IN PYTHON

Handling Large ResultSets

Dealing with Large ResultSets

- `fetchmany()` lets us specify how many rows we want to act upon
- We can loop over `fetchmany()`
- It returns an empty list when there are no more records
- We have to close the `ResultProxy` afterwards



Fetching Many Rows

```
In [1]: while more_results:
...:     partial_results = results_proxy.fetchmany(50)
...:     if partial_results == []:
...:         more_results = False

...:     for row in partial_results:
...:         state_count[row.state] += 1

In [2]: results_proxy.close()
```



INTRODUCTION TO DATABASES IN PYTHON

Let's practice!