A logo of a university

Description automatically generated

**كلية العلوم**

**قــســــــــــم الانظمة الطبية الذكية**

**Lecture: (1)**

**Subject: Database Systems**

**Level: Second**

**Lecturer:** **Asst. Lecturer Qusai AL-Durrah**

# Introduction to Database

Data is central to how many of today’s applications and websites function. Comments on a viral video, changing scores in a multiplayer game, and the items you left in a shopping cart on your favorite online store are all bits of information stored somewhere in a database.

Broadly speaking, a database is any logically modeled collection of information. A database does not necessarily have to be stored on a computer, and things like a stack of patient files in a hospital, a set of contacts in a rolodex, or file cabinet filled with old invoices all qualify as examples of databases.

A database is a collection of interrelated data that helps in the efficient retrieval, insertion, and deletion of data from the database and organizes the data in the form of tables, views, schemas, reports, etc. For Example, a university database organizes the data about students, faculty, admin staff, etc. which helps in the efficient retrieval, insertion, and deletion of data from it.

The database system is an excellent computer-based record-keeping system. A collection of data, commonly called a **database**, contains information about a particular enterprise. It maintains any information that may be necessary to the decision-making process involved in the management of that organization. It can also be defined as a collection of interrelated data stored together to serve multiple applications, the data is stored so that it is independent of programs that use the data. A generic and controlled approach is used to add new data and modify and retrieve existing data within the database. The data is structured so as to provide the basis for future application development.

# History of Database Systems

## Manual Systems - 1950s

⇒ Data Storage: Paper records.

⇒ High manpower requirement and time-consuming searches for specific records. Very inefficient.

## 1950s and Early 1960s

⇒ Use of magnetic tapes for storage.

⇒ Magnetic tapes allow only sequential access to data.

## Late 1960s and 1970s

⇒ Use of Hard disks for storage.

⇒ Hard disks allow direct access to data.

⇒ 1968:Introduction of the File-Based System for data storage.

⇒ Non-relational Databases (1968-1980)

⇒ Hierarchical Model:IBM's first hierarchical DBMS called IMS (Information Management System).

⇒Network Model: Charles Bachmann developed the first DBMS at Honeywell, called Integrated Data Store (IDS).

CODASYL DBTG (Conference on Data System Languages, Data Base Task Group) developed the network model.

IDMS (Information Data Management System) became the most popular network DBMS.

⇒ Use:Both network and hierarchical data models were widely used.

## 1980-Present Era: Relational Databases

⇒ Ted Codd:Defined the Relational Data Model and received the ACM Turing Award for his work.

⇒ Prototypes of Relational Data Model:

⇒ IBM Research:Developed the System R prototype.

⇒ UC Berkeley: Developed the Ingres prototype.

⇒ Entity-Relational Model:Proposed by Peter Chen for database design.

## 1980s

⇒ Evolution:Research prototypes evolved into commercial systems.

⇒ SQL:Became the industrial standard. New Types of Databases:

⇒ Parallel and distributed database systems.

⇒ Object-oriented database systems.

## 1990s

⇒ Applications:Large decision support and data-mining applications.

⇒ Data Warehouses:Large multi-terabyte data warehouses emerged.

⇒ Web Commerce:Emerged as a significant application.

## Early 2000s

⇒ Standards:XML and XQuery standards were introduced.

⇒ Automation:Automated database administration became more prevalent.

## Later 2000s

⇒ Giant Data Storage Systems:Cloud storage became common. Examples include Google BigTable, Yahoo PNuts, and Amazon Dynamo.

## Purpose of Database

The intent of a database is that a collection of data should serve as many applications as possible. Therefore, a database is often thought of as a repository of information needed to run certain functions in a corporation or organization. It would permit only the retrieval of data but also the continuous modification of data needed for the control of operations. It may be possible to search the database to obtain answers to questions or information for planning purposes. In a typical file-processing system, permanent records are stored in different files. Many different application programs are written to extract the records and add the records to the appropriate files. However, this scheme has several major limitations and disadvantages, such as data redundancy (duplication of data), data inconsistency, maladaptive data, non-standard data, insecure data, incorrect data, etc. A database management system is an answer to all these problems as it provides centralized control of the data.

# Concept of Database

To store and manage data efficiently in the database let us understand some key terms:

1. Database Schema: It is a design of the database. Or we can say that it is a skeleton of the database that is used to represent the structure, types of data will be stored in the rows and columns, constraints, relationships between the tables.
2. Data Constraints: In a database, sometimes we put some restrictions on the table that what type of data can be stored in one or more columns of the table, it can be done by using constraints. Constraints are defined while we are creating a table.
3. Data dictionary or Metadata: Metadata is known as the data about the data. Or we can say that the database schema along with different types of constraints on the data is stored by DBMS in the dictionary is known as metadata.
4. Database instance: In a database, a database instance is used to define the complete database environment and its components. Or we can say that it is a set of memory structures and background processes that are used to access the database files.
5. Query: In a database, a query is used to access data from the database. So users have to write queries to retrieve or manipulate data from the database.
6. Data manipulation: In a database, we can easily manipulate data using the three main operations that is Insertion, Deletion, and updation.
7. Data Engine: It is an underlying component that is used to create and manage various database queries.

# Advantages of Database

Let us consider some of the benefits provided by a database system and see how a database system overcomes the above-mentioned problems:-

* 1. Reduces database data redundancy to a great extent
  2. The database can control data inconsistency to a great extent
  3. The database facilitates sharing of data.
  4. Database enforce standards.
  5. The database can ensure data security.
  6. Integrity can be maintained through databases.

Therefore, for systems with better performance and efficiency, database systems are preferred.

**Disadvantages of Database**

With the complex tasks to be performed by the database system, some things may come up which can be termed as the disadvantages of using the database system. These are:-

1. Security may be compromised without good controls.
2. Integrity may be compromised without good controls.
3. Extra hardware may be required
4. Performance overhead may be significant.
5. The system is likely to be complex.

database-related concept that is often overlooked or no Database system is an excellent computer-based record-keeping system. A collection of data, commonly called a database, contains information about a particular enterprise. It maintains any information that may necessary to the decision-making process involved in the management of that organization. It can also be defined as a collection of interrelated data stored together to serve multiple applications, the data is stored so that it is independent of programs that use the data. A generic and controlled approach is used to add new data and modify and retrieve existing data within the database. The data is structured so as to provide the basis for future application development.