Database Systems

Lecture #1 : Introduction

General Information

- Ext #: 144
- Email: shoaib.khan@nu.edu.pk

Prerequisites

- Data Structures

Grading Scheme

- Quizzes – 10% -
- Homeworks – 10%
- Project – 20%
- Midterm1 – 10%
- Midterm2 – 10%
- Final – 50%

Grading Policy

- All deadlines will be hard.

Academic Dishonesty

- Any form of cheating on exams/homeworks/quizzes is subject to serious penalty.

Reference Books

- Fundamentals of Database Systems by Elmasri & Navathe
- Database Systems, A Practical Approach by Connolly & Begg

Contents

- Introduction to Databases
- Basic Concepts and Architecture
- Relational Model
- Relational Algebra
- SQL
- Data Manipulation, Data Definition
- ER Modeling
- Functional Dependencies
- Normalization
- Relational Database Design
- Conceptual, Logical & Physical Database Design
- Record Storage and Primary File Organization

Contents

- Index Structures for Files
- Query Processing and Optimizations
- Transaction Processing
- Concurrency Control
- Recovery Techniques
- Data Mining Concepts
- Data Warehousing Concepts

Basic Concepts

Basic Definitions

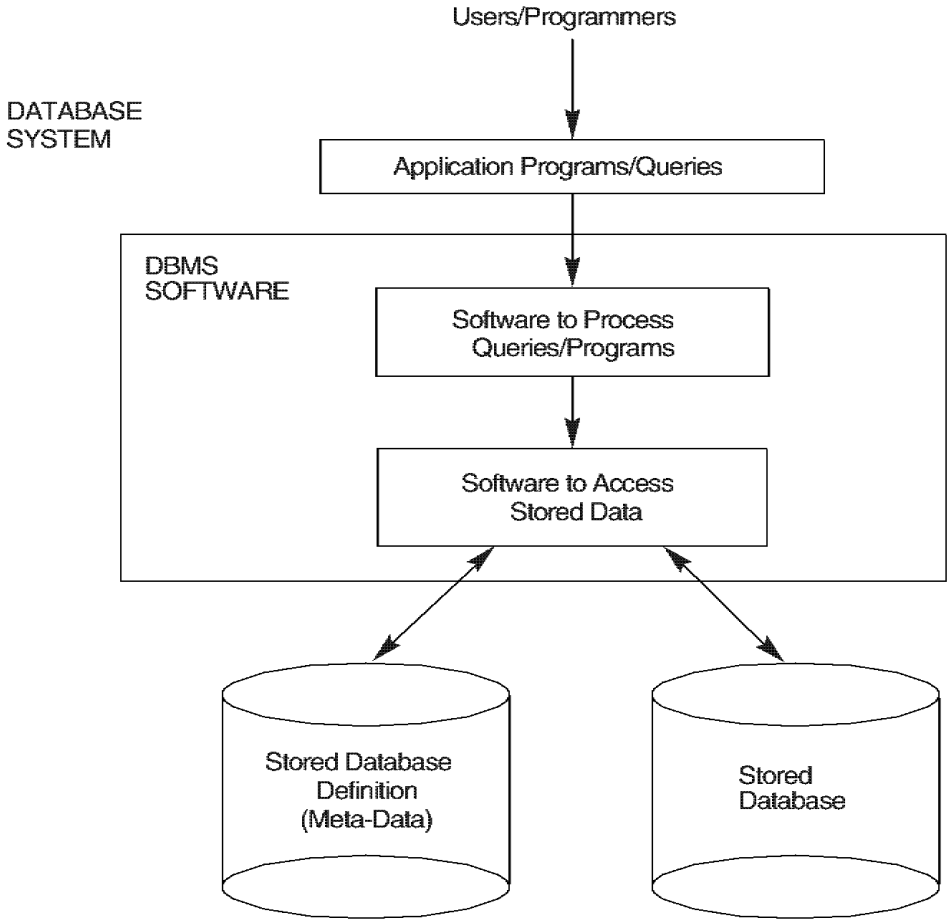
- **Database**: A collection of related data.
- **Data**: Known facts that can be recorded and have an implicit meaning.
- **Database Management System (DBMS)**: A software package/ system to facilitate the creation and maintenance of a computerized database.
- Examples:
  - Oracle
  - DB2 (IBM)
  - MS SQL Server
  - MS Access
  - Ingres
  - PostgreSQL
  - MySQL

- **Database System**: The DBMS software together with the data itself. Sometimes, the applications are also included.

Databases

- Library catalogues
- Medical records
- Bank accounts
- Stock control
- Personnel systems
- Product catalogues
- Telephone directories
- Train timetables
- Airline bookings
- Credit card details
- Student records
- Customer histories
- Stock market prices
- and so on…

Simplified Database Systems Environment



Database Example

STUDENT	Name	StudentNumber	Class	Major
	Smith	17	1	CS
	Brown	8	2	CS

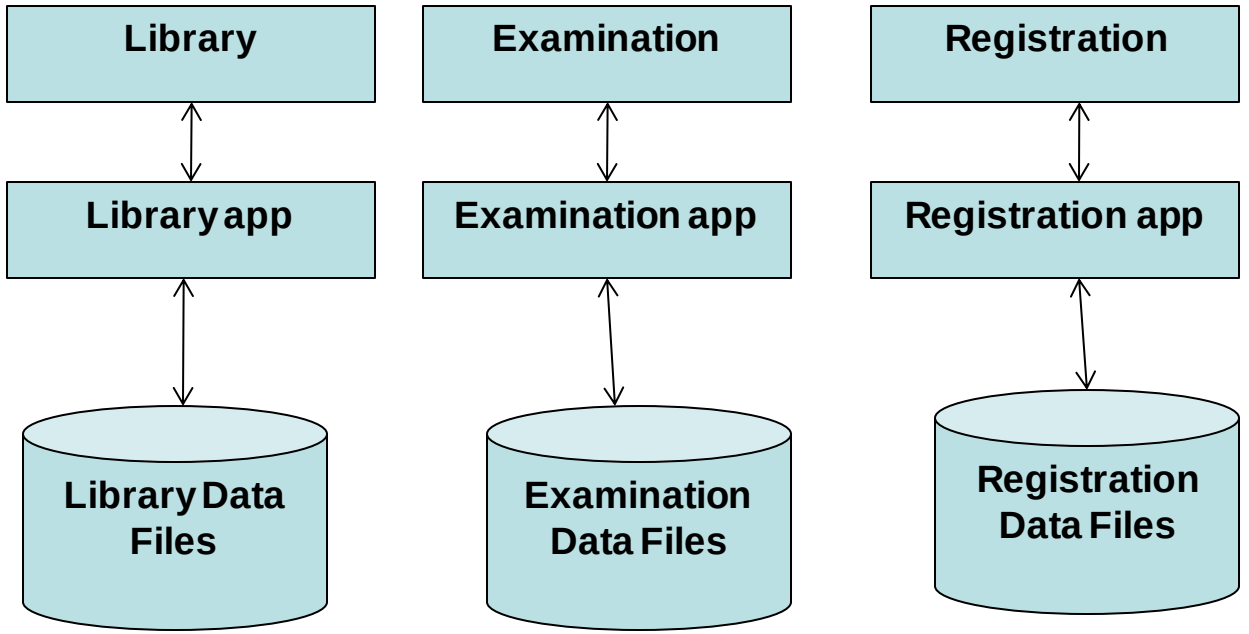
COURSE	CourseName	CourseNumber	CreditHours	Department
	Intro to Computer Science	CS1310	4	CS
	Data Structures	CS3320	4	CS
	Discrete Mathematics	MATH2410	3	MATH
	Database	CS3380	3	CS

SECTION	SectionIdentifier	CourseNumber	Semester	Year	Instructor
	85	MATH2410	Fall	98	King
	92	CS1310	Fall	98	Anderson
	102	CS3320	Spring	99	Knuth
	112	MATH2410	Fall	99	Chang
	119	CS1310	Fall	99	Anderson
	135	CS3380	Fall	99	Stone

GRADE_REPORT	StudentNumber	SectionIdentifier	Grade
	17	112	B
	17	119	C
	8	85	A
	8	92	A
	8	102	B
	8	135	A

PREREQUISITE	CourseNumber	PrerequisiteNumber
	CS3380	CS3320
	CS3380	MATH2410
	CS3320	CS1310

File Processing Systems

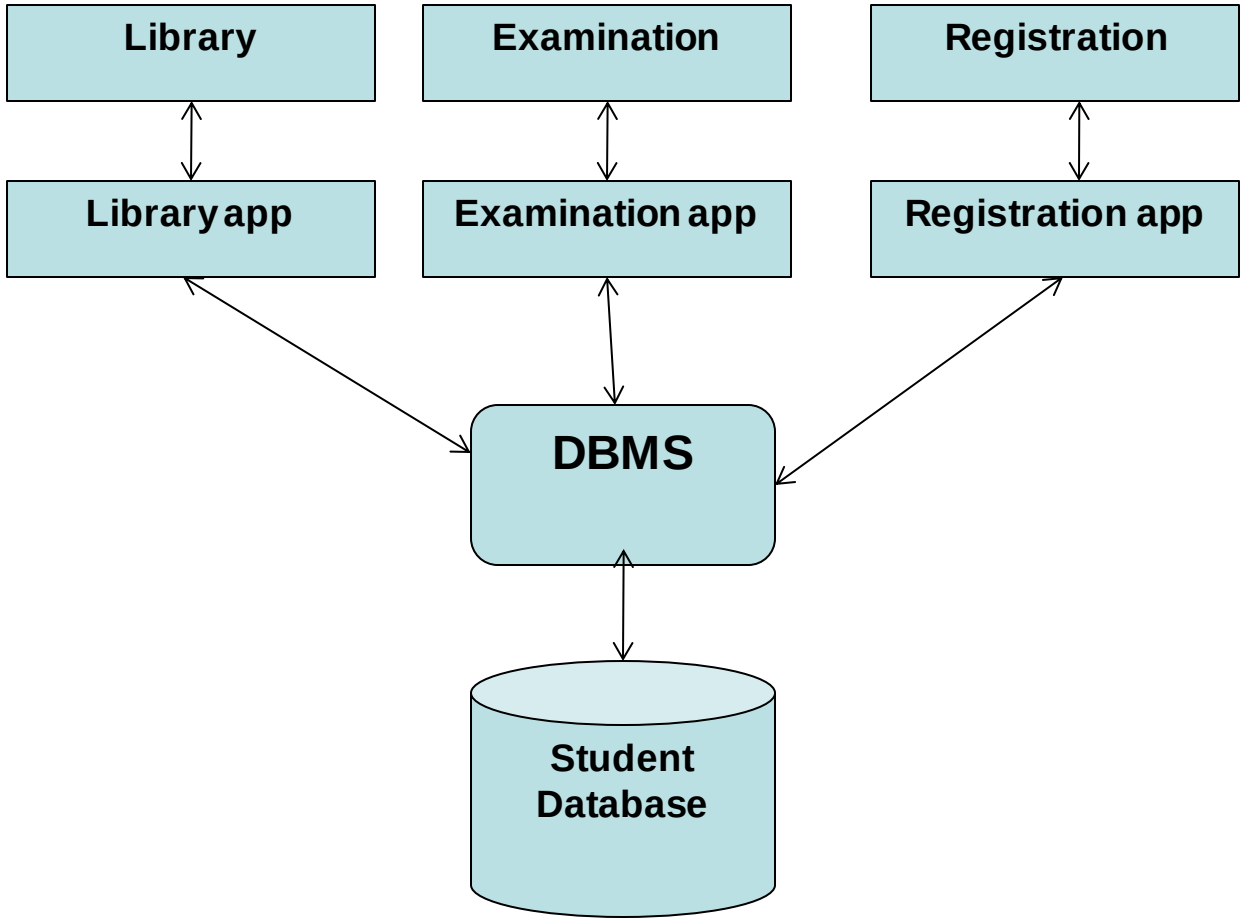


Why Database System..?

Problems with regular file system

- **Separation and isolation of data**
- **Duplication of data**
- **Data and Program interdependence**
- **Incompatible file formats**

Database System Environment



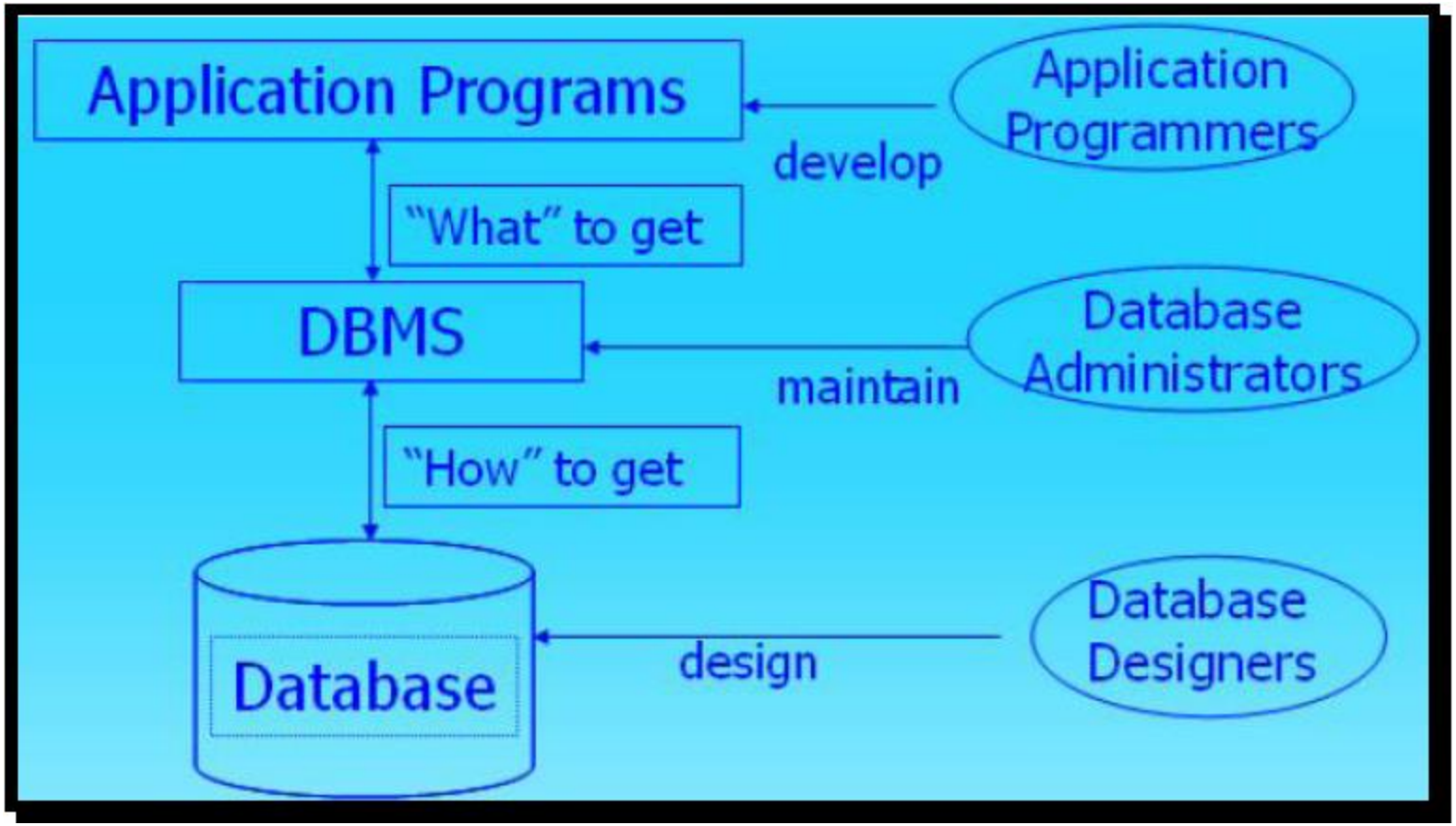
Advantages of Database System

- Shared data
- Reduce redundancy
- Help avoid inconsistencies
- Enforce integrity
- Crash recovery
- Data independence

Why not to use a DBMS?

- **Complexity**
- **Cost of DBMS**
- **Additional hardware costs**
- **Cost of conversion**

Application Programmers, Administrators and Designers

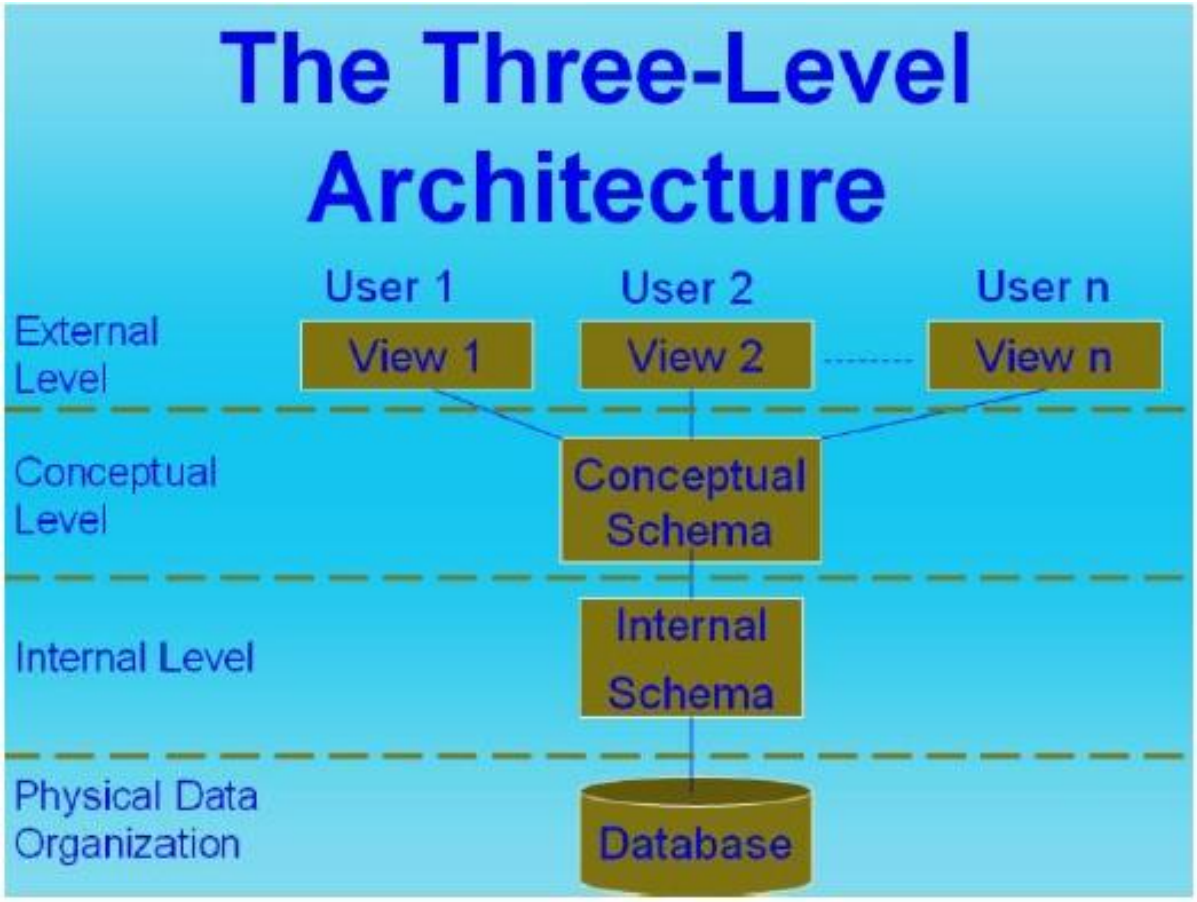


ANSI/SPARC Architecture

- ANSI - American National Standards Institute
- SPARC - Standards Planning and Requirements Committee
- 1975 - proposed a framework for DBs

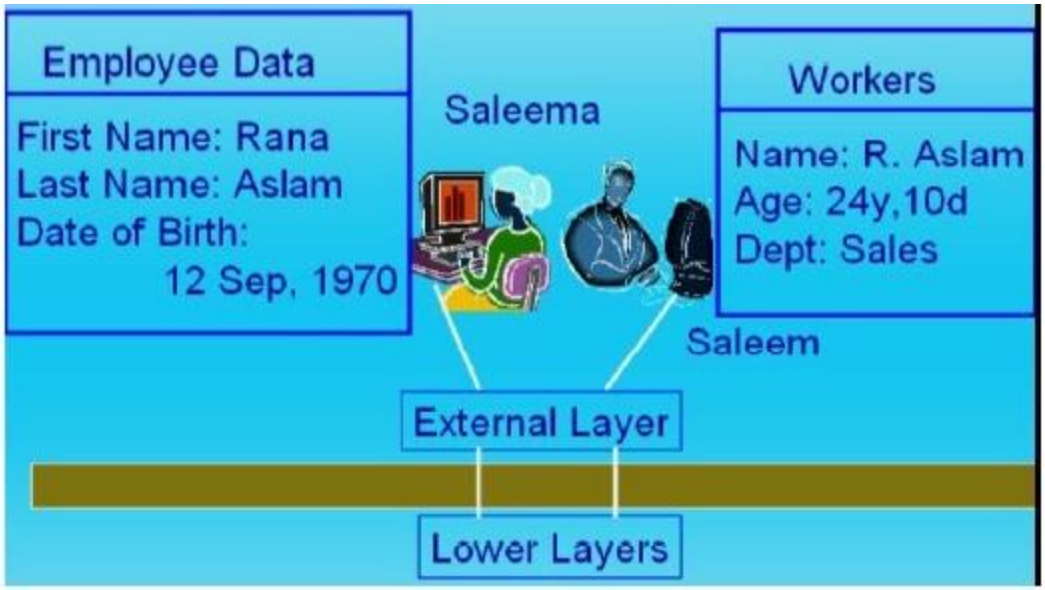
- A three-level architecture
  - Internal level
  - Conceptual level
  - External level

ANSI/SPARC Architecture



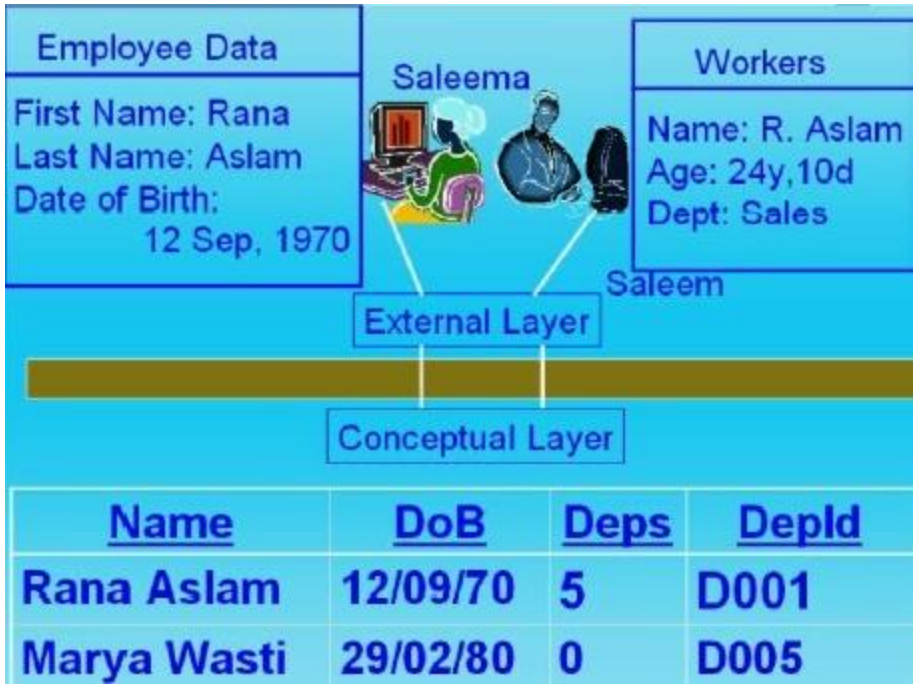
External Level

- Provides a view of the database tailored to a user
  - Parts of the data may be hidden
  - Data is presented in a useful form
  - Used by end users



Conceptual Level

- Deals with the organisation of the data as a whole
  - Abstractions are used to remove unnecessary details of the internal level



Internal Level

- Deals with physical storage of data
  - Structure of records on disk - files, pages, blocks

ANSI/SPARC Architecture