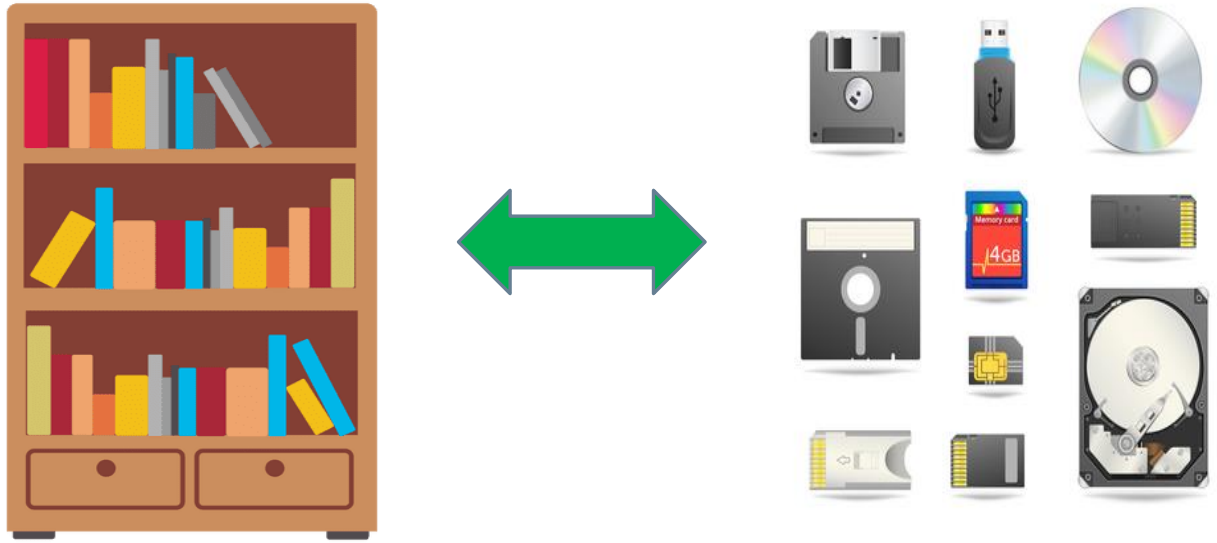
1213 COMP
Computer Skills-2
Database
Lecture #1

Introduction

Like a library, secondary storage is designed to store information.



Introduction

01 How is this stored information **organized**?

02 In today's world, almost all information is stored in databases, they are an important part of nearly every organization including **schools, hospitals, and banks**.

03 You need to know how to **find information** and understand **how it is stored.**

04 End users need to understand:

- How information is **organized** in fields, records, tables and databases.
- different **types** of databases
- different **ways** in which a database can be structured

Data

Can be defined as facts or observations about **people**, **places**, **things**, and **events**

People

Name, Age, Gender, Birth Date

Place

Name, Area, Population size

Things

Name, Price, Expiry date, Made

Events

Venue, Time, Attendance

Data

Past

In the past, data was limited to **numbers**, **letters**, and **symbols** recorded by keyboards

1 5 A b Y $ # + *

Data

Now

Now data includes – **Audio**, **music**, **photographs**, and **video.**

Data

Two ways to view data:

1. **Physical view**
2. **Logical view**

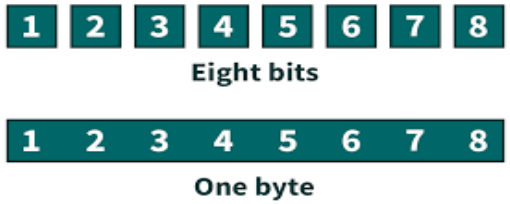
Data

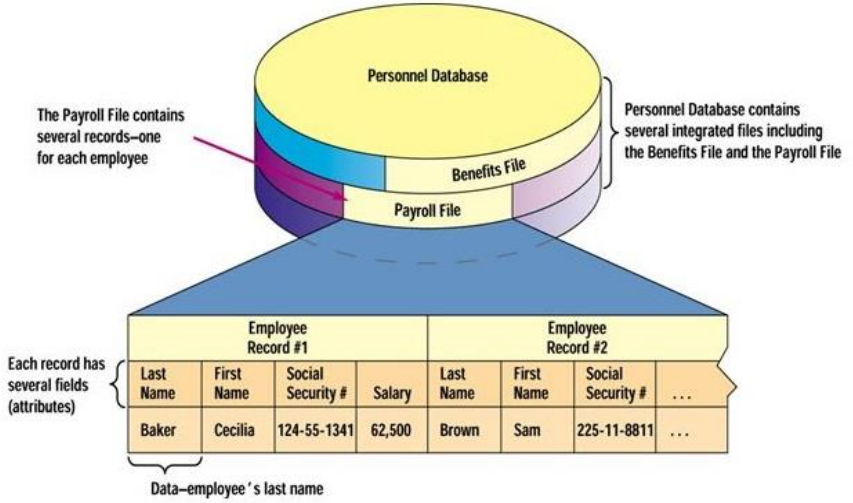
Physical view

1

Physical view: focuses on the actual format and location of the data.

Data is recorded as **digital bits** that are typically grouped together into **bytes** that represent characters using a **coding scheme** such as Unicode.





Data

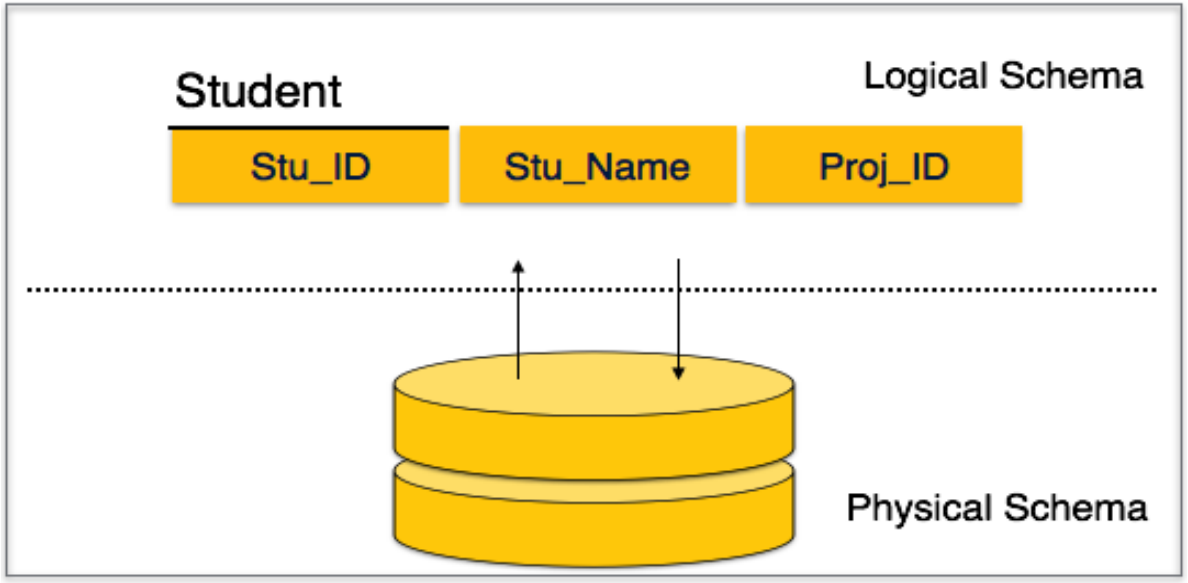
Logical view

2

Logical view : focuses on the meaning, content, and context of the data.

End users and most computer professionals are concerned with this view.

They are involved with actually using the **data** with **application programs**.



Data Organization

- To understand databases, learn how data is organized.
- In the logical view, data is organized into **groups or categories:**

Data Organization

Character

1

Character:

A **character** is the most **basic** logical data element. It is a **single** letter, number, or special characters such as /, &, *, $, ...

1 5 A b Y $ # + *

Data Organization

Field

2

Field: The next higher level is a field or **group of related characters**. A data field represents an **attribute** (**description** or **characteristic**) of some **entity** (**person**, **place**, **thing**, or **object**).

Example: Name or ID Number or Age of a student

STID	First Name	Last Name	Course ID
301	John	Smith	20
302	Mark	Davis	30
303	Steve	William	40
304	James	Brown	20

record (row)

record(row)

Field (Column) Field(Column)

Data Organization

Record

3

Record: a collection of related fields. A record is a collection of attributes that describe an entity.

- In our example, the record for a **student** consists of the data fields describing the **attributes** for one student. These **attributes** are First Name, Last Name, Student ID, and Age.

STID	First Name	Last Name	Course ID
301	John	Smith	20
302	Mark	Davis	30
303	Steve	William	40
304	James	Brown	20

record (row)

record(row)

Field (Column) Field(Column)

Data Organization

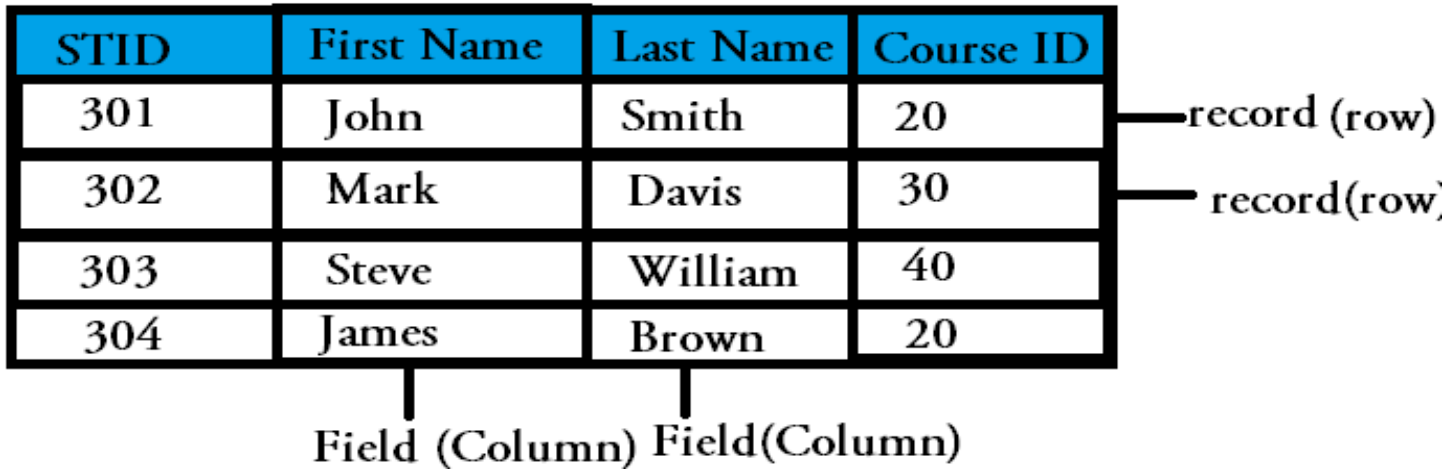
Table

4

Table:

a collection of related records.

For example, the **Student** Table would include information (records) for all the students (entities).



Data Organization

Database

5

Database:

A database is an integrated collection of logically related tables. (A table for a college)

STID	First Name	Last Name	Course ID
301	John	Smith	20
302	Mark	Davis	30
303	Steve	William	40
304	James	Brown	20

record (row)

record(row)

Field (Column) Field(Column)

Data Organization

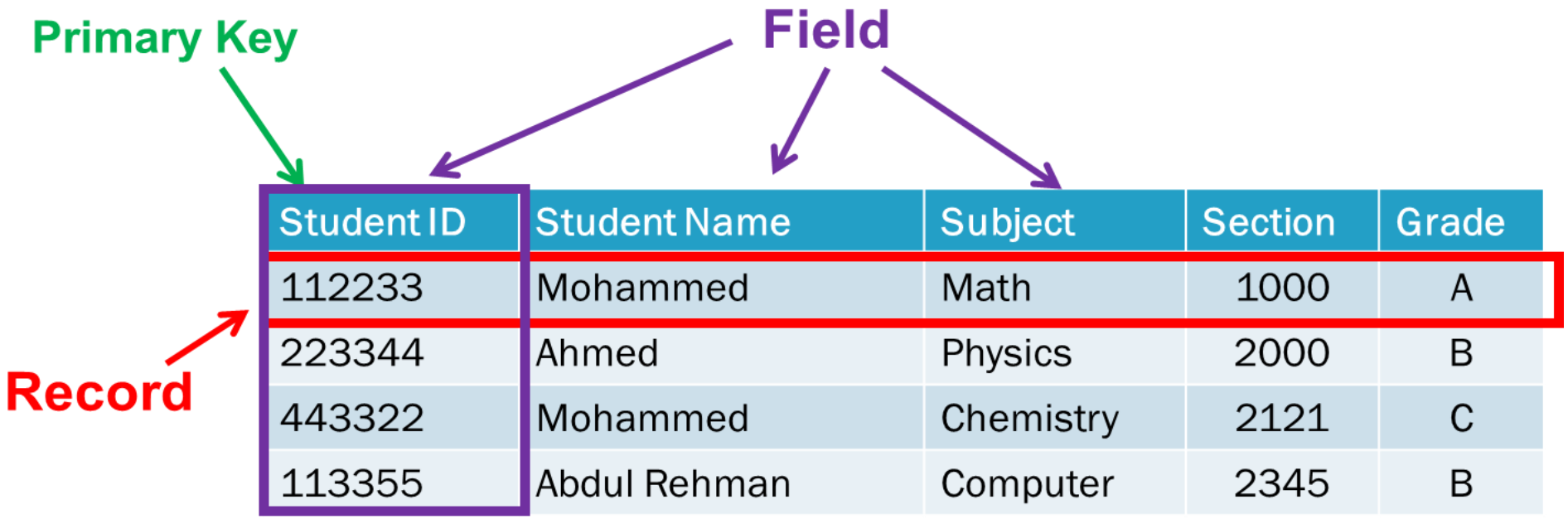
Key Field

- Each record in a table has at least one distinctive field, called the key field.
- Also known as the primary key, this field uniquely identifies the record.

Common examples:

1. Student Identification Numbers
2. Employee Identification Numbers
3. Car License Plate Numbers

Data Organization



Student ID	Student Name	Subject	Section	Grade
112233	Mohammed	Math	1000	A
223344	Ahmed	Physics	2000	B
443322	Mohammed	Chemistry	2121	C
113355	Abdul Rehman	Computer	2345	B

Table

Data Organization

Connecting Tables: Tables can be related or connected to other tables by common key fields.

Primary Key

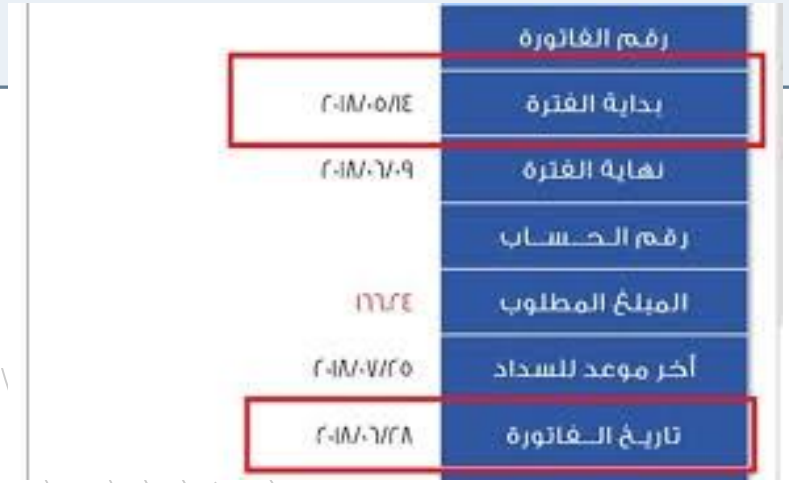
Student ID	Student Name	Gender	Birth Date	Department
112233	Mohammed	M	1-1-2000	Computer
223344	Jood	F	2-3-2001	Electrical
443322	Abdul Aziz	M	4-5-2000	Mechanical
113355	Reem	F	12-2-2001	Physics

Student ID	Student Name	Subject	Section	Grade
112233	Mohammed	Math	1000	A
223344	Jood	Physics	2000	B
443322	Abdul Aziz	Chemistry	2121	C
113355	Reem	Computer	2345	B

Batch Processing & Real - time Processing

Batch Processing

Data is collected over a period of time and the processing happens **later** all at one time. for example, Monthly Credit card billing.

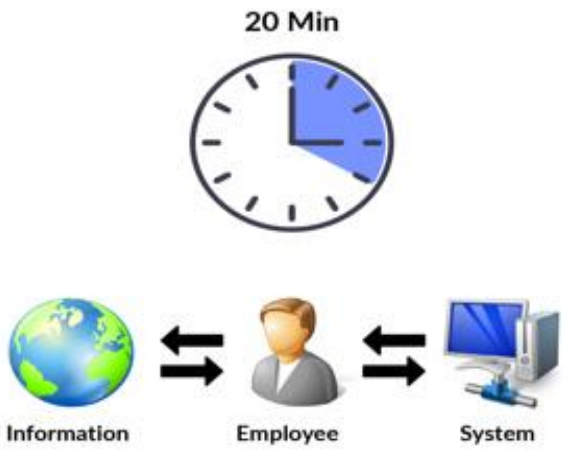


Real - time Processing

occurs when data is processed at the same time the transaction occurs, also known as **online processing**. For example, whenever you request funds at an ATM, real-time processing occurs.

Batch Processing & Real - time Processing

Batch Processing



Real-Time Processing

Data Redundancy

Many organizations have multiple files on the same subject or person. This is called **Data Redundancy**.

For example, a customer's name and address could appear in different files within the sales department, billing department, and credit department.

Data Redundancy

01

If a customer address is stored in multiple files and if the customer moves, then the address in each file must be updated.

02

If one or more files are overlooked, problems will likely result, **for example**, a product ordered might be sent to the new address, but the bill might be sent to the old address.

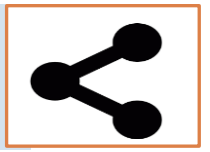
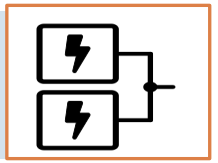
03

This situation results from a lack of data integrity.

Need for Databases

Data spread around in different files is not as useful, It would be much more efficient if all data were in a common database.

Advantages of having databases

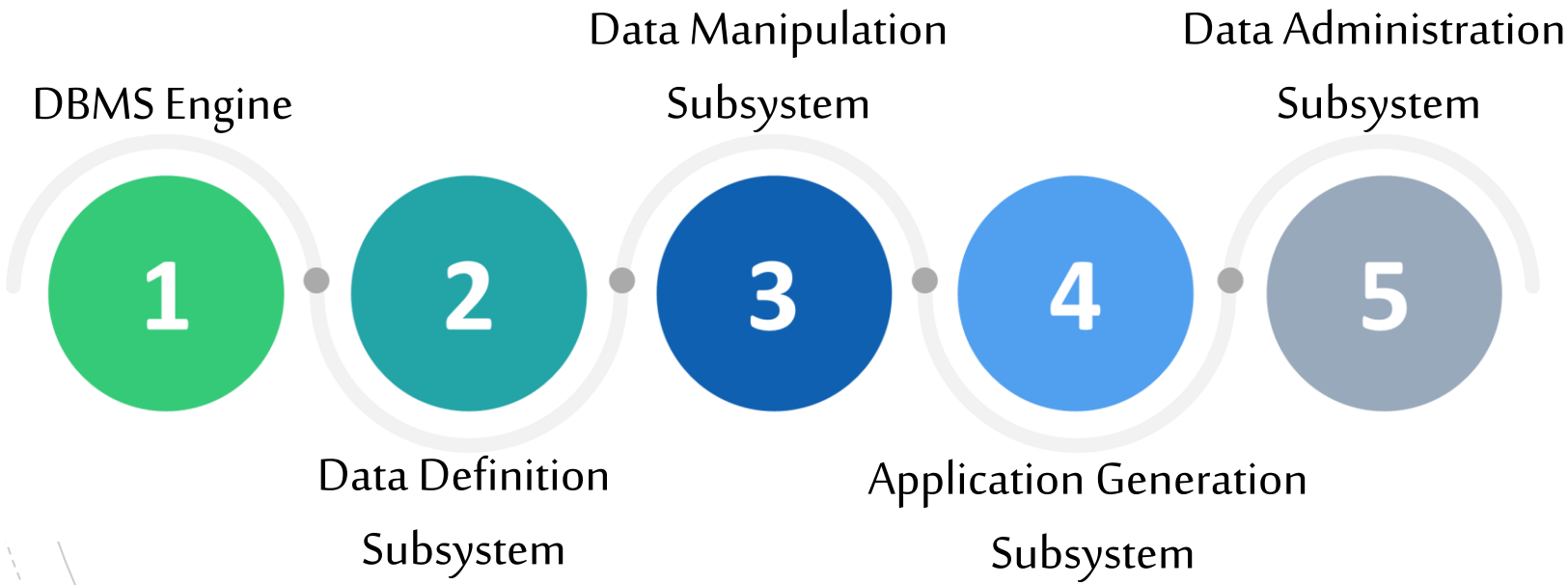
Sharing	In organizations, information from one department can be readily shared with others. 
Security	Users are given passwords or access only to the kind of information they need. 
Less data redundancy	Without a common database, individual departments have to create and maintain their own data, and data redundancy results. 
Data integrity	When there are multiple sources of data, each source may have variations. 

Database Management

- In order to **create**, **modify**, and **gain access** to a database, special software is required.
- This software is called **a database management system**, which is commonly abbreviated **DBMS**.
- Some DBMSs, such as **Microsoft Access**, are designed specifically for personal computers.
- Other DBMSs like **Oracle** are designed for specialized database servers.

Database Management System

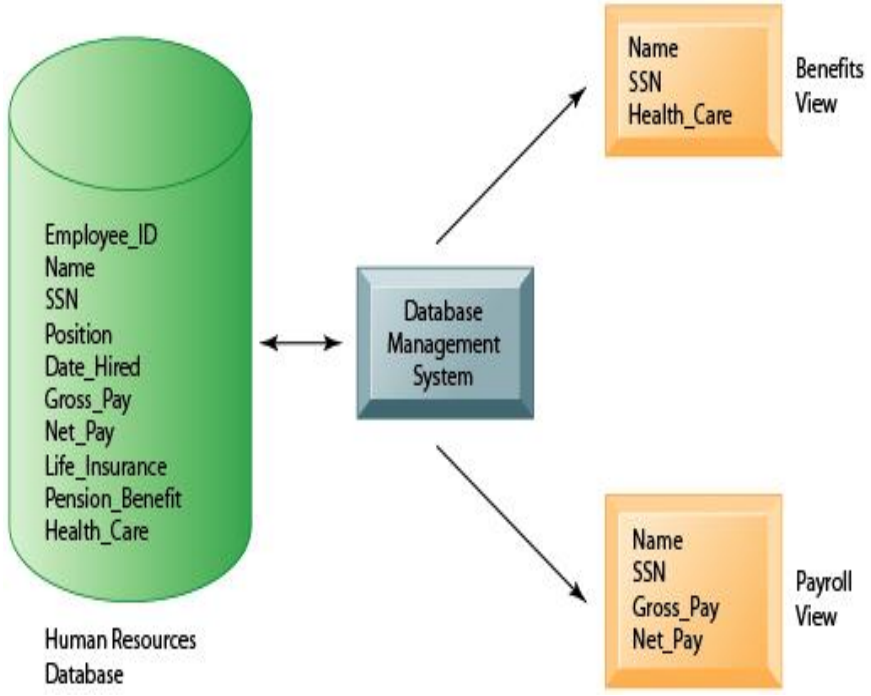
DBMS software is made up of five parts or subsystems:



Database Management System

1 **The DBMS Engine:** provides a bridge between the logical view of data and the physical view of the data.

- When users request data (logical perspective), the DBMS engine handles the details of actually locating the data (physical perspective).



Database Management System

2 **The Data Definition Subsystem:** defines the logical structure of the database by using a data dictionary or schema. This dictionary contains a description of the structure of data in the database.

- For a particular item of data, it defines the names used for a particular field. It defines the type of data for each field (text, numeric, time, graphic, audio, and video).

Field Name	Data Type	Data Format	Field Size	Description	Example
StudentID	Text	XNNNNNNN	8	Unique Identification for each Student	S1234567
First_Name	Text		20	Student's First Name	Connor
Last_Name	Text		20	Student's Surname	Thomas
Year_Group	Number	##	2	Year level the student is in	8
Date_of_Birth	Date/Time	DD/MM/YYYY	10	Date the Student was born	14/08/2005
Student_Image	Image	.jpg	---	Profile photo of the Student	---
School_Team	Text		10	Coloured team student assigned	Blue

Database Management System

3 **The Data Manipulation Subsystem**: provides tools for maintaining and analyzing data. Maintaining data is known as data maintenance.

- It involves adding new data, deleting old data, and editing existing data.

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Database Management System

- Analysis tools support viewing all or selected parts of the data, querying the database, and generating reports.
- Specific tools include query-by-example and a specialized programming language called **structured query language** (**SQL**).

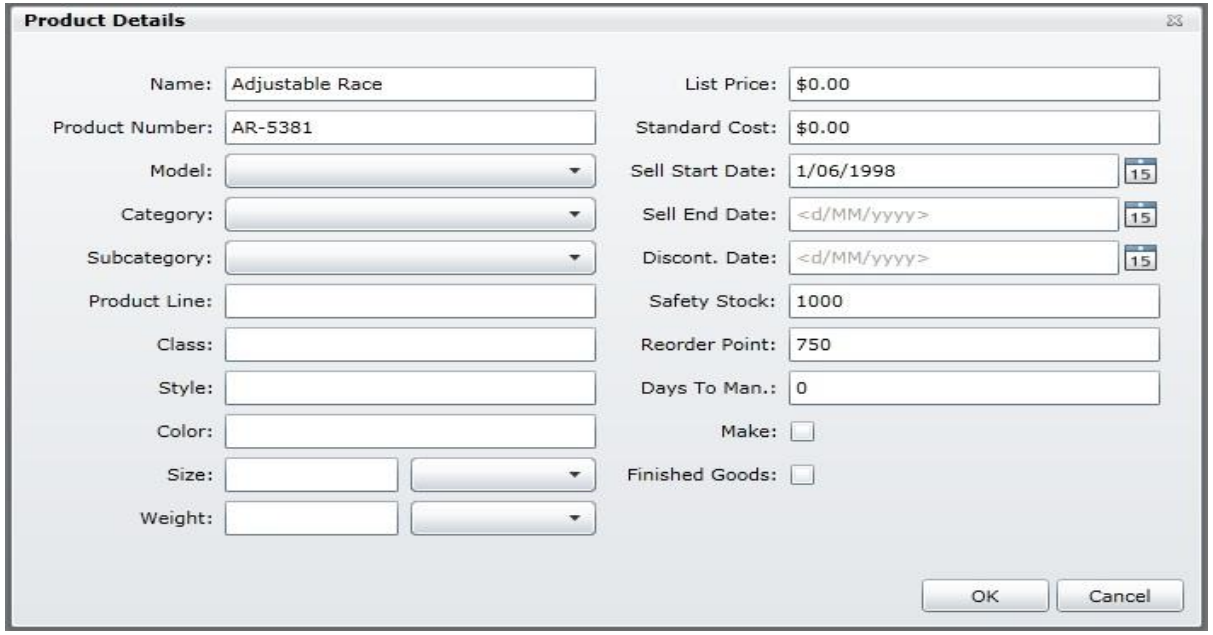
```
SELECT Student Name FROM Table1
SELECT Student Name FROM Table1 WHERE StudentID = 112233
```

Student ID	Student Name	Subject	Section	Grade
112233	Mohammed	Math	1000	A
223344	Ahmed	Physics	2000	B
443322	Mohammed	Chemistry	2121	C
113355	Abdul Rehman	Computer	2345	B

Database Management System

4 **The Application Generation Subsystem**: provides

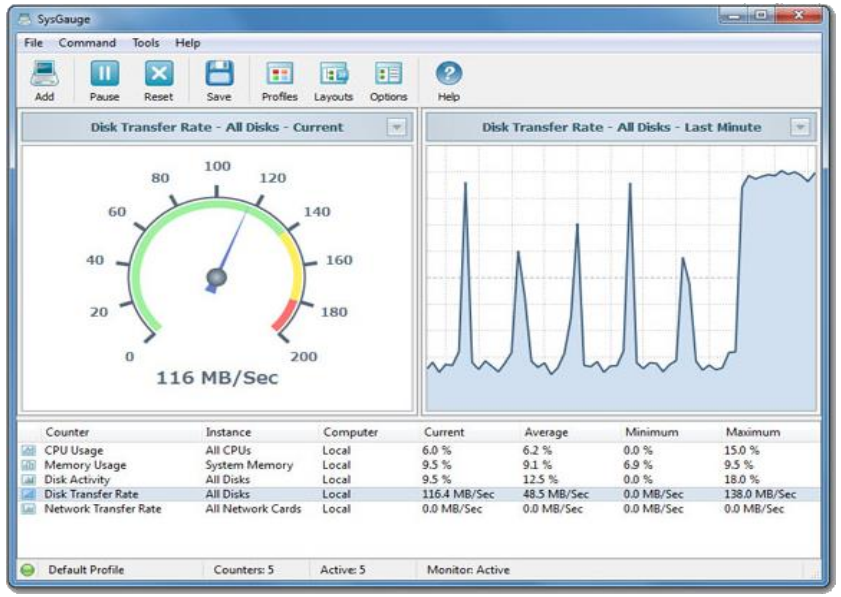
- **Tools** to create data entry forms and
- **Specialized programming languages** that interface or work with common and widely used programming languages such as C++ or Visual Basic.



Database Management System

5

The Data Administration Subsystem: helps to manage the overall database, including maintaining security, providing disaster recovery support, and monitoring the overall performance of database operations.



Database Management System

Database administrators

Database administrators (DBAs):

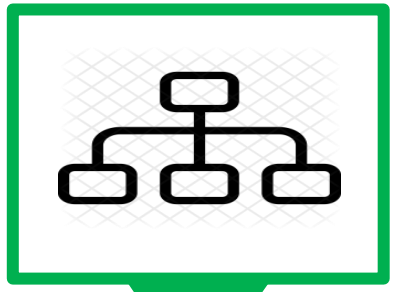
Interact with the data administration subsystem and also

1. Determine **processing rights** or
2. Determine which **people** have access to **what kinds of data** in the database.

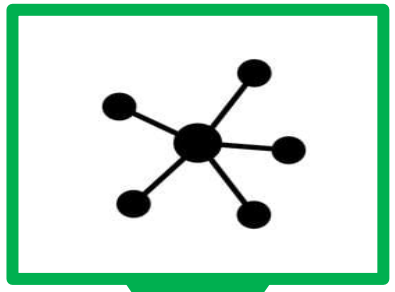
Database Models

- DBMS programs are designed to work with data that is logically structured or arranged in a particular way.
- This arrangement is known as the database model that define rules and standards for all the data in a database.

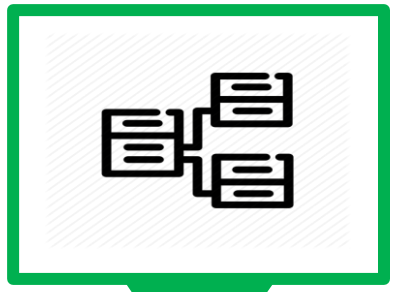
Five common database models are:



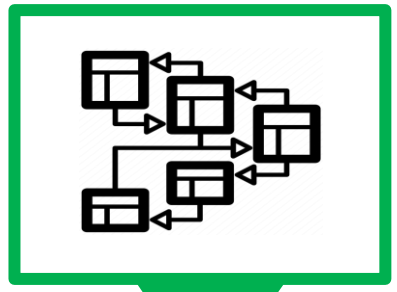
1 **Hierarchical**



2 **Network**



3 **Relational**



4 **Multidimensional**

5 **Object-Oriented**

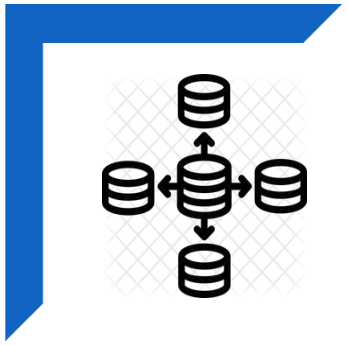
Relational Database Model

1. The data elements are stored in different **tables**, each of which consists of **rows** and **columns.**
2. A **table** and its **data** are called a **relation.**
3. All related tables must have a **common data item** (key) enabling information stored in one table to be linked with information stored in another.
4. Entries can be easily added, deleted, and modified.
5. The relational model is common for personal computer DBMSs such as **MS-Access.**

Types of Databases

Individual Database

Company Database



Distributed Database

Types of Databases

Individual Database

The Individual Database is also called a personal computer database. It is a collection of integrated files primarily used by just **one person** and is stored on the user's hard-disk

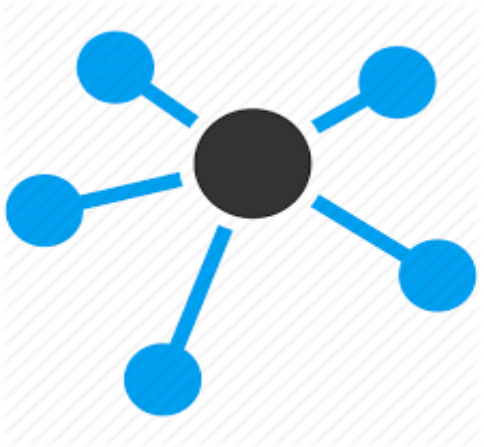
Types of Databases

Company Database

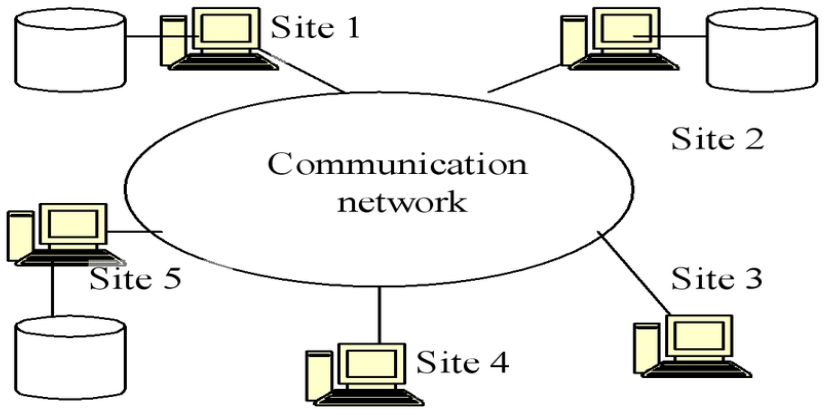
The company database may be stored on a **central** database server and managed by a **database administrator**. Users throughout the company have access to the database through their personal computers linked to **local** or **wide area networks**.

Types of Databases

Distributed Database



Distributed Database Many times the data in a company is stored not in just one location but in **several locations** accessible through a variety of communications networks.



Database Uses and Issues

Strategic:

Databases help users to keep up to date and to plan for the future.

To support the needs of managers and other business professionals, many organizations collect data from a variety of internal and external databases.

This data is then stored in a special type of database called a data warehouse.

A technique called data mining is often used to search these databases to look for related information and patterns.

Database Uses and Issues

Security:

One concern is that personal and private information about people stored in databases may be used for the wrong purposes.

Another concern is unauthorized users gaining access to a database.

Special hardware and software called firewalls is used to control access to their internal networks.

End of lecture