



Advanced Databases 1



Outline

1. Writing queries in SQL
2. Querying databases directly from Python
3. Alternative Database Management Systems



Writing queries in SQL

- ▶ So far we have used a graphical interface for working with databases
- ▶ This graphical interface automates the writing of SQL
- ▶ Sometimes it is valuable to write the SQL ourselves
 - ▶ More complex queries
 - ▶ Programmatic use of queries



Basic Queries

```
SELECT year, mo, species FROM Surveys;
```



Basic Queries

```
SELECT yr, mo, species
```

```
FROM Surveys;
```



Filtering

```
SELECT yr, mo, species
```

```
FROM Surveys
```

```
WHERE yr >= 2000;
```



Sorting

```
SELECT yr, mo, species
```

```
FROM Surveys
```

```
WHERE yr >= 2000
```

```
ORDER BY yr;
```



Sorting

```
SELECT yr, mo, species
```

```
FROM Surveys
```

```
WHERE yr >= 2000
```

```
ORDER BY yr ASC, mo DESC;
```



Aggregation

```
SELECT yr, mo, species, AVG(wgt), COUNT(wgt)
```

```
FROM Surveys
```

```
WHERE yr >= 2000
```

```
GROUP BY yr, mo, species
```

```
ORDER BY yr;
```



Joining

SELECT yr, mo, species

FROM Surveys

JOIN Species

ON "New Code" = species

WHERE yr >= 2000 AND Rodent = 1 and Unknown = 0

ORDER BY yr;



Getting more information

http://software-carpentry.org/4_0/databases/



Accessing Databases From Python

- ▶ **One standard workflow**
 - ▶ Data stored in database
 - ▶ Write a query in the DBMS to extract desired information
 - ▶ Export to csv file
 - ▶ Import into programming language
 - ▶ Analyze the data



Accessing Databases From Python

- ▶ **A more streamlined workflow**
 - ▶ Data stored in database
 - ▶ Write a query inside the programming language to extract desired information
 - ▶ Analyze the data



Accessing Databases From Python

```
import sqlite3 as dbapi
con = dbapi.connect('portal_database.db')
cur = con.cursor()
cur.execute("""SELECT year, mo, species
FROM Surveys
WHERE year >= 2000""")
data = cursor.fetchall()
```



More information

- ▶ Chapter 15 of your book



Alternative Database Management Systems

- ▶ **Graphical**

- ▶ MS Access
- ▶ Base

- ▶ **Non-graphical**

- ▶ **SQLite** (<http://www.sqlite.org/>)
- ▶ MySQL
- ▶ PostgreSQL

