

# 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
10251	VICTE	3	7/8/1996 12:00:00 AM	8/5/1996 12:00:00 AM	7/15/1996 12:00:00 AM	1	41.34	Victuailles en stock	2, rue du Commerce
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

- 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

- 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**

# 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

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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())
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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**

# The pandas way to query

```
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import pandas as pd
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```
df = pd.read_sql_query("SELECT * FROM Orders", engine)
```

# **Let's practice!**

**INTRODUCTION TO IMPORTING DATA IN PYTHON**

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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

- 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
10251	VICTE	3	7/8/1996 12:00:00 AM	8/5/1996 12:00:00 AM	7/15/1996 12:00:00 AM	1	41.34	Victuailles en stock	2, rue du Commerce
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

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# INNER JOIN in Python (pandas)

```
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**

# 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**