DATABASE SYSTEMS
IS211

Dr. Noha Nagy

Lecture 1

Database Concepts

Welcome!

- Instructor: Dr. Noha Nagy
  - Office: New Building, second floor, next to IS TA's room
  - Email: n.nagy@fci-cu.edu.eg
- Homepage: blackboard

Lecture Norms

- Mobile Silent
- No side talks
- No Late entry [10 Minutes only]
- Mask

Textbook

- Fundamental of Database Systems, Ramez Elmasri, Shamkant Navathe, Addison-Wesley; th7 edition.

Course Mechanics

- Evaluation:
  - Final (60)
  - Midterm (20)
  - Individual assignments in labs(10)
  - Project (10)
    - 3 to 5 students
  - Popup Quizzes and participation

What you expect to study in the course?

Course Overview

- Introduction to Database Systems
  - Theory and the use of relational database
- Focus on:
  - Relational Model
  - SQL (Structured Query Language)
  - Relational Algebra
  - The ER(Entity Relationship)Model
  - Normalization

What is Meant by Data and Information?

Data	Student
20120023	ID: 20120023
20	Age: 20
CS	Department: CS

What is Meant by Data and Information?

- Data
  - Raw facts
  - No context
- Information
  - Data with context
  - Processed data

Accurate, relevant, and timely information is key to good decision making

Good decision making is the key to survival in a global environment

Data: A Resource

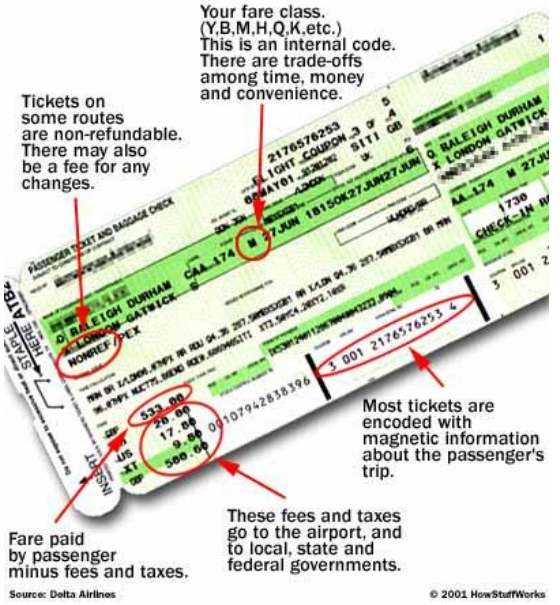
- The Success of an organization depends on efficient use of its resources:
  - Buildings, factories, equipment
  - Technical know-how
  - Human resources
  - *Data*
- *Data*: An important organizational resource

Why we need a Database?

- What kind of data we need to store?
- Examples on DB applications
  - Hospital system
  - Business clients
  - Car registration
  - Airline reservation
  - Supermarket
  - Hotel reservation

Databases Everywhere

amazon.com



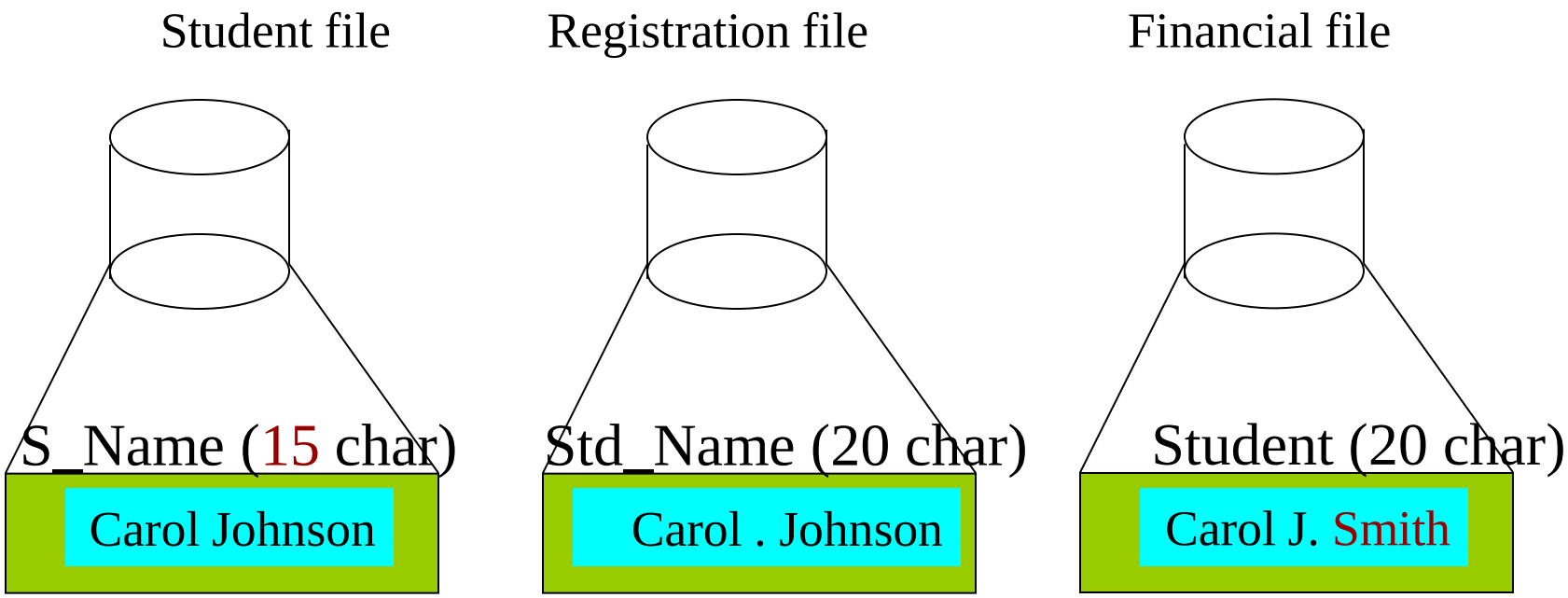
Why should we care about databases?

- We are in a data driven world
- “Big Data” is supposed to change the mode of operation for almost every single field
- Science, technology, Healthcare, Business

- We use DB systems to store data.

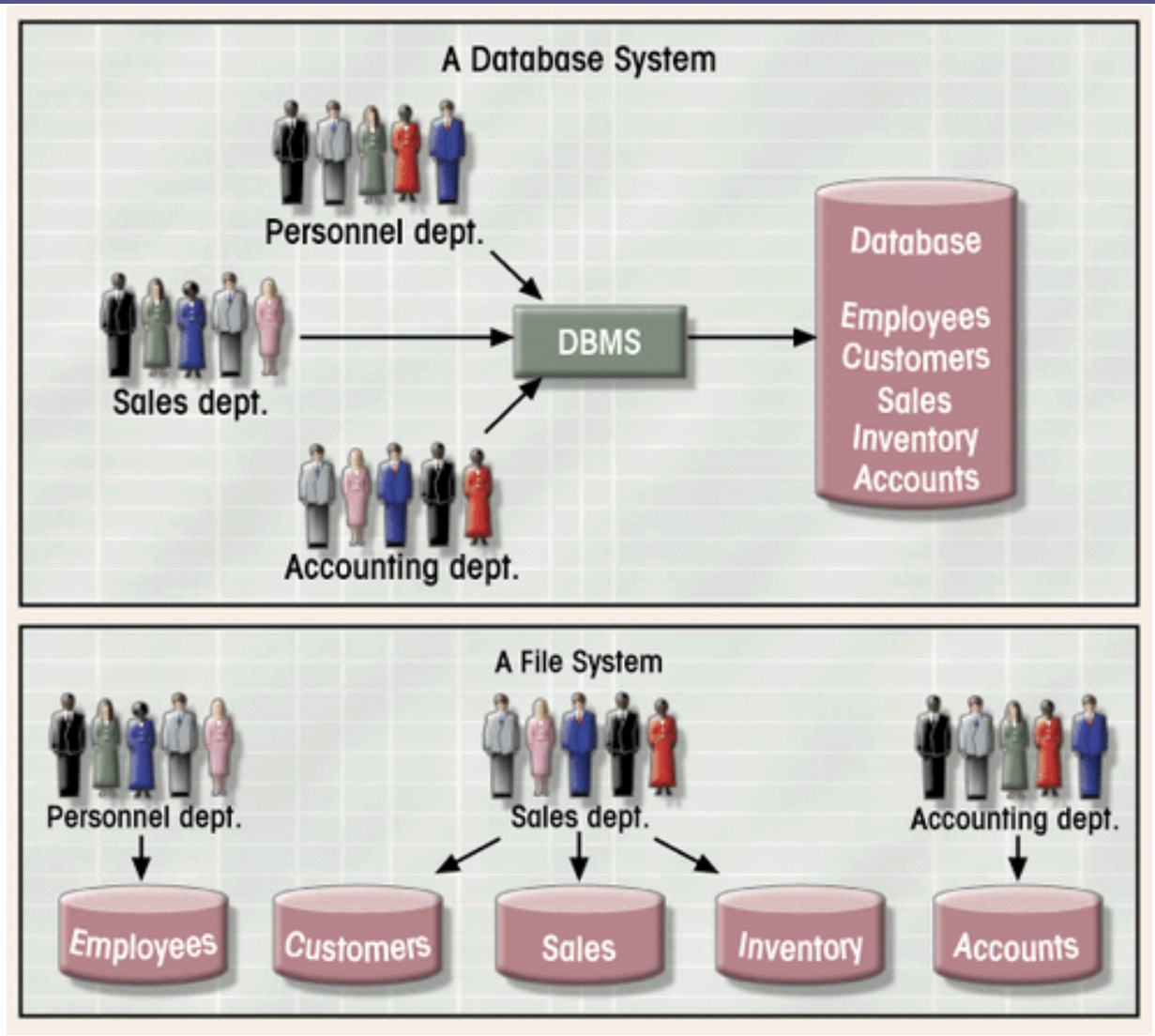
Why not to use file system?

File System: Problem Case



- inconsistent field name, field size
- inconsistent data values
- data duplication

Database System vs. File System



File Systems

- Problems
  - Duplication
    - same data may be stored in multiple files
  - Inconsistency
    - same data may be stored by different names in different format
  - Rigidity
    - requires customized programming to implement any changes
    - cannot do ad-hoc queries

- Implications
  - Waste of space
  - Data inaccuracies
  - High overhead of data manipulation and maintenance

DB Systems

- It answers queries fast
  - Q1: among a set of log pages, find those pages written by Tramp after 2019
  - Among a set of employers, increase the salary by 20% for those who have worked longer than 4 years
- Queries from multiple users can execute concurrently without affecting each other.
- It recovers from crash
  - No corrupted data after restart

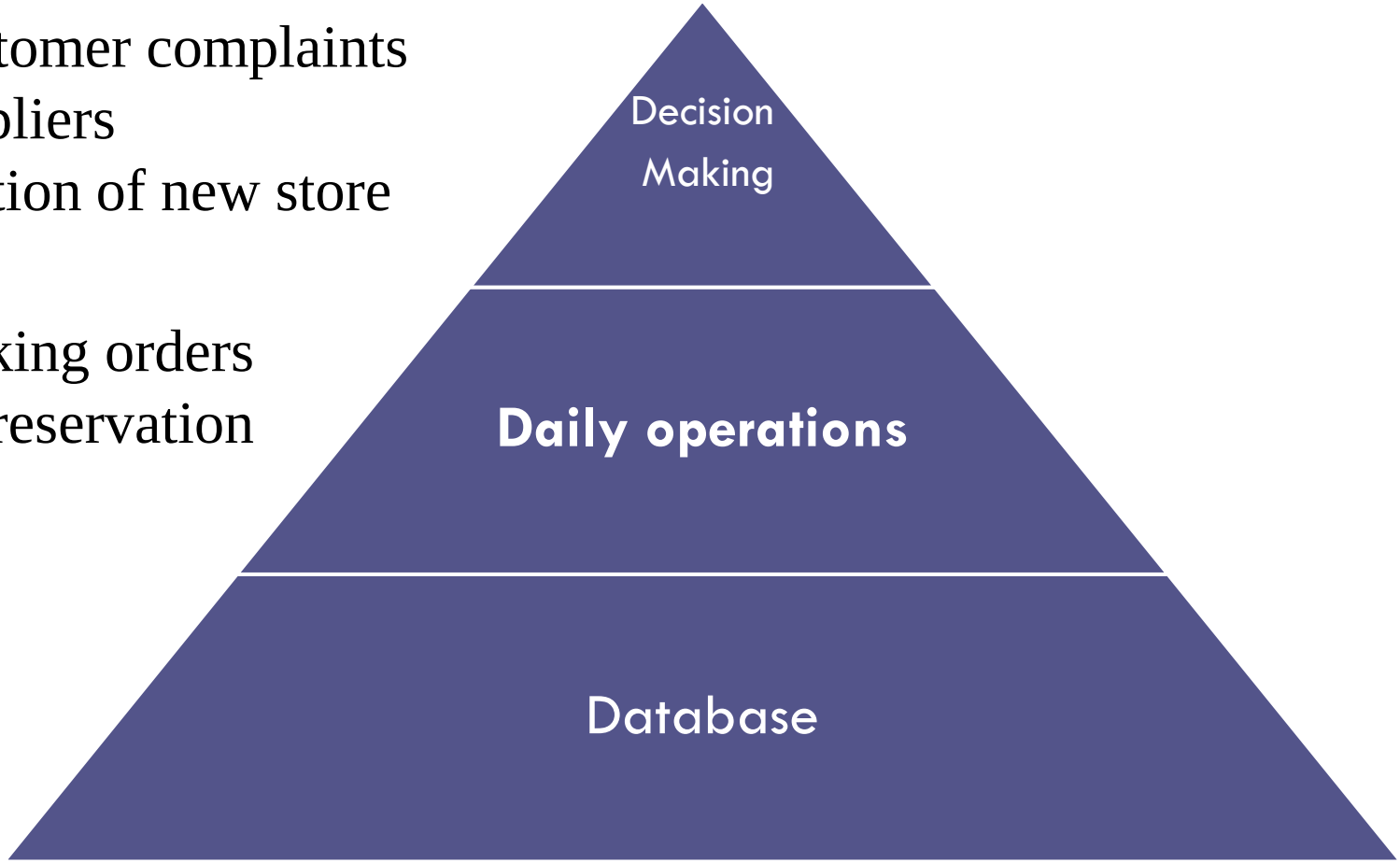
File System Vs Databases

- Small Systems
- Often single user
- Simple structure
- Isolated data
- Redundant data
- Relatively cheap
- Less secure

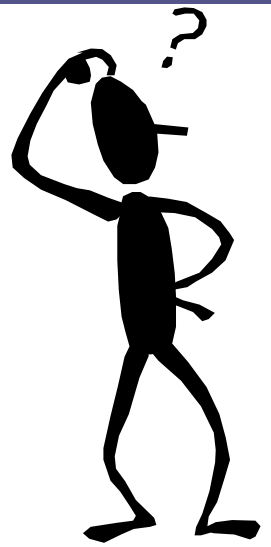
- Large systems
- Multiple users
- Complex structure
- Shared data
- Reduced redundancy
- Relatively expensive
- More secure using views

Resolving customer complaints
Choosing suppliers
Deciding location of new store

Taking orders
Making reservation



Definitions

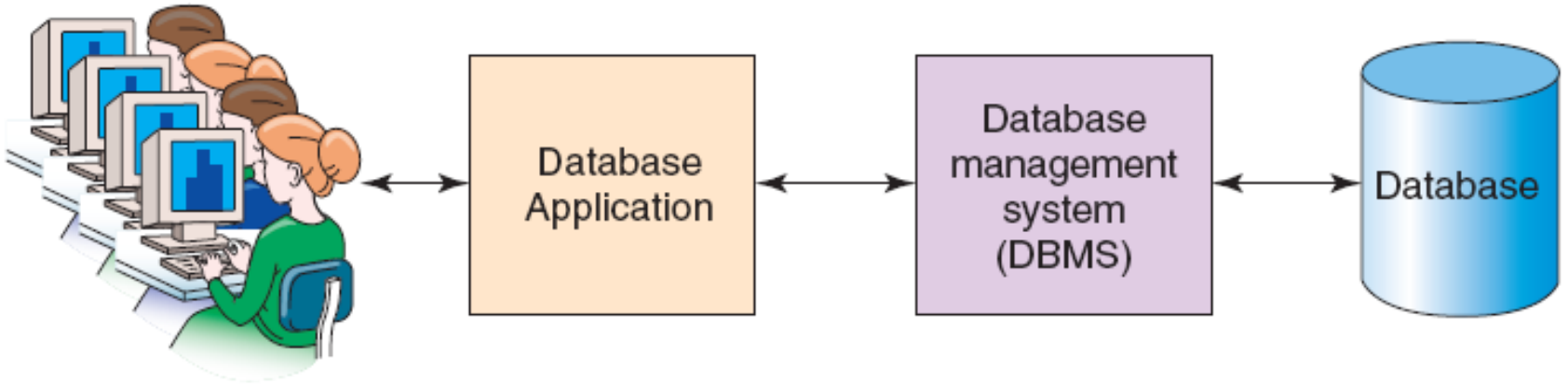


- **Database:**
  - Collection of related data.
  - A database contains a model of something!

- **A Database Management System (DBMS):** is a software system designed to store, manage and facilitate access to the database

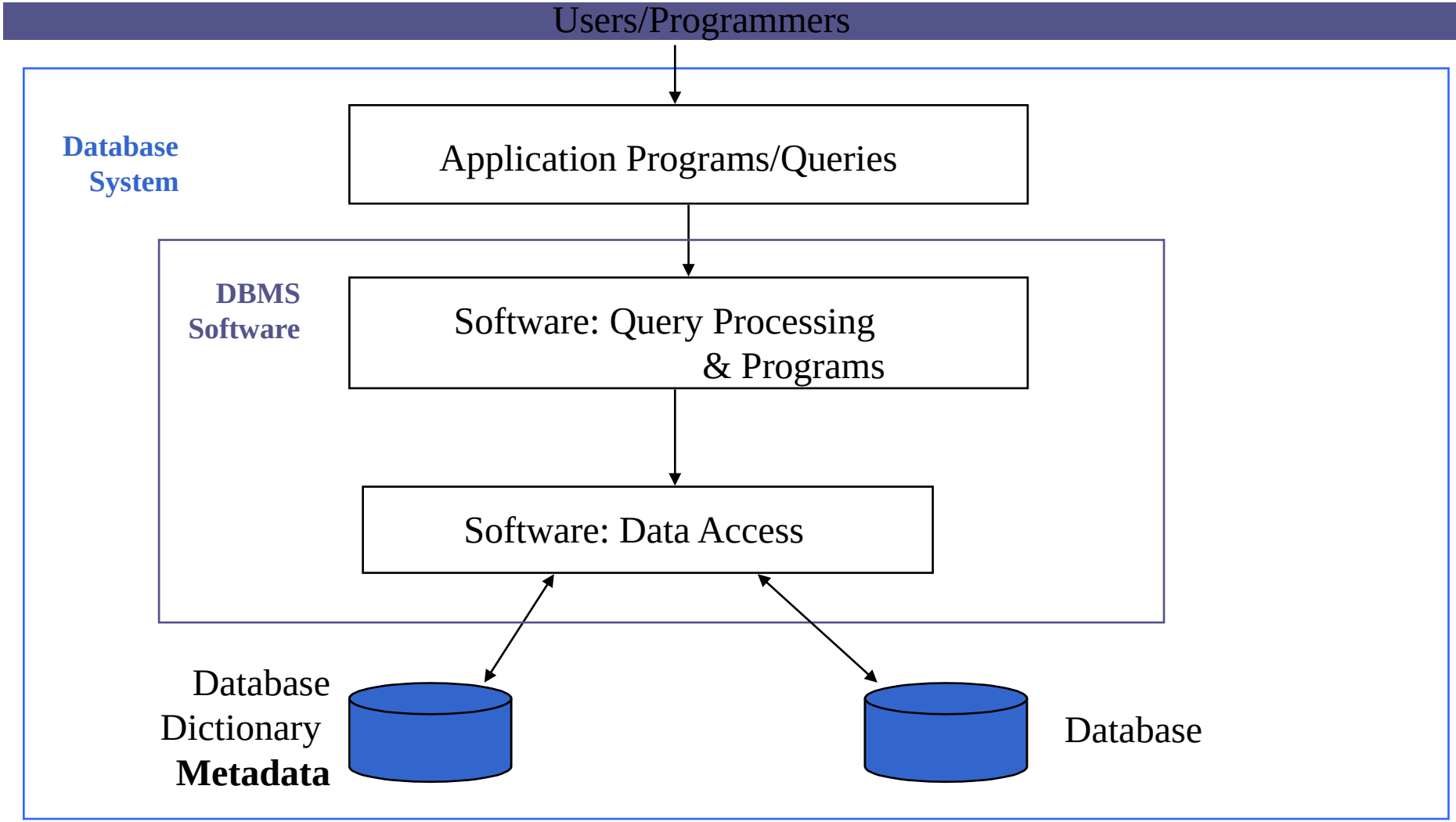
- **Database/Application Program:** A computer program that interacts with the database through the DBMS

Components of a Database System

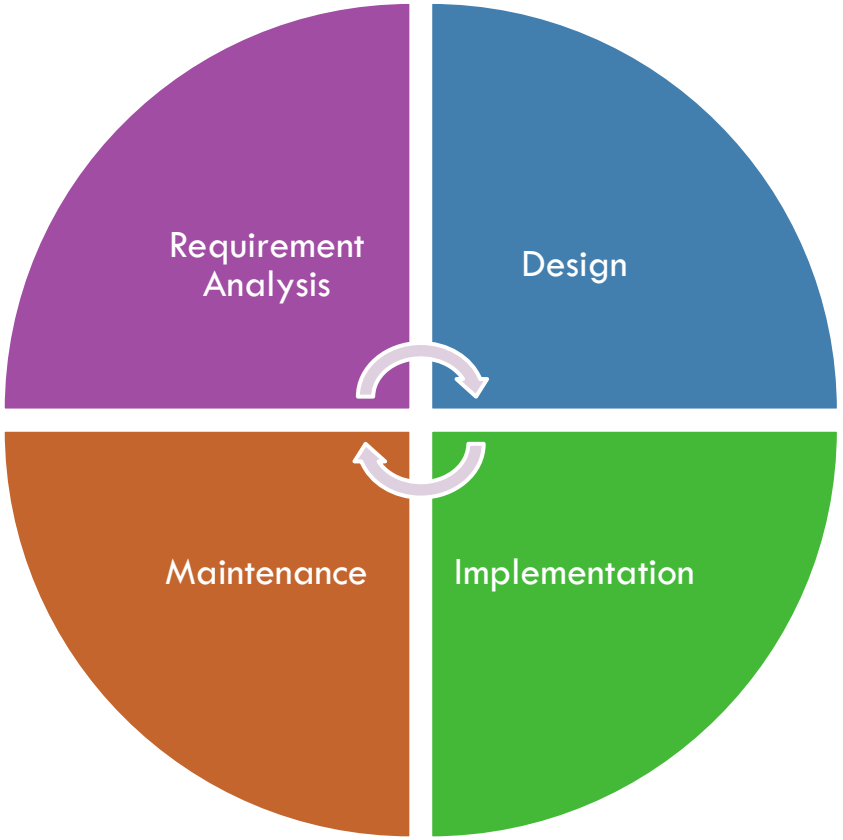


Query Engine
Query optimizer
Storage management
Transaction management

Database System Environment



Database Systems Lifecycle



Database Players

- **DB Administrator DBA**
  - Access authorization, coordination & monitoring database usage, problem determination, performance tuning etc
- **Designers**
  - choose the appropriate structures to represent & store the data
- **System analysts & application programmers**
- **Users**

Database States

- **Empty State:** DB is empty when we first define the DB schema
- **Initial State:** DB is first populated or loaded with data
- **Current State:** snapshot in time

Example of Relational DB Management System Products

- Oracle
- Sybase
- Informix (Unix)
- DB2, SQL/DS (IBM)
- Access, SQL Server (Microsoft)

Database Models

A Database model is a collection of concepts that can be used to define the DB structure (data items, types, relationships, operations, behaviors and constraints)

- Relational model
- Hierarchical & Network models
- Object Oriented models
- Distributed models
- NoSQL models
- And Others

Next Relational Model