Introduction to relational databases

INTRODUCTION TO IMPORTING DATA IN PYTHON

Hugo Bowne-Anderson
Data Scientist at DataCamp

datacamp

What is a relational database?

- Based on relational model of data
- First described by Edgar “Ted” Codd

Example: Northwind database

- Orders table

OrderID	CustomerID	EmployeeID	OrderDate	RequiredDate	ShippedDate	ShipVia	Freight	ShipName	ShipAddress
10248	VINET	5	7/4/1996 12:00:00 AM	8/1/1996 12:00:00 AM	7/16/1996 12:00:00 AM	3	32.38	Vins et alcools Chevalier	59 rue de l'Abbaye
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- Customers table

CustomerID	CompanyName	ContactName	ContactTitle	Address	City	Region	PostalCode	Country
ALFKI	Alfreds Futterkiste	Maria Anders	Sales Representative	Obere Str. 57	Berlin	None	12209	Germany
AROUT	Around the Horn	Thomas Hardy	Sales Representative	120 Hanover Sq.	London	None	WA1 1DP	UK
BLAUS	Blauer See Delikatessen	Hanna Moos	Sales Representative	Forsterstr. 57	Mannheim	None	68306	Germany
BONAP	Bon app'	Laurence Lebihan	Owner	12, rue des Bouchers	Marseille	None	13008	France

- Employees table

EmployeeID	LastName	FirstName	Title	TitleOfCourtesy	BirthDate	HireDate	Address	City	Region
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2	Fuller	Andrew	Vice President, Sales	Dr.	2/19/1952 12:00:00 AM	8/14/1992 12:00:00 AM	908 W. Capital Way	Tacoma	WA
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Relational model

- Widely adopted
- Codd's 12 Rules/Commandments
  - Consists of 13 rules (zero-indexed!)
  - Describes what a Relational Database Management System should adhere to to be considered relational

Relational Database Management Systems

- PostgreSQL

Relational Database Management Systems

- PostgreSQL
- MySQL

Relational Database Management Systems

- PostgreSQL
- MySQL
- SQLite

Relational Database Management Systems

- PostgreSQL
- MySQL
- SQLite
- SQL = Structured Query Language

Let's practice!

INTRODUCTION TO IMPORTING DATA IN PYTHON

Creating a database engine in Python

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Creating a database engine

- SQLite database
  - Fast and simple
- SQLAlchemy
  - Works with many Relational Database Management Systems

```
from sqlalchemy import create_engine
engine = create_engine('sqlite:///Northwind.sqlite')
```

Getting table names

```
from sqlalchemy import create_engine
engine = create_engine('sqlite:///Northwind.sqlite')
```

```
table_names = engine.table_names()
print(table_names)
```

```
['Categories', 'Customers', 'EmployeeTerritories',
'Employees', 'Order Details', 'Orders', 'Products',
'Region', 'Shippers', 'Suppliers', 'Territories']
```

Let's practice!

INTRODUCTION TO IMPORTING DATA IN PYTHON

Querying relational databases in Python

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Basic SQL query

```
SELECT * FROM Table_Name
```

- Returns all columns of all rows of the table
- Example:

```
SELECT * FROM Orders
```

- We'll use SQLAlchemy and pandas

Workflow of SQL querying

- Import packages and functions
- Create the database engine
- Connect to the engine
- Query the database
- Save query results to a DataFrame
- Close the connection

Your first SQL query

```
from sqlalchemy import create_engine
import pandas as pd
engine = create_engine('sqlite:///Northwind.sqlite')
con = engine.connect()
rs = con.execute("SELECT * FROM Orders")
df = pd.DataFrame(rs.fetchall())
con.close()
```

Printing your query results

```
print(df.head())
```

```
       0      1   2                     3                     4
0  10248  VINET   5   7/4/1996 12:00:00 AM   8/1/1996 12:00:00 AM
1  10251  VICTE   3   7/8/1996 12:00:00 AM   8/5/1996 12:00:00 AM
2  10254  CHOPS   5  7/11/1996 12:00:00 AM   8/8/1996 12:00:00 AM
3  10256  WELLI   3  7/15/1996 12:00:00 AM  8/12/1996 12:00:00 AM
4  10258  ERNSH   1  7/17/1996 12:00:00 AM  8/14/1996 12:00:00 AM
```

Set the DataFrame column names

```
from sqlalchemy import create_engine
import pandas as pd
engine = create_engine('sqlite:///Northwind.sqlite')
con = engine.connect()
rs = con.execute("SELECT * FROM Orders")
df = pd.DataFrame(rs.fetchall())
df.columns = rs.keys()
con.close()
```

Set the data frame column names

```
print(df.head())
```

```
   OrderID CustomerID  EmployeeID              OrderDate
0    10248      VINET           5   7/4/1996 12:00:00 AM
1    10251      VICTE           3   7/8/1996 12:00:00 AM
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```

Using the context manager

```
from sqlalchemy import create_engine
import pandas as pd
engine = create_engine('sqlite:///Northwind.sqlite')
```

```
with engine.connect() as con:
    rs = con.execute("SELECT OrderID, OrderDate, ShipName FROM Orders")
    df = pd.DataFrame(rs.fetchmany(size=5))
    df.columns = rs.keys()
```

Let's practice!

INTRODUCTION TO IMPORTING DATA IN PYTHON

Querying relational databases directly with pandas

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The pandas way to query

```
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    df.columns = rs.keys()
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```
df = pd.read_sql_query("SELECT * FROM Orders", engine)
```

Let's practice!

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Advanced querying: exploiting table relationships

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10254	CHOPS	5	7/11/1996 12:00:00 AM	8/8/1996 12:00:00 AM	7/23/1996 12:00:00 AM	2	22.98	Chop-suey Chinese	Hauptstr. 31

- Customers table

CustomerID	CompanyName	ContactName	ContactTitle	Address	City	Region	PostalCode	Country
ALFKI	Alfreds Futterkiste	Maria Anders	Sales Representative	Obere Str. 57	Berlin	None	12209	Germany
AROUT	Around the Horn	Thomas Hardy	Sales Representative	120 Hanover Sq.	London	None	WA1 1DP	UK
BLAUS	Blauer See Delikatessen	Hanna Moos	Sales Representative	Forsterstr. 57	Mannheim	None	68306	Germany
BONAP	Bon app'	Laurence Lebihan	Owner	12, rue des Bouchers	Marseille	None	13008	France

JOINing tables

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OrderID	CustomerID	EmployeeID	OrderDate	RequiredDate	ShippedDate	ShipVia	Freight	ShipName	ShipAddress
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INNER JOIN in Python (pandas)

```python
from sqlalchemy import create_engine
import pandas as pd
engine = create_engine('sqlite:///Northwind.sqlite')
df = pd.read_sql_query("SELECT OrderID, CompanyName FROM Orders
INNER JOIN Customers on Orders.CustomerID = Customers.CustomerID", engine)
print(df.head())
```

```
   OrderID                CompanyName
0    10248  Vins et alcools Chevalier
1    10251       Victuailles en stock
2    10254          Chop-suey Chinese
3    10256     Wellington Importadora
4    10258               Ernst Handel
```

Let's practice!

INTRODUCTION TO IMPORTING DATA IN PYTHON

Final Thoughts

INTRODUCTION TO IMPORTING DATA IN PYTHON

Hugo Bowne-Anderson
Data Scientist at DataCamp

datacamp

What you've learned:

- Relational databases
- Queries
  - SELECT
  - WHERE
  - JOIN

Next course:

- Scrape data from the web
- Interact with APIs

Let's practice!

INTRODUCTION TO IMPORTING DATA IN PYTHON