CS489:
Applied Software Development

Lesson 5:
Database Design and Development

Wholeness

- In this lesson, we will learn the concepts, principles and techniques for how to create suitable Database design and how to implement it for an enterprise application software solution.
- A Database is an organized, structured collection of data, useful to an enterprise.
- Science of Consciousness: *Order is present everywhere.*

1.1 Overview

Meaning of essentials terms:

- Data: is facts or figures collected together through observation or measurement, for the purpose of referencing or analysis.
- Information: is what is derived, when data has been made to become meaningful or useful through processing, interpreting or presenting.
- Database: is a structured collection of related data.
- Database Management system (DBMS): is software that manages and controls access to and operation of, a database.

1.1 Overview

- Database Application: is any computer program that interacts with a database at some point during its execution.
- Database system: is the collection of application programs that interact with the database, together with the DBMS and the database itself.

Note: All access to the Database is through the DBMS.

1.1 Overview

Why study Databases?

- The Database system is perhaps the most important development in the field of software engineering.
- A Database typically forms the underlying framework of the information system on which most organizations operate.
- The importance of database systems keeps increasing, driven by significant developments in hardware capability/capacity and data communication and the emergence of the Internet, eCommerce, Business Intelligence and network/grid computing.

1.1 Overview

- Some areas of application of Database systems:
  - Purchases from the supermarket.
  - Online purchases using your credit card.
  - Booking a vacation with a travel agency
  - Using the local/school library
  - Taking out insurance
  - Finding and watch a movie
  - Conducting online or traditional banking
  - Studying at a college or university
  - Using the Internet/World-wide websites

Main Point 1

- It is important that we understand what Databases are, their usefulness within the context of an overall enterprise information system and the related terminologies surrounding the study of Database systems. *Knowledge is different in different states of consciousness.*

Database technologies

- Relational Databases – SQL:
  - Relational model – relations (tables – columns & rows)
  - Structured Query Language (SQL)
  - Examples: MySQL, PostgreSQL, Oracle, MSSQL etc.
- Non-Relational Databases:
  - Document databases e.g. MongoDB, Cassandra etc.
  - Graph databases e.g. neo4j
  - Etc.

1.10 Introduction to MySQL

- MySQL is an open-source relational database management system (RDBMS)
- In this course we will be studying and implementing the various Database Management system concepts and techniques using a MySQL instance
- Therefore, you are required to download and install a MySQL Database server on your local machine (if you do not already have it).*
- MySQL can be obtained from https://dev.mysql.com/

***Note: A demonstration of how to obtain and install MySQL will be given.**

Data Modeling & Database Design

- Conceptual database model
  - Entity-Relationship model (E-R diagram)
  - Not tied to any specific RDBMS, yet
- Physical data model
  - Implementation of the E-R model on to a physical RDBMS using DB tables, views, stored procedures etc.
  - Includes RDBMS-specific data types and constructs

Implementing Relational Database

- Two possible approaches:
  - Bottom-up (a.k.a Database-First approach)
    - The Database objects (tables, views etc.) are created first, before the application code is written
    - This can be down either Interactively, using a Database client tool, such as MySQL Workbench or SQL Script
  - Top-down (a.k.a Code-First approach)
    - The Domain Entity classes are first coded in the application
    - And then an Object-Relational Mapping framework/tool is used to generate the corresponding Database objects.

Database Design and Implementation Demo

- **Exercise**:
  - Create an E-R model for the City Library system. You may draw the ER diagram using a graphical drawing tool on computer or draw by hand.
  - Implement the model on a physical Relational database. Use any RDBMS of your choice e.g. MySQL

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