CSE2DBF – CSE4DBF

Introduction to Database Technology

Why use a Database?

Imagine owning a business, say a DVD rental agency, what sort of information, that is data, would you like to keep?

- Current stock: titles, manufacturers
- Customer details
- Current loans, past loans, hold requests (who by?, what of?)
- Staff details
- Suppliers: DVDs, snacks
- Accounts, income, outgoings, overdue fines

How would you manage this information?

Create a database that stores the information and tracks the business transactions.

Why use a Database?

- So, you have a database.

  What questions might you ask the database?

  - How many DVDs are overdue?
  - Do we have enough copies of The Hobbits?
  - Can we pay the staff this week?
  - Which customers haven't been in for a while?
    - We should send them this special offer.

  These questions can be translated into queries, that is, written in a form that a database system can understand.

Why use a Database?

- To have a good database:

  As the business owner, you need to have clear idea about your business, in particular what information that you need to store (requirements).

  Information is described by a model, which (as for queries) should be written in a language the database understands.

  The stored information should be correct and sensible.

Why use a Database?

- Database usage:
    - Retail information.
    - Hospital records: treatments available, per-patient information, per-doctor information, ward and bed availability, billing data.
    - Mass storage:
        - Weather records: thousands of sites, many observations per day, many values per observation, many years of records.
        - Satellite images.
        - Telephone records: who to, who from, what route, how long, what costing?

- Databases provide a uniform framework for handling these very different activities.

What is a Database?

" *A shared collection of related data designed to meet the information needs of an organisation.*"

Database vs Database System

A Database is:

- A representation of some aspect of the real world; or perhaps, a collection of data elements (facts) representing real world information.
- Logically coherent and internally consistent.
- Designed, built, and populated with data for a specific purpose.

A Database System is:

- A software system for managing databases: definition and creation, population, querying.

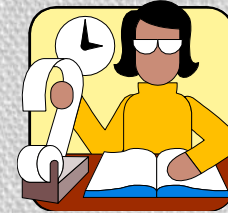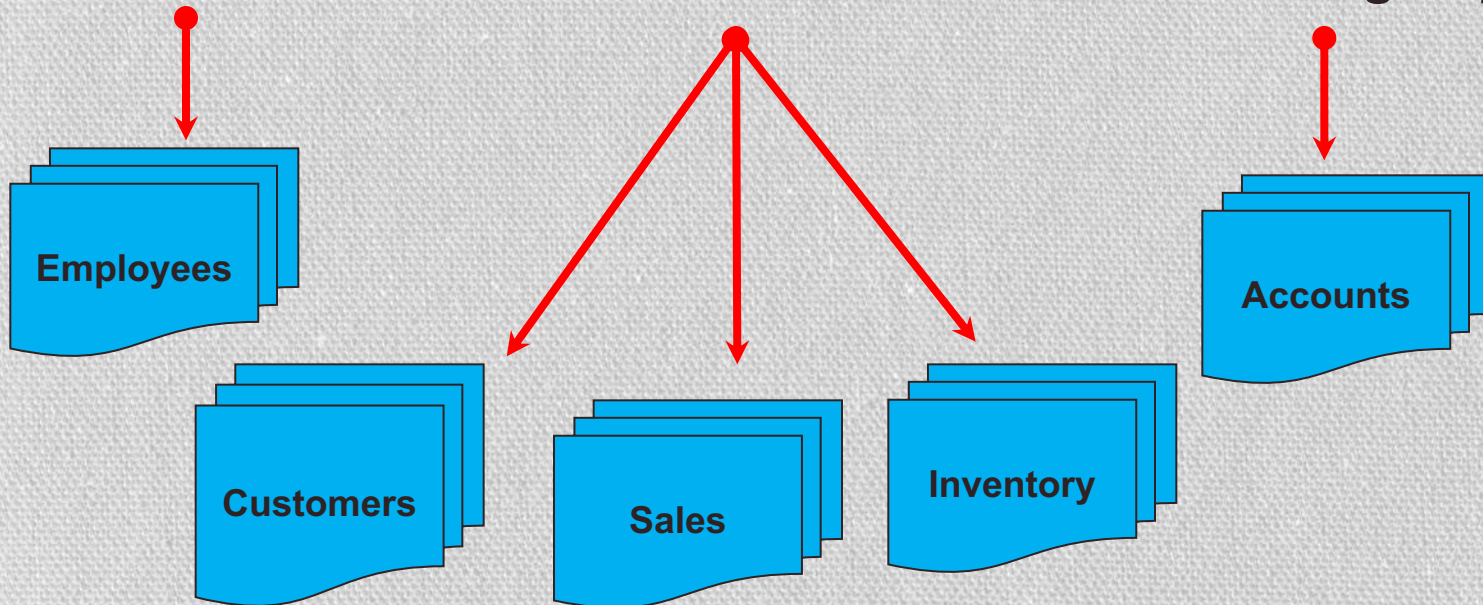These terms are used somewhat interchangeably - don't get confused.

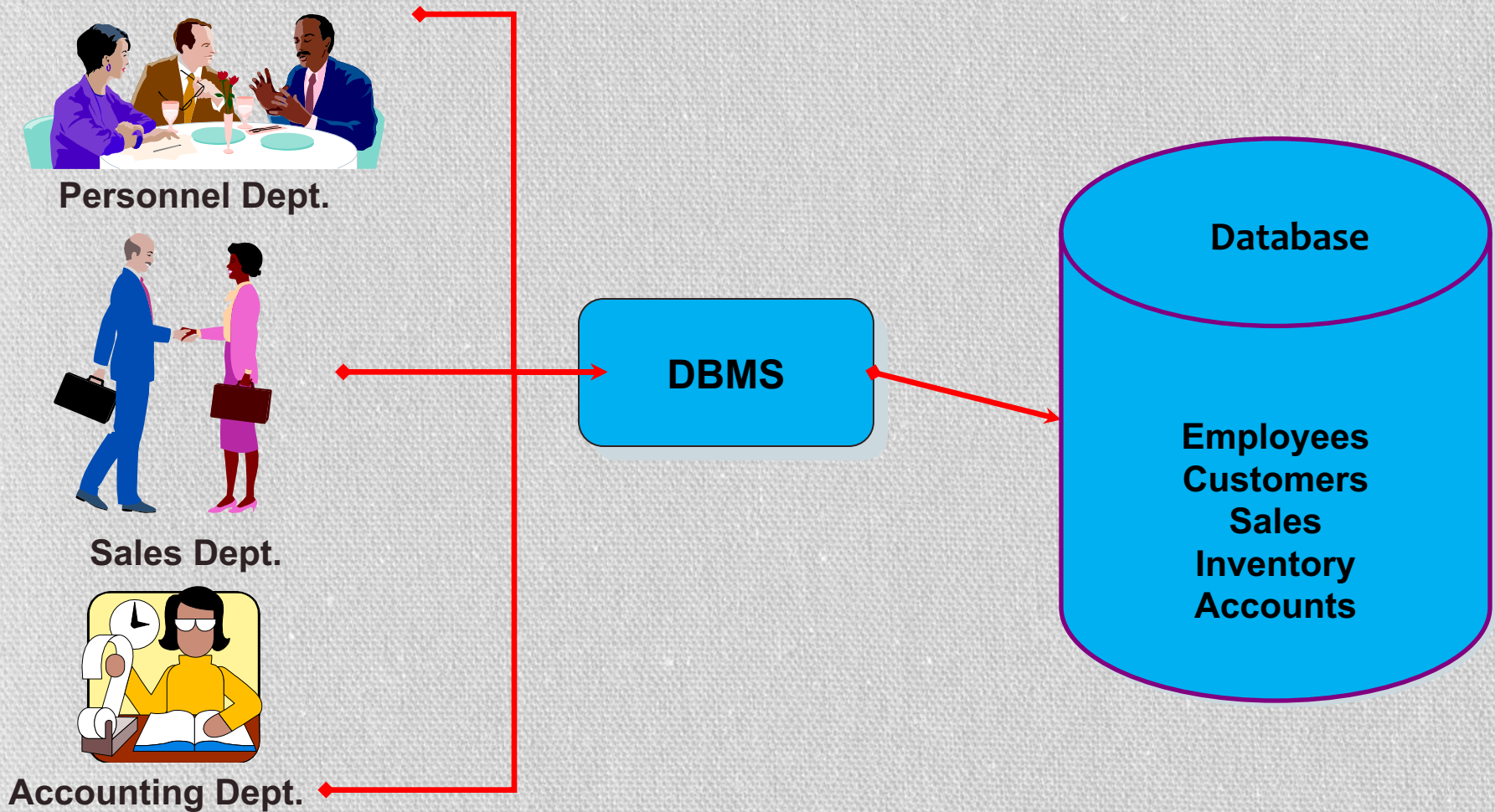# A File System

Personnel Dept.

Sales Dept.

Accounting Dept.

Employees

Customers

Sales

Inventory

Accounts

A Database System

Personnel Dept.

Sales Dept.

Accounting Dept.

DBMS

Database

Employees
Customers
Sales
Inventory
Accounts

An Example of a Database

STUDENT

Name	StudNumber	Class	Major
Smith	17	1	CS
Brown	8	2	CS

SUBJECT

SubjName	SubjCode	CPoints	Dept
Intro to Computer Science	CS001	15	CSIT
Data Structures	CS002	15	CSIT
Discrete Mathematics	MAT001	15	MATH
Databases	CS003	15	CSIT
Calculus and Linear Algebra	MAT002	15	MATH

STUDENT_RESULT

StudNum	SubjCode	Grade
17	CS001	B
17	MAT001	C
8	CS001	A
8	MAT001	A
8	MAT002	B

PREREQUISITE

SubjCode	PrereqCode
CS002	CS001
CS003	CS001
MAT002	MAT001

Benefits of a Database Approach

a. **To control data redundancy**

Data redundancy leads to three major problems:

- Duplicate effort
- Waste of storage
- Inconsistency of data

However, please note that in Relational systems redundancy will still exist as some fields need to be duplicated to provide relationships, but such redundancy is controlled and kept to a minimum.

Benefits of a Database Approach

Example:

(1) Data Redundancy : Duplicate Effort and Waste of Storage

STUDENTGRADE

StudentNumber	StudentName	SubjectCode	Grade
17	Smith	CS001	B
17	Smith	MAT001	C
8	Brown	CS001	A
8	Brown	CS002	A
8	Brown	MAT002	B

(2) Data Redundancy: Leads to Inconsistencies

STUDENTGRADE

StudentNumber	StudentName	SubjectCode	Grade
17	Brown	CS001	B

Benefits of a Database Approach

b. **Data Integrity**

Most databases applications have certain *Integrity constraints* that must hold for the data. A DBMS provides capabilities for defining and enforcing these constraints. The simplest type of integrity constraint involves specifying a data type for each data item.

c. **Restricting Unauthorised Accesss**

A DBMS provides a security and authorisation subsystem, which the DBA uses to create accounts and to specify account restrictions. The DBMS should then enforces these restrictions automatically.

Benefits of a Database Approach

d. **Programming Advantages**

- Persistent storage for program
- Multiple user interface.

e. **Providing Backup and Recovery**

If the computer system fails in the middle of a complex update program, the recovery subsystem is responsible for making sure that the database is restored to the state it was in before the program started executing.

DBMS Languages

Data Definition Language (DDL)

This is used to define the conceptual and internal schemas for a database system.

It is not a procedural language, rather a language for describing the types of entities, and the relationships among them in terms of a particular data model.

Data Manipulation Language (DML)

This is used to manipulate the database, which typically includes retrieval, insertion, deletion, and modification of the data.

Classification of DBMS

Based on Data Model

- Relational (RDBMS) Eg. ORACLE, INFORMIX, ACCESS
- Network Eg. IDMS (Integrated Database Management systems)
- Hierarchical Eg. IMS (Information Management Systems)
- Objected Oriented (OO) DBMS Eg. O_2, ObjectStore, Jasmine

Based on Number of Users

Based on ways the database is distributed

- Single User
- Multiple User

- Centralized
- Distributed
- Federated

Summary - Why Database Systems are important

- The collection of data becomes increasingly important for operational activities/transactions
- The amount of data to be stored is increasing
- A good way of managing such data is crucial

- Database systems
  - help to create an environment in which end-users have better access to better-managed databases
  - support an integrated view of the whole operation of an organisation.

Next Lecture

Database Models