CPET 499/ITC 250 Web Systems

Chapter 11
Working with Databases
Part 1 of 3

Text Book:
*** Fundamentals of Web Development, 2015, by Randy Connolly and Ricardo Hoar, published by Pearson**

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Topics

- Database and Web Development
  - The Role of Database in Web Development
  - Database Design
  - Database Options
- SQL (Structure Query Language)
  - SELECT Statement
  - INSERT, UPDATE, and DELETE Statements
  - Transactions: Local Transactions, Distributed Transactions
  - Data Definition Statements
  - Database Indexes and Efficiency

Figure 11.1 Separating content from data

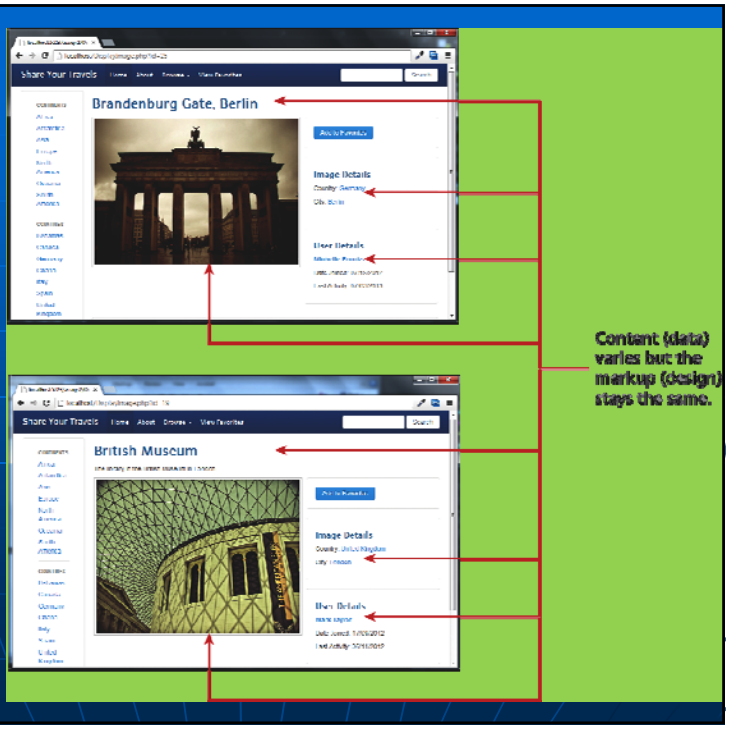

Figure 11.2 How website use databases

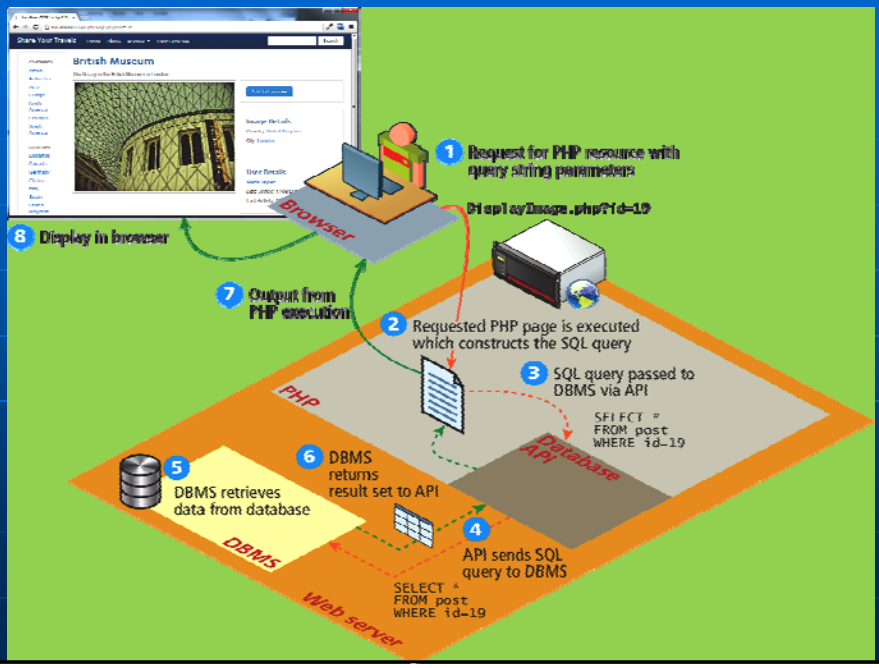

Figure 11.3 A database table

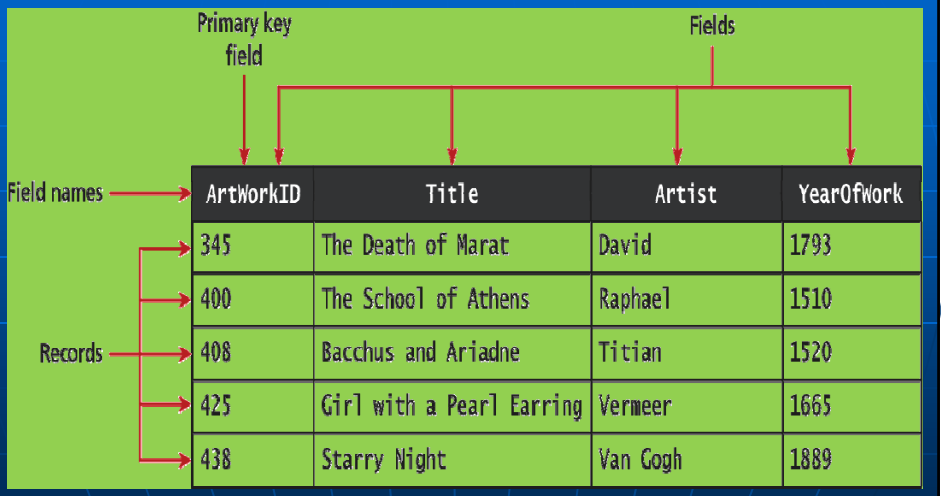

Figure 11.4 Diagraming a table

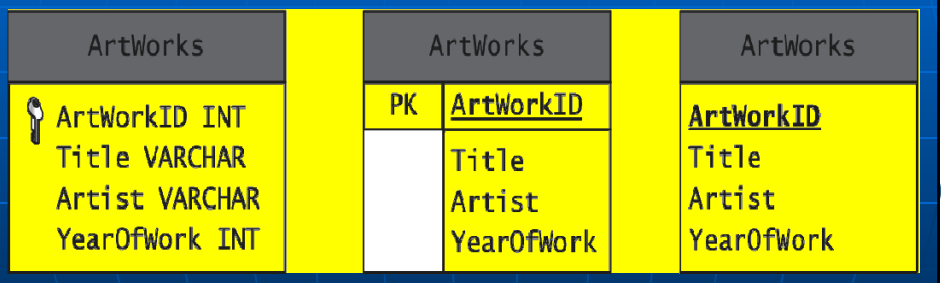

Table 11.1 Common Database Table Data Types

- BIT – BOOLEAN or BOOL
- BLOG – Binary Large Object (images and other data objects)
- CHAR(n) – a fixed number of character (n = number of chars) that are padded with spaces to fill the field
- DATE – also TIME and DATETIME data types
- FLOAT - also DOUBLE, DECIMAL data types
- INT - also SMALLINT data type
- VARCHAR(n) – a variable number of characters (n = maximum number of chars with no space padding)

Figure 11.5 Foreign keys links tables

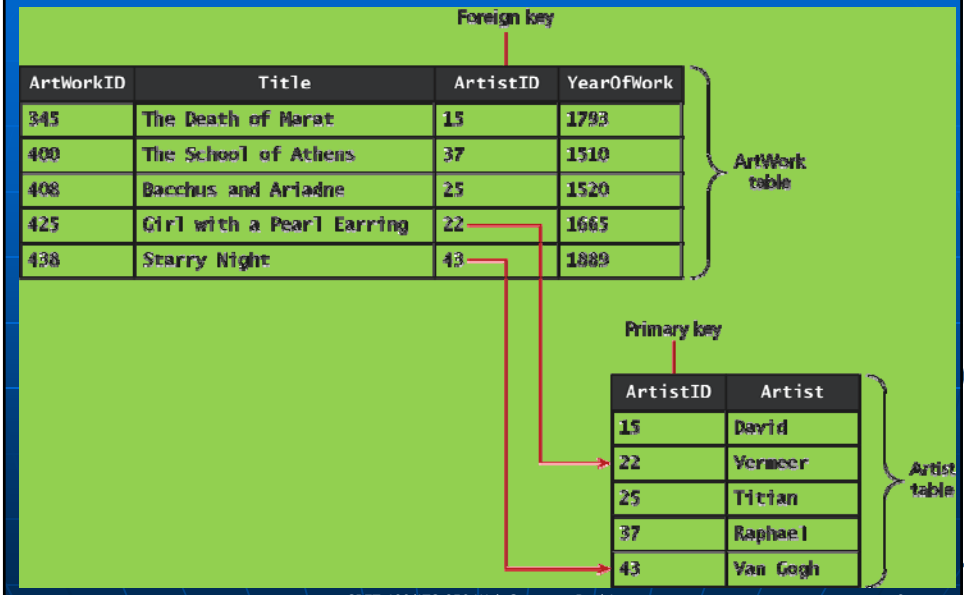

Figure 11.6 Diagraming a one-to-many relationship

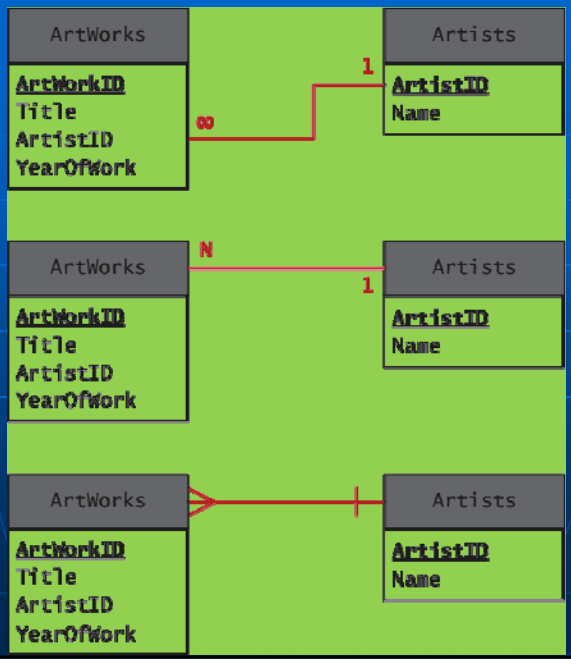

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Figure 11.7 Implementing a many-to-many relationship

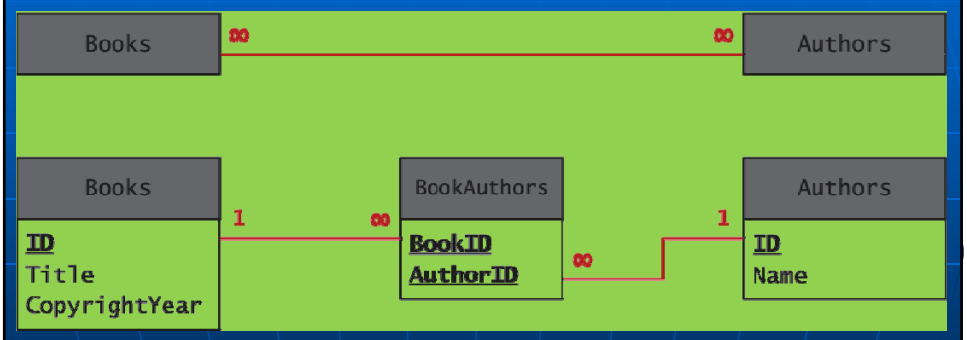

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Figure 11.8 Database in the Enterprise

- SQL Databases
  - Financial and order management systems
  - Manufacturing system
  - Point of sales
  - Groupware and file servers
- Examples
  - DB2
  - Oracle DB
  - Microsoft SQL
  - MySQL
  - PostgreSQL
  - etc

Figure 11.8 Database in the Enterprise

- Non-SQL Databases
  - Documentation oriented, No relationship among stored data
  - Optimized to retrieve data using simple Key-Value syntax similar to PHP associative arrays
  - May be very large data sets
  - Examples:
    - Web server logs, geographical data
    - Twitter posted information
  - Non-SQL DB examples:
    - Couch DB, monoDB
    - Amazon SimpleDB , Google's Big Table

Figure 11.8 Database in the Enterprise

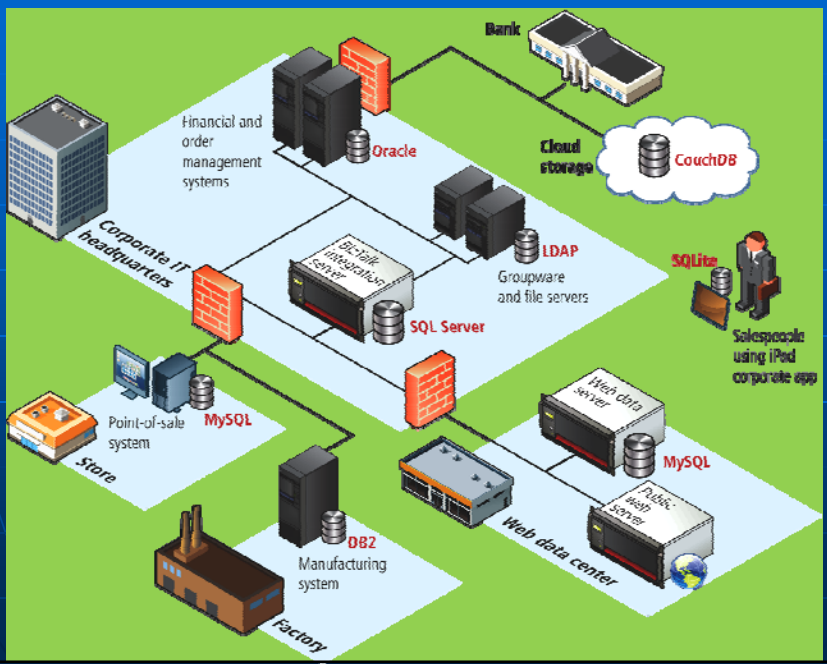
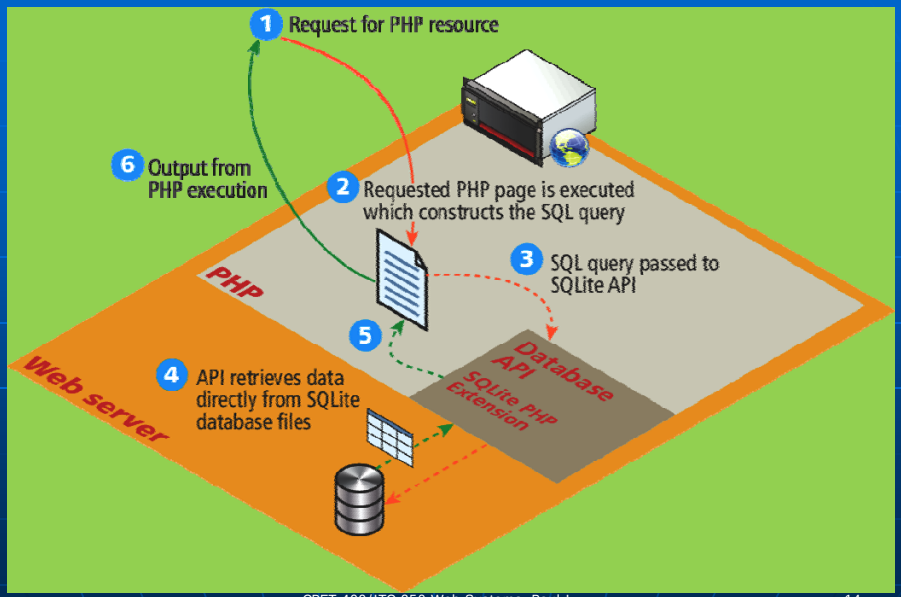


Figure 11.9 SQLite



SQL

- SELECT statement – retrieve data from the database
- INSERT statement – add new records
- UPDATE statement – update existing records
- DELETE statement – delete existing records

Figure 11.10 SQL SELECT from a single table

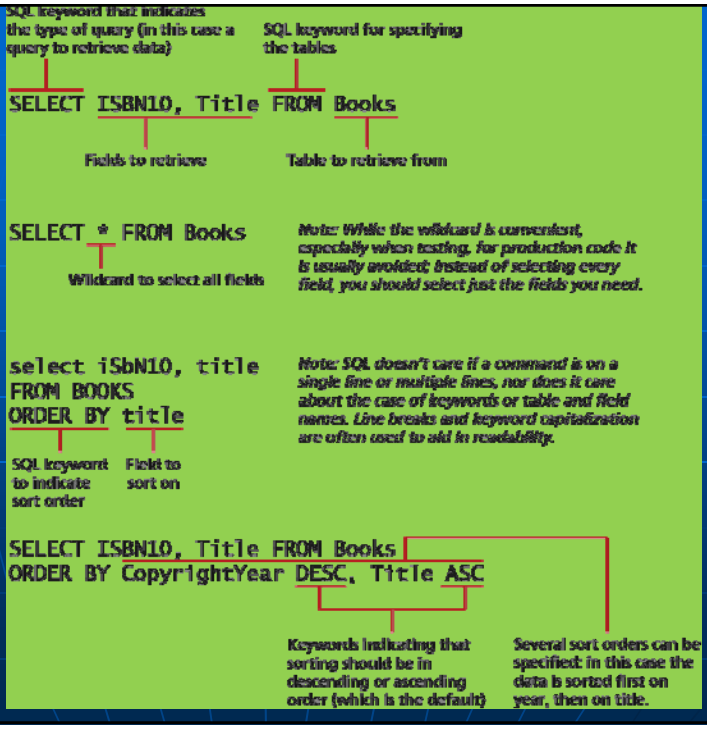


Figure 11.12 Using the WHERE clause

```
SELECT isbn10, title FROM books
WHERE copyrightYear > 2010
```

SQL keyword that indicates to return only those records whose data matches the criteria expression

Expressions take form: field *operator* value

```
SELECT isbn10, title FROM books
WHERE category = 'Math' AND copyrightYear = 2014
```

Comparisons with strings require string literals (single or double quote)

Figure 11.12 SQL SELECT from multiple table using an INNER JOINT

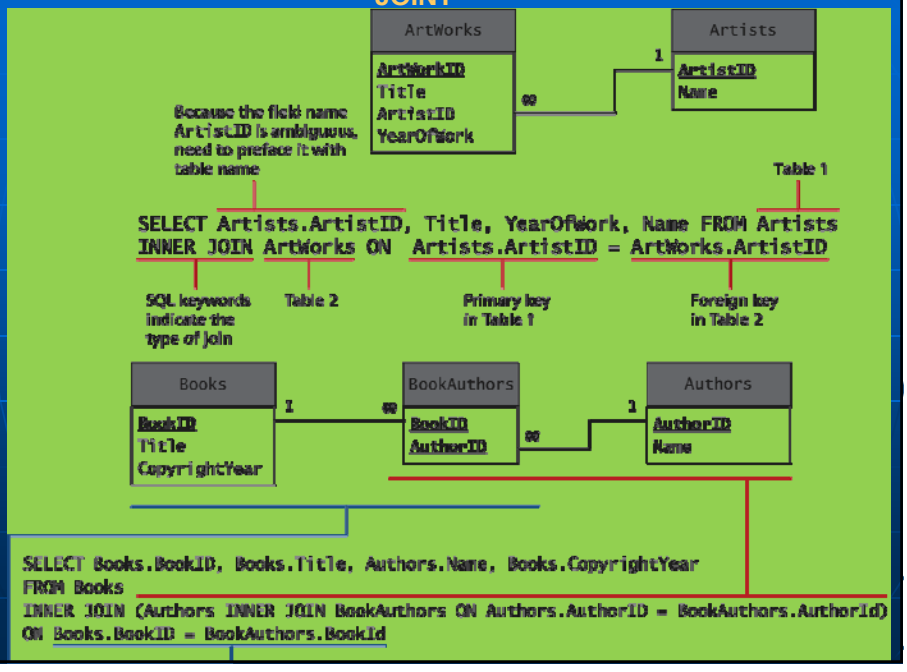


Figure 11.13 Using GROUP BY with aggregate functions

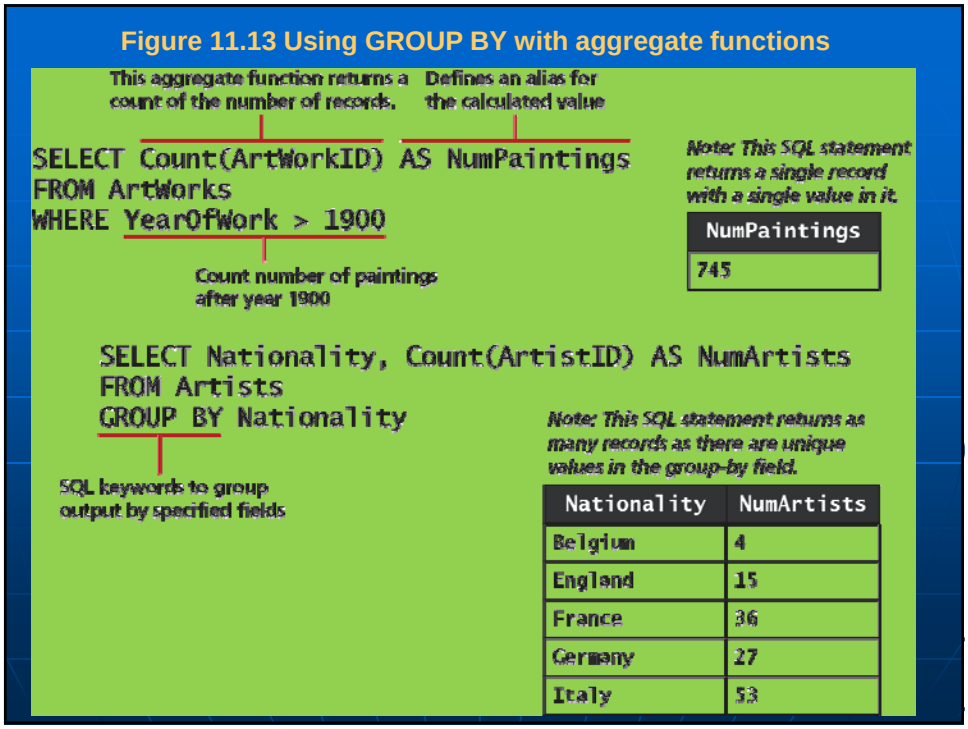


Figure 11.14 SQL INSERT, UPDATE, and DELETE

Local and Distributed Transactions

- Transactions
  - A transaction refers to a sequence of steps that are treated as a single unit, and provide a way to gracefully handle errors and keep your data properly consistent when error occur.
  - Local Transactions: transactions handled by the DBMS
  - Distributed Transactions: transactions involve multiple hosts, several of which we may have no control over.

Local and Distributed Transactions

- Web Storefront Example
  - A customer: Checkout, Verified address, entered credit card, select shipping option
  - Click Pay for Order Button, what happen?

1. Write order records to the website database.
2. Check credit card service to see if payment is accepted.
3. If payment is accepted, send message to legacy ordering system.
4. Remove purchased item from warehouse inventory table and added to the order shipped table.
5. Send message to shipping provider

Local and Distributed Transactions

- Web Storefront Example
- Distributed Transactions
  - Local database writes
  - External credit car processor
  - External legacy ordering system
  - External shipping systems

Local Transactions

- Through SQL Statements or API calls
  - START TRACSACTION
  - COMMIT
  - ROLLBACK

- LISTING 11.1

```
START TRANSACTION
INSERT INTO orders …
INSERT orderDetails …
UPDATE inventory …
COMMIT
```

Figure 11.15 Distributed transaction processing