

# Databases

## 2. Single-table queries

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18–20 Nov 2014

# Outline

## **What is a database**

purpose, design, data types

## **Create database**

software, import data

## **Query**

get data, join tables, SQL language

## **Interface**

connect to database from other program

# Goals

After this three-day module, you should:

1. **Understand** what a database is, and how it works
2. Be able to **create** a simple database
3. Be able to **get data** from any database

# Database

How does a database work?

# Database

## Tables

- A database is a collection of **tables**
- Related tables are joined using **key** columns
- Each table column has one **data type**

# Database

## Tables

- A database is a collection of **tables**
- Related tables are joined using **key** columns
- Each table column has one **data type**

## Queries

- Users ask for specific data with a **query**
- Queries are written in a standard language called **SQL**

# Database



# Visual query builder

- Database – Queries
- Create query in design view
- Add table
- Drag columns
- View – Preview (press the F4 key)



# SQL

## The SQL language

# SELECT, FROM

## Select table columns

SELECT column FROM table

SELECT col1, col2 FROM table

# SELECT, FROM

## Select table columns

```
SELECT column FROM table
```

```
SELECT col1, col2 FROM table
```

## All columns

```
SELECT * FROM table
```

# SELECT, FROM

## Alias

SELECT column *newname* FROM table

# SELECT, FROM

## Alias

```
SELECT column newname FROM table
```

## Arithmetic

```
SELECT col1 + col2 newname FROM table
```

```
SELECT col1 - col2 newname FROM table
```

```
SELECT col1 * col2 newname FROM table
```

```
SELECT col1 / col2 newname FROM table
```

# WHERE

## Condition (number)

SELECT \* FROM table WHERE col = 0

SELECT \* FROM table WHERE col > 0

SELECT \* FROM table WHERE col BETWEEN 1 AND 3

SELECT \* FROM table WHERE col IN (1,3)

# WHERE

## Condition (number)

SELECT \* FROM table WHERE col = 0

SELECT \* FROM table WHERE col > 0

SELECT \* FROM table WHERE col BETWEEN 1 AND 3

SELECT \* FROM table WHERE col IN (1,3)

## Many conditions

SELECT \* FROM table WHERE col1 = 0 AND col2 > 0

SELECT \* FROM table WHERE col1 = 0 OR col2 > 0

# WHERE, ORDER BY

## Condition (string)

```
SELECT * FROM table WHERE col = 'foo'
```

```
SELECT * FROM table WHERE col IN ('foo','bar')
```

```
SELECT * FROM table WHERE col LIKE '%fish%'
```



# WHERE, ORDER BY

## Condition (string)

```
SELECT * FROM table WHERE col = 'foo'
```

```
SELECT * FROM table WHERE col IN ('foo','bar')
```

```
SELECT * FROM table WHERE col LIKE '%fish%'
```

## Condition (NA)

```
SELECT * FROM table WHERE col IS NOT NULL
```

## Sort

```
SELECT * FROM table ORDER BY col
```

# GROUP BY

## Function

```
SELECT avg(col) FROM table
```

```
SELECT sum(col) FROM table
```

```
SELECT min(col) FROM table
```

```
SELECT max(col) FROM table
```

```
SELECT count(col) FROM table
```

# GROUP BY

## Function

```
SELECT avg(col) FROM table
```

```
SELECT sum(col) FROM table
```

```
SELECT min(col) FROM table
```

```
SELECT max(col) FROM table
```

```
SELECT count(col) FROM table
```

## Aggregate

```
SELECT col1, avg(col2) FROM table GROUP BY col1
```

# Overview of SQL commands

Required

**SELECT**  
**FROM**

# Overview of SQL commands

Required

**SELECT**  
**FROM**

Condition

**WHERE**  
BETWEEN ... AND  
IN  
LIKE  
IS NULL  
AND  
OR  
NOT

# Overview of SQL commands

Required

**SELECT**  
**FROM**

Sort

**ORDER BY**

Condition

**WHERE**

BETWEEN ... AND  
IN  
LIKE  
IS NULL  
AND  
OR  
NOT

# Overview of SQL commands

Required

**SELECT**  
**FROM**

Condition

**WHERE**  
BETWEEN ... AND  
IN  
LIKE  
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AND  
OR  
NOT

Sort

**ORDER BY**

Function

avg  
sum  
min  
max  
count

# Overview of SQL commands

Required

**SELECT**  
**FROM**

Condition

**WHERE**  
BETWEEN ... AND  
IN  
LIKE  
IS NULL  
AND  
OR  
NOT

Sort

**ORDER BY**

Function

avg  
sum  
min  
max  
count

Aggregate

**GROUP BY**



## R interface

# Querying from R

# The ODB package

## Connection between R and LibreOffice Base

Other R packages can connect to Microsoft Access, Microsoft SQL Server, MySQL, Oracle, PostgreSQL, SQLite, etc.

# The ODB package

## Connection between R and LibreOffice Base

Other R packages can connect to Microsoft Access, Microsoft SQL Server, MySQL, Oracle, PostgreSQL, SQLite, etc.

## Functions

<code>odb.open</code>	Establish connection
<code>odb.tables</code>	List all tables
<code>odb.read</code>	Send query

# The ODB package

```
# install.packages("ODB")  
  
library(ODB)  
  
con <- odb.open("c:/database/TeamDB.odb")  
  
odb.tables(con)  
  
odb.read(con, "SELECT * FROM people")
```

We create a “connection” object and call it `con`