Introduction

Basic Definitions

- The term **data** refers to an **individual unit of information**.
- The term **record** refers to a **grouping of data**.
- The term **database** refers to an **organized collection of records**.
- **Databases** are **managed** by **software systems** known as **Database Management Systems (DBMS)**.
  - These systems allow **users** to **manage the database along with the data stored within the database**.

Typical DBMS Functionality

- **Database Management Systems** provide a **data model** that is used to **define the layout of databases**.
  - **Data models** are composed of **data types, structures, and constraints**.
  - There are a large amount of data models, some of the more popular ones include: the relational model, the document model, and the network model.
- **Database Management Systems** provide a **Data Definition Language (DDL)**, which is a **domain-specific language** that allows **users** to **create, read, update, and delete** the **structure (schema)** of a **database**.
- **Database Management Systems** provide a **Data Manipulation Language (DML)**, which is a **domain-specific language** that allows **users** to **create, read, update, and delete** the **records** stored within the **databases**.
- The **DDL and DML** are sometimes **combined** into a **single-language**.
- **Database Management Systems** allow **concurrent processing** and **sharing of data** to **external users and external applications**.
  - This is done with the use of **Integrity Constraints (IC)** and **transactions** to ensure the **data** is always **valid and consistent**.
- **Databases Management Systems** provide **security tools** that **prevent unauthorized access** to the **data** stored within the **databases**.
- **Database Management Systems** provide **maintenance tools** that help administrators **maintain databases** over the **lifetime** of **applications**.

Characteristics of Databases

- **Databases** are naturally **self-describing**. The **Database Management System** stores a **catalog of meta-data** that describes **databases** (types, constraints, etc).
- **Databases** provide a **layer of insulation** between **external applications** that **access the same datasets**.
  - This is know as **program-data independence**; it is made possible by the **three-level architecture design** that databases use.
- The **physical storage** of **data** is **abstracted** from **users and applications**; they only know about the **external view** of the **database**.

- **Users and programs** refer to the **data model constructs** rather than the **internal storage details**.
- The **Database Management System** supports **multiple-views** of **databases** that are based on a **per-user / per-application permission system**.
- When **users and applications** are interacting with the **Database Management System**, they do so without having to be **concerned with interfering with each other**, the **DBMS automatically handles this**.

Database Advantages Over the File System

- **Databases store all data in a single place**, so there is **no need for redundant copies** of the **dataset**.
- **Databases** support **complex, fine-grained, access-controls**.
- **Databases** support **non-primitive storage types**.
- **Databases** automatically **optimize queries for you**.
- **Databases** support **Integrity Constraints**.

Types of Users

- Database Administrators (DBA).
- Database Designers.
- End-Users.
- Programmers.
- Developers of the DBMS.