Definitions

- **Database**
  - "Collection of related facts" (Pat Martin, CISC 332)
  - Organized data set
  - Used for large quantities of information

- **Relational database**
  - Information is stored in multiple tables
  - Rows contain data about a single item
    - Known as *tuples* or *records*
  - Columns represent specific properties
    - Known as *fields* or *attributes*
An Example

<table>
<thead>
<tr>
<th>shows</th>
<th>mysteries</th>
</tr>
</thead>
<tbody>
<tr>
<td>id</td>
<td>name</td>
</tr>
<tr>
<td>63</td>
<td>Doctor Who</td>
</tr>
<tr>
<td>18</td>
<td>Lorna Doone</td>
</tr>
<tr>
<td>92</td>
<td>A Touch of Frost</td>
</tr>
<tr>
<td>47</td>
<td>Jane Eyre</td>
</tr>
<tr>
<td>11</td>
<td>Sense and Sensibility</td>
</tr>
<tr>
<td>10</td>
<td>Sense and Sensibility</td>
</tr>
<tr>
<td>91</td>
<td>Prime Suspect</td>
</tr>
<tr>
<td>13</td>
<td>Pride and Prejudice</td>
</tr>
<tr>
<td>2</td>
<td>Foyle’s War</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>bbc_costume_dramas</th>
</tr>
</thead>
<tbody>
<tr>
<td>id</td>
</tr>
<tr>
<td>11</td>
</tr>
<tr>
<td>18</td>
</tr>
<tr>
<td>13</td>
</tr>
<tr>
<td>47</td>
</tr>
</tbody>
</table>

Definitions

- Relational Database Management Systems (RDBMSs)
  - Programs used to access and alter a database
  - Commercial: Oracle, DB2 (IBM), MS SQL
  - Open Source: PostgreSQL, MySQL
    - MySQL is used in this course

- Queries
  - Requests made of the database
    - Most commonly used to search for information
    - Also used to add, change and remove data and/or tables

- Schema
  - The design and structure of your database
    - Table definitions, attributes and their types, etc.
Database vs. Spreadsheet

- "Databases sound somewhat like spreadsheets"
  - Databases are very different

- Databases are built to ...
  - store vast amounts of information
  - search at tremendous speed
  - provide access to many users at once
  - keep the data safe and secure

- Spreadsheets provide a convenient approach for ...
  - entering data
  - performing calculations
  - creating graphs and charts

Some Database History

- 1960s
  - First data models produced

- 1970s
  - Relational databases developed by E.F. Codd
  - RDBMSs appear at the end of the decade

- 1980s and 1990s
  - RDBMSs become the standard
  - Databases are employed in new fields (e.g. data mining)

- 2000s
  - Databases are widely employed in web applications
SQL

- Structured Query Language (SQL)
  - Implements an information standard
    - Managed by International Organization for Standardization (ISO)
  - Not all RDBMSs interpret it the same way ...
    - but the basics are fine

- SQL is the prominent query language for RDBMSs

- Not a "traditional" (*imperative*) programming language
  - No functions, objects, *etc.*

- SQL is a *declarative* programming language
  - You use the syntax to "declare" what you want
  - The RDBMS "fills your order"

Working with Tables

- Each row represents a unique record
  - No two rows can be the same

- Records must be uniquely identified
  - Option: use a combination of attributes
  - Better option: assign a unique ID
  - Use the ID to refer to the record in other tables

- Best practices
  - Separate data to avoid redundancy
  - Keep the schema as a simple as possible
MySQL

- Open-source RDBMS
  - First developed by Michael Widenius and David Axmark
  - First released in 1995
  - Now owned by Oracle

- How to access MySQL
  - Via another program (e.g., PHP)
  - Via the command line and SSH

```
mysql [-h hostname] -u username -p
```

- Type `quit` to exit

- **NOTE:** you will not use the command line in CISC 282
  - Access will be discussed in a future lecture

Data Types

- **BOOLEAN**
  - TRUE or FALSE (equivalent to 1 or 0)

- Some numeric types
  - TINYINT, SMALLINT, MEDIUMINT, INT, ...
  - DOUBLE and FLOAT
  - Can also specify type **UNSIGNED**

- Some string types
  - Strings use single-quotes
  - VARCHAR(maxLength) is often used
  - CHAR(fixedLength), TEXT(maxLength), ...
  - SET('value1', 'value2', ...)
    - Attribute must be a member of this set
Statements

- Complete commands for a RDBMS
  - End with a semi-colon
- Clause
  - A component of a statement
  - Specifies a requirement of the command

```sql
SELECT novel_author
FROM bbc_costume_dramas
WHERE year < 2005;
```

Database Statements

<table>
<thead>
<tr>
<th>Statement</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHOW DATABASES;</td>
<td>Displays a list of all the databases available for use</td>
</tr>
<tr>
<td>USE databaseName;</td>
<td>Specifies <code>databaseName</code> as the current working database</td>
</tr>
<tr>
<td>CREATE DATABASE databaseName;</td>
<td>Creates a new database named <code>databaseName</code></td>
</tr>
<tr>
<td>DROP DATABASE IF EXISTS databaseName;</td>
<td>Deletes the entire database named <code>databaseName</code></td>
</tr>
</tbody>
</table>
## Table Statements

<table>
<thead>
<tr>
<th>Statement</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SHOW TABLES</strong>;</td>
<td>Displays a list of all of the tables in the current working database</td>
</tr>
<tr>
<td><strong>DESCRIBE</strong> tableName;</td>
<td>Displays all of the attributes of the table named tableName</td>
</tr>
<tr>
<td><strong>CREATE TABLE</strong> tableName(</td>
<td>Creates a table named tableName with attributes named attr# of</td>
</tr>
<tr>
<td>attr1 type1 [constr1],</td>
<td>type type# with optional constraints constr#</td>
</tr>
<tr>
<td>attr2 type2 [constr2], ...);</td>
<td></td>
</tr>
<tr>
<td><strong>DROP TABLE IF EXISTS</strong> tableName;</td>
<td>Deletes the entire table named tableName</td>
</tr>
</tbody>
</table>

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