

DBMS

Data : Data is the raw material that can be processed for any computing machine.

Example :- Employee name, Product name, Student name, Marks of the student, any number, image.

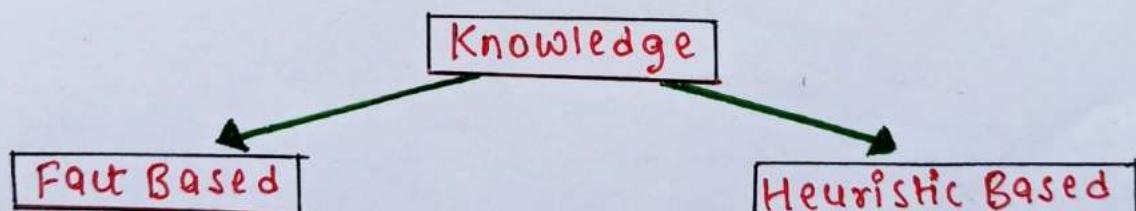
Information : It is the data that has been converted into more useful or intelligible form eg. report card sheet.

- **Why we need Information ?**

- 1]. To gain knowledge about the surroundings.
- 2]. To keep the system upto date.
- 3]. To know about the rules and regulation of the society.

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Knowledge : Human mind purposefully organise the information and evaluate it to produce knowledge eg 238 is a data and Marks of student is information and the hardwork require to get mark is knowledge.



1]. **Fact Based :-** The knowledge gain from fundamental & through experiment.

2]. **Heuristic Based :-** It is the knowledge of good practice and good judgement like hypothesis.

Difference between Data and Information

| DATA | INFORMATION |
|-------------------------------------------------|------------------------------------------|
| 1]. Data is the raw fact. | 1]. It is the processed form of data. |
| 2]. It is not significant to a business. | 2]. It is the significant to a business. |
| 3]. Data are Atomic level piece of Information. | 3]. It is a collection of data. |
| 4]. Data does not help in decision making. | 4]. It helps in decision making. |
| 5]. Examples :- Product name, name of student. | 5]. Example :- Report card sheet. |

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Database: The related information when placed in an organised form makes a database or an organised collection of related information is known as database.
Example:- Dictionary, Telephone directory, Mobile contact.

Operations performed on Database

- 1]. Insertion
- 2]. Updation
- 3]. Deletion
- 4]. Retrieve
- 5]. Sorting.

Difference b/w computerised database and manual database.

Traditional file system :

File System :- A File system is the method of storing and organising the computer files and the data they contain to make it easy to find and access them.

Characterstic of Files System :

- 1]. It is a group of files for storing the data of an Organisation.
- 2]. Each file is independent from one another.
- 3]. Each file is called a flat files.
- 4]. Files are design by using the program written in Programming language such as, C++.

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Disadvantages of File Processing system:

- 1]. Separated and isolated data.
- 2]. Duplication of data :- It cost time and money.
 - It takes up additional storage space.
 - It can lead to loss of data integrity.
- 3]. Data dependencies :- Files and record were describe by specific physical format that were code in the application program by the programs.
- 4]. Difficulty in representing the data from the user point of view.
- 5]. Data Security :- The security of data is low in the files based system because the data is maintain in a flat file is easy accessible.
- 6]. Transactional problems :- This system does not satisfy transactional properties called **ACID properties** → A → Atomicity, C → consistency, I → Isolation, D → Durability.
- 7]. Concurrency problem :- When multiple user access a same piece of data at a same interval of time then it is called a concurrency of system. When two or more user read the data simultaneously then there is no problem but when they like to update the file simultaneously. It may result in a problem.

Building Block of Database :-

- 1]. Column / Fields.
- 2]. Row / tuple / Record
- 3]. Tables.

DBMS (Data Base Management System) :

It is the software system that allows the user to define, to create and maintain the database and provide control access to the data.

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Application of Database :

- 1]. Library system
- 2]. Banking system
- 3]. ATM

Database :- MySql , oracle , Sql server , DB2 , Microsoft Access.

Components of DBMS :

Hardware :- The hardware is the actual computer system used for keeping and accessing the database conventional DBMS hardware consist of secondary storage devices such as harddisk. Database run on the range of machine from micro computers to main frames.

Software :- Software is the actual DBMS between the physical Database and the user of the system. All the request from the user for accessing the database are handled by DBMS.

Data :- It is an important component of the database management system. The main task of DBMS is to process the data. Databases are used to store the data, retrieved, and updated to and from of database.

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★ **User :-** There are no. of users who can access or retrieve the data on demand using the application and the interfaces provided by the DBMS.

The users of the database can be classified into the following groups.

- **Naïve Users**
- **Sophisticated Users**
- **Online Users**
- **Specialized Users**
- **Application programmers**
- **DBA - Database Administrator**
- **Naïve users :-** Those user who need not be aware of the presence of the database system. They are the end users of the database who work through a menu driven application programs, where the type and range of response is always indicated to the users.
- **Sophisticated user :-** They are those user who interact with the system without writing the program Instead they form their request in database query language.
- **Online user :-** Those users who may communicate with database directly through an online terminal or indirectly through user interface and application program .
- **Specialized user :-** Specialized users who write specialized database applications that do not fit into the fractional database processing framework.

- **Application Programmer :-** The application programmer users who are responsible for developing the application programs or user Interface. The application programs could be written in high level language. Example:- Java, .net, php etc.
- **Database Administrator (DBA) :-** It is a person or the group incharge of implementing the database system within the organization. The DBA has all the privileges allowed by the DBMS and can assign or remove the privileges from the users.

★ **Procedure :**

Disadvantages of DBMS :-

- Complexity
- Size
- Performance
- Higher impact of failure
- Cost of DBMS

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Differentiate b/w file management system & DBMS.

- **Master File :-** Master file are those file which remain static. There is no change.
- **Transaction File :-** Transaction file are those file which is dynamic in nature. We can make changes.
- **Instances :-** The situation where a data or information is stored in the database at a particular moment of time is called an instances.

- **Schema :-** The overall design of the database is called Schema OR Description of database.
- **Subschema :-** It is the subset of the schema and inherit the same property that a schema has. It gives the users a window through which he/she can view only that part of database which is of interest to him.

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Architecture of DBMS:-

There is 3 level.

- 1]. External Level
- 2]. Conceptual Level
- 3]. Internal Level.

Objective of three level Architecture or 3 level Architecture:

The objective is to separate each user's view of the data from the way the database is physically represented.

There are several reasons.

- 1). The internal structure of the database should be unaffected while changes to the physical aspects of storage.
- 2). The DBA should be able to change the conceptual structure of the database without affecting all other users.

- 1]. **External level / View level :-** This level describes that part of the database that is relevant to each user. This level insulates the users from the details of conceptual and the internal level.

2]. **Conceptual level / logic level :-** This level describe what data is stored into the database and the relationship among the data.

It represents :-

- All the entities, attributes and there relationships.
- The constraints on the data.
- Security and integrity information.

3]. **Internal level / storage level :-** It is the physical representation of the database on the computer. This level describe how the data is stored in the database. It covers the data structure and file organisation used to store the data on storage devices.

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Schemas :-

- External Schema
- Conceptual Schema
- Internal Schema.

1]. **External schema :-** The external view is described by means of schema called External schema. That corresponds to different view of the data.

2]. **Conceptual Schema :-** The conceptual view is defined by conceptual schema, which describes all the entities, attributes and their relationship with the integrity constraints.

3]. **Internal schema :-** Internal level is defined by internal schema, which is a complete description of the internal model. There is only 1 conceptual schema and 1 internal schema per database and more than 1 external schema.

Schema is also known as Intension.

Note:- Instance / Extension of database.

Mapping between the levels :-

- 1). External / Conceptual Mapping .
- 2). Conceptual / Internal Mapping .

1]. **External / conceptual mapping :-** Each External schema is related to the Conceptual schema by external Conceptual Mapping . This mapping gives the correspondence among the records and the relationships of the external & conceptual views . There is a mapping from a particular Logical record in the external view to one or more Conceptual record in the conceptual view .

2]. **Conceptual / Internal Mapping :-** Conceptual scheme is related to Internal schema by Conceptual Internal mapping . Mapping between the conceptual and Internal level specifies the method of deriving the conceptual Record from physical database .

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Data Independence :-

- 1). Logical data independency .
- 2). Physical data independency .

1]. **Logical data Independency :-** It indicates that the Conceptual schema can be changed without effecting the existing external schema . The changes would be absorbed by the mapping between external and Conceptual level .

2]. **Physical data Independence :-** It indicates that the physical storage structure or devices can be changed without effecting the conceptual schema. The change would be absorbed by the conceptual internal mapping.

→ Logical data independency is much more difficult to achieve than physical data independency as it require the flexibility in the design of the database and programmer has to see the future requirement or modification in the design.

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★ **Limitation of File Processing system :-**

1]. **Separated and Isolated Data :-** To make a decision a user might need data from two separate files. First the files were evaluated by analysts and programmers to determine the specific data required from each file and the relationship between the data and then application could be written in a programming language to process and extract the needed data.

2]. **Difficulty in representing data from the user view :-**

To create useful application for the user, often data from various files must be combined.

In file processing It was difficult to determine relationships between isolated data in order to meet user application.

★ Components of DBMS :-

- **DATA :-** It is the most important component of DBMS environment from the end users point of view. One of the major features of database is that actual data are separated from the programs that use the data. A database should always be designed, built and populated for a particular audience and for a specific purpose.
- **PROCEDURES :-** Procedures refer to the instructions and rules that govern the design and use of the database. The user of the system and the staff that manage the database require documented procedures and how to use or run the system.

★ Disadvantages of DBMS :-

- 1]. **Complexity :-** The provision of the functionality that is expected of a good DBMS makes the DBMS an extremely complex piece of software. Database designers, developers, database administrators and end-users must understand this functionality to take full advantage of it failure to understand the system can lead to bad design decisions, which can have serious consequences for an organization.
- 2]. **Size :-** The complexity and breadth of functionality makes the DBMS an extremely large piece of software, occupying megabytes of disk space and requiring substantial amount of memory to run efficiently.

3]. **Performance :-** A file based system is written for a specific application such as invoicing. A result performance is generally very good. However the DBMS is written to be more general to cater for many application rather than just one.

4]. **Higher Impact of a failure :-** The centralization of resource increases the vulnerability of the system. since all user and applications rely on the availability of the DBMS, the failure of any component can bring operation to a halt.

5]. **Cost of DBMS :-** The cost of DBMS varies significantly depending on the environment and functionality provided. There is also the recurrent annual maintenance cost.

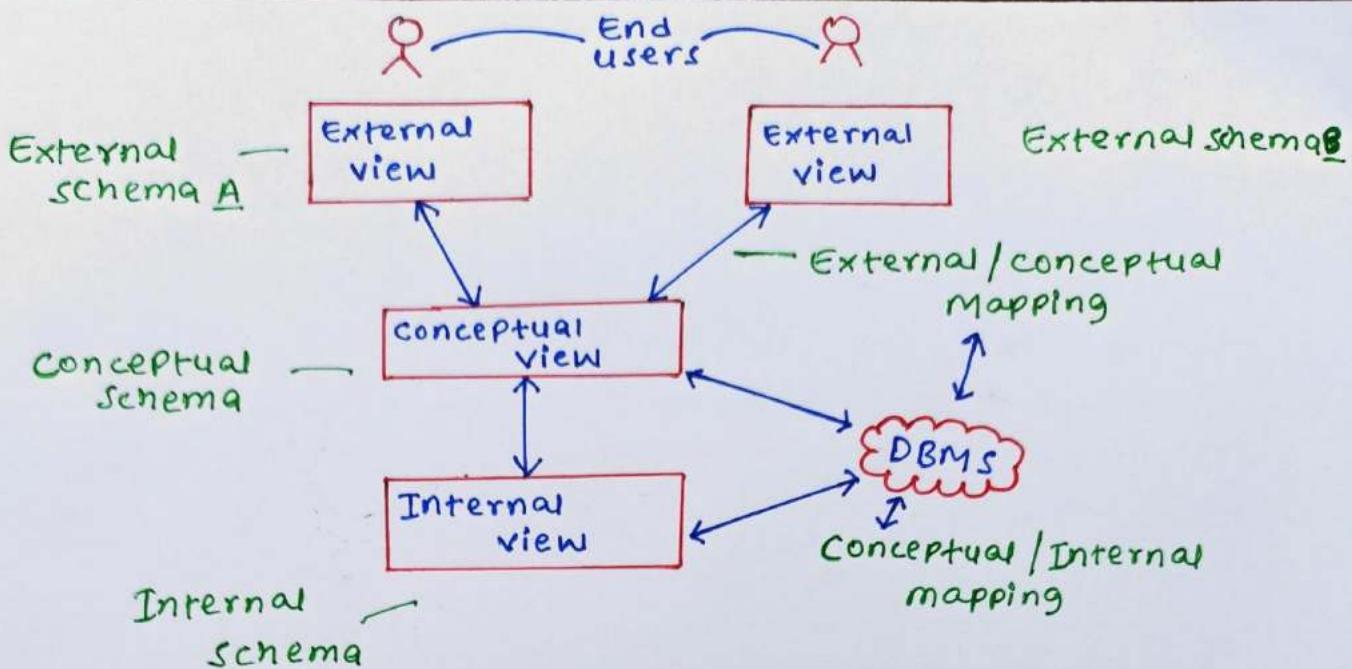
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File Management eg. C++ or COBOL
Program

Database Management
eg. Oracle or Sybase

- 1]. Small system.
- 2]. Relatively cheap.
- 3]. Few files.
- 4]. Files are files.
- 5]. Simple structure
- 6]. Little preliminary design.
- 7]. Integrity left to application programmer.
- 8]. No security.
- 9]. Simple, Primitive backup/recovery
- 10]. Often single user.

- 1]. Large system.
- 2]. Relatively expensive
- 3]. Many files.
- 4]. Files not necessarily files.
- 5]. Complex structure.
- 6]. Vast preliminary design.
- 7]. Rigorous inbuilt integrity checking.
- 8]. Rigorous security.
- 9]. Complex & Sophisticated backup/recovery.
- 10]. Multiple users.



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Role of DBA (Database Administrator :-) It is a person or group incharge for implementing DBMS in an Organisation. The DBA job requires high degree of technical expertise DBA consist of a team of people rather than just one person.

Responsibilities of DBA :-

- 1). Makes the decision concerning the content of the database.
- 2). Plans the storage structure and access strategy.
- 3). Provides the support to the users.
- 4). Defines the security and Integrity checks.
- 5). Interprets backup and recovery strategies.
- 6). Monitoring the performance and responding to the changes in the requirements.

Data Dictionary or MetaData :-

It is of two type.

- 1]. Active Data Dictionary.
- 2]. Passive Data Dictionary.

A MetaData is the data about the data. It is the self describing nature of database.

It holds the following information about each data element in the database such as names, types, range of values, access authorization, indicate which application program uses the data.

MetaData is used by the developers to develop the program, queries to manage and manipulate the data.

1]. **Active Data Dictionary :-** It is managed automatically by the data management software. It is always consistent with the current structure of the Database.

2]. **Passive Data Dictionary :-** It is one use for documentation purposes. It is managed by the user of the system and is modified manually by the users.

Database Languages :-

Data Definition Language :-

It is a language that allows the user to define the data and their relationship to other type of data. Command are

- 1). Create
- 2). Alter
- 3). Remove
- 4). Drop

2]. **Data Manipulation language (DML) :-** It is a language that provides a set of operation to support the basic data manipulation , operation on the data held in the database. Command used are:

- 1). Insert
- 2). Delete
- 3). Select
- 4). Update

3]. **Data Control Language (DCL) :-** Command are :-

- 1). GRANT
- 2). REVOKE

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Data Models:-

There are three type of data Models

- 1). Object based.
- 2). Record based Logical Models.
- 3). Physical based.

It can be define as an integrated collection of concept for describing and manipulating the data , relationship between the data and constraint on the data in an Organisation.

It comprises of three component.

1). Structural Part:-

There are rule which help in designing modal.

2). Manipulative Part:-

Which type of operation is apply on Model.

3). Integrity Rules:-

The relational model includes two general integrity rules. These integrity rules implicitly or explicitly define the set of consistent database states, or changes of state, or both.

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Data Model are divided into three Category.

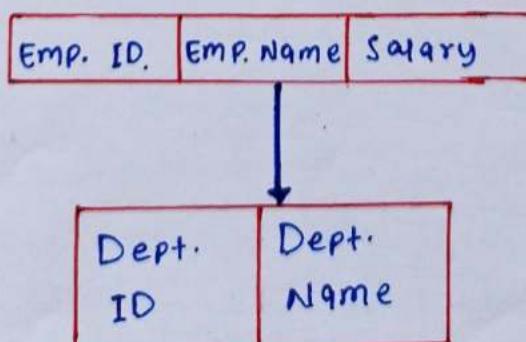
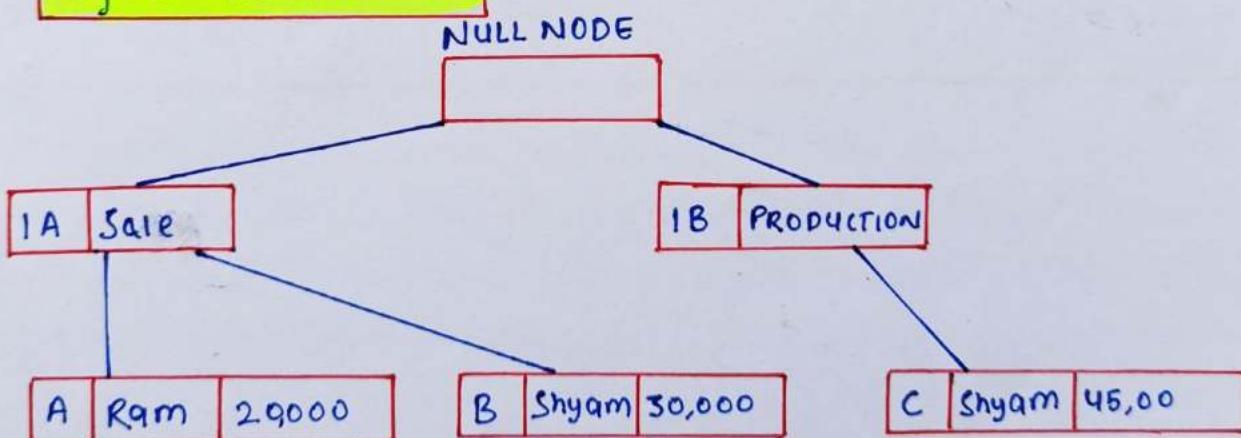
- 1]. **Object based**: It uses a concept such as entities, attribute and there relationship. This model can be used to describe the data at the conceptual and External level.

Example:- E-R Models.

- 2]. **Physical based**: These Model describe how the data is stored in the computer. This model is used to describe the data at the Internal level.

- 3]. **Record based Logical Models**: These models are used in describing the data at the logical and the view level. These Models are used to specify the over all logical structure of the database.

Eg. of Hierarchical :-



1]. Hierarchical Model :-

It is based on tree structure. It consists of collection of records that are connected to each other by links. The tree structure used in a Hierarchical model is known as rooted tree.

The root node of that tree is an empty node. So Hierarchical model is a collection of rooted tree and the relationship exists in the Hierarchical model is one to many and one to one.

Advantages :-

- 1). It is easy to understand.
- 2). More efficient than ER model.

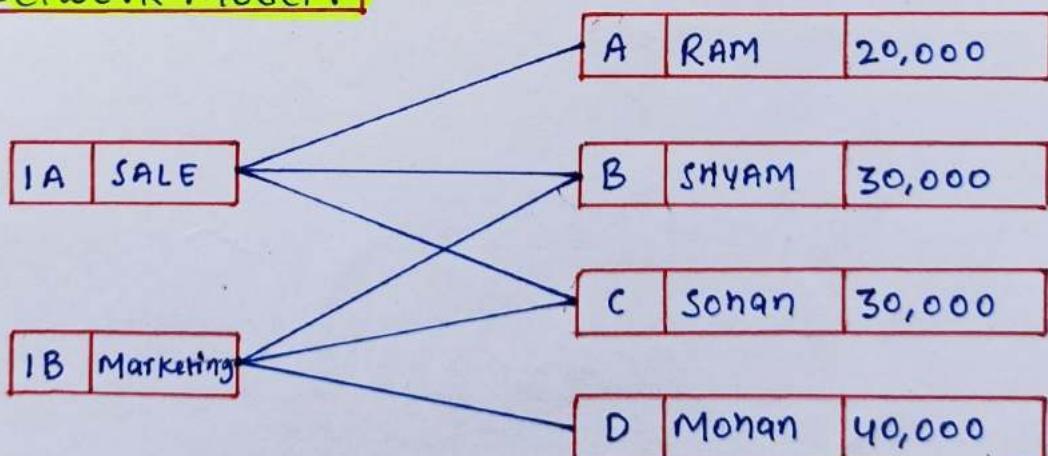
Disadvantages :-

- 1). Data inconsistency occurs when the parent node is deleted that result in the deletion of the child node.
- 2). Wastage of storage space.
- 3). Complex to design.
- 4). Absence of structural independency.

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2]. Network Model :-



For One to many →
One to one ↔
many to many

It is based on Graph structure. It consists of collection of records, which are connected to each other by links.

Advantages:-

- 1). It is easy to design than the Hierarchical Model.
- 2). Data access is easy in the network model.

Disadvantages:-

- 1). It is complex to design than a relational Model.
- 2). Efficiency are less than the relational Model.
- 3). Absence of structure independency.

3]. Relational Model :-

Relational Model stores data in form of tables.

Employee

| Emp. id | Emp. Name | Salary. |
|---------|-----------|---------|
| 1 | A | 20,000 |
| 2 | B | 30,000 |
| 3 | C | 40,000 |
| 4 | D | 50,000 |

Department.

| Dep. id | Name. |
|---------|------------|
| A | Sales |
| B | Marketing. |

Domain
Tuple Variable.

Table → Relation

Tuple → rows (Each Row of data).

Attributes → Column. (Each column in the tuple)

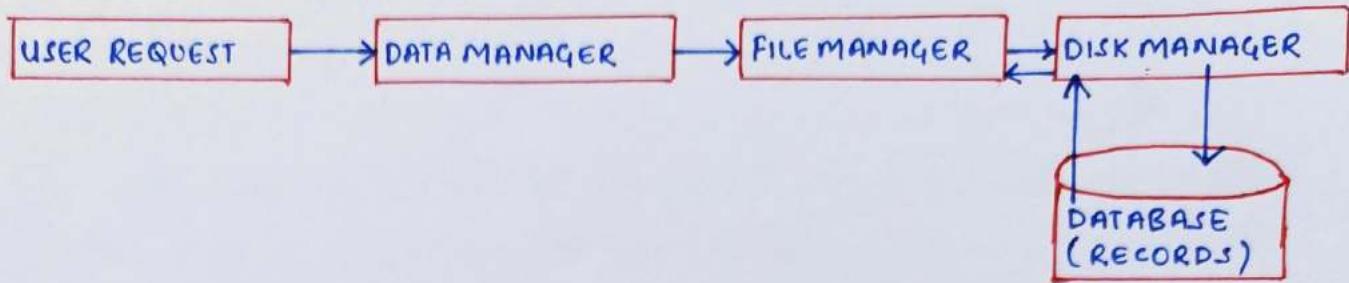
Domain → Set of permitted values

Tuples variable → Any value of a Tuple

Degree → No. of Column in a relation → 3 in emp.

Cardinality → No. of rows in a relation
(tuples).

Data Manager :-



- In Relational Model many to many relationship can be easily implemented.
- It is useful for representing most of the real world object and relationship among them.
- Relational model does not maintain physical connection among records. Data is organized logically in the forms of rows and columns and stored in table.

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UNIT-2.

Data Modelling using ER Models :

- Enterprise :- Object about which information is to be collected.
- Entity :- It is the name, thing etc; These are the data.
- Attributes:- Characteristic of entity OR Data elements & Data field.

TYPES OF ATTRIBUTES :-

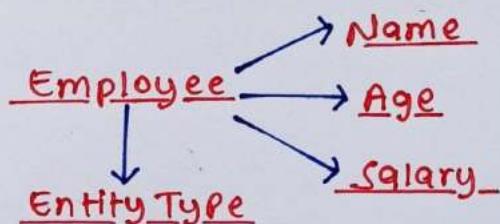
- 1). **Single Value Attributes :-** Those attribute which contain a single value. for example :- Age, salary etc.
- 2). **Multivalued Attributes :-** That contain more than one value of a single entry . for example :- Phone no.

- 3). **Composite Attribute :-** Those attribute which can be further divided. for example :- name → firstname lastname,
Date of Birth etc.
- 4). **Simple or Atomic attributes :-** Those attribute which can not be further divided. for example :- Age.
- 5). **Stored Attributes :-** Attributes which can not be derived from another attribute. Date of Birth.
- 6). **NULL value :-** Empty.

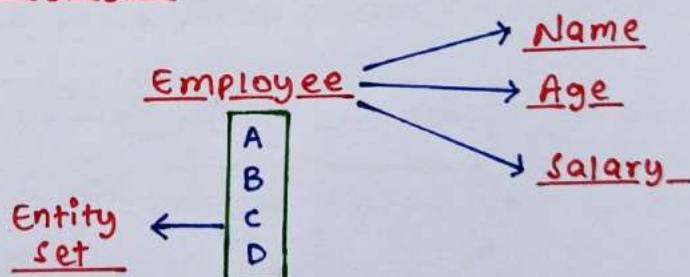
Entity Types :-

Collection of entity that share the same attribute.

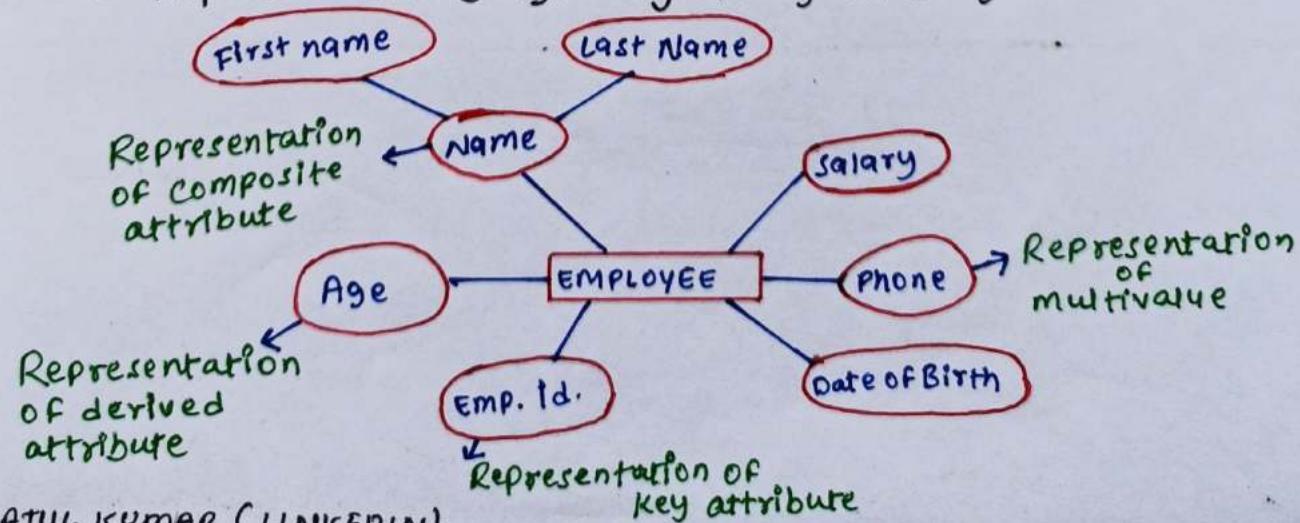
eg :-



Entity set :-

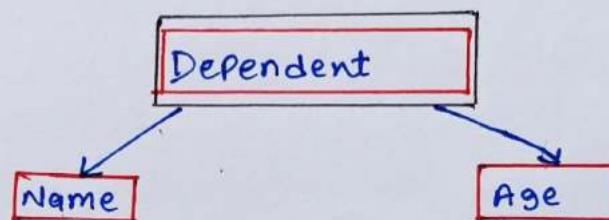


To Represent Entity Type by using ER diagram.



- **Key attribute:** Key attribute are those attribute which is uniquely identify the record.
- **Weak Entity type:** In Those entity type in which no key attributes is present.
- **Strong Entity type:** Those Entity type which consist of key attributes.

Example of weak Entity type:-



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Domain of the Attributes :- Set of possible values.

To join two entities → Relationship
Relationship type:-

Representation of Relationship

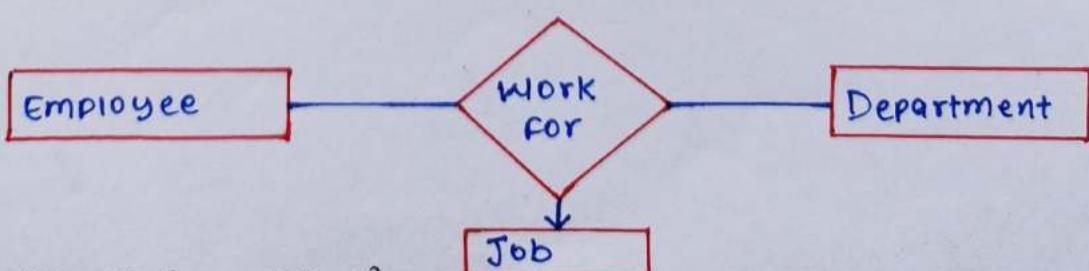


Degree of relationship type :- How much entity are involved in a relationship.

1). **Binary type** → 2 entity are related.

2). **Ternary type** → 3 entity are related.

Example:-



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Relationship Constraints :-

- ① Participation constraints,
② → cardinality ratio.

①

Participation constraints

Total Participation

Partial Participation

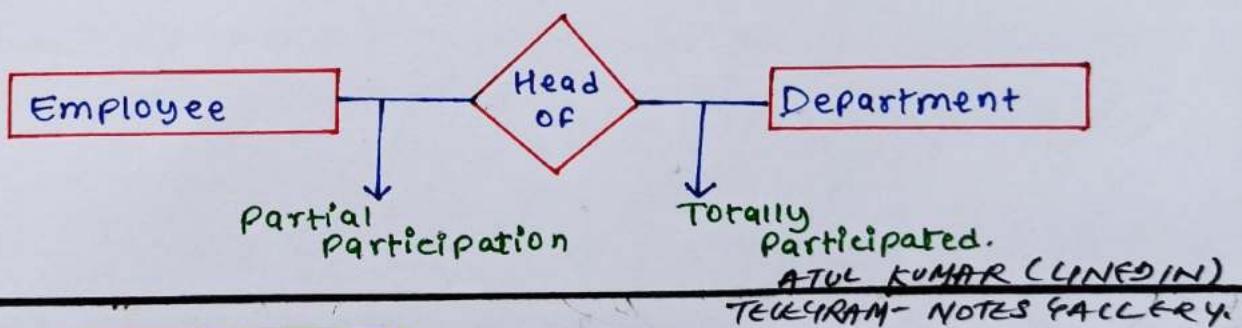
1]. Total Participation

In total participation every entity in the empty set must depend on another entity. It is also known as existence dependency.

In E-R diagram it is represented as a double line connecting the participating entity type two the relationship.

2]. Partial Participation

Partial participation some entities in the entity set are depend upon another entity.



- ② Cardinality ratio
- Cardinality ratio for binary relationship specifies the no. of relationship instance that an entity can participate in a relation set.

Relationship exists are :-

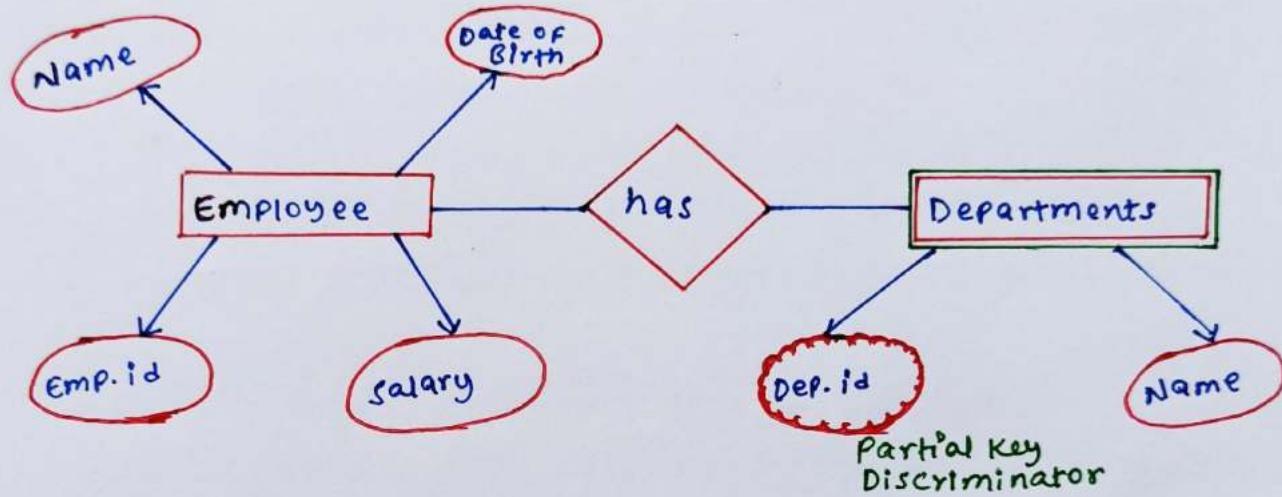
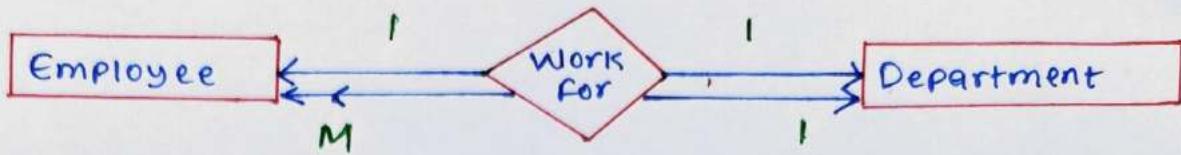
One to One \rightarrow (1:1)

One to many \rightarrow (1:N)

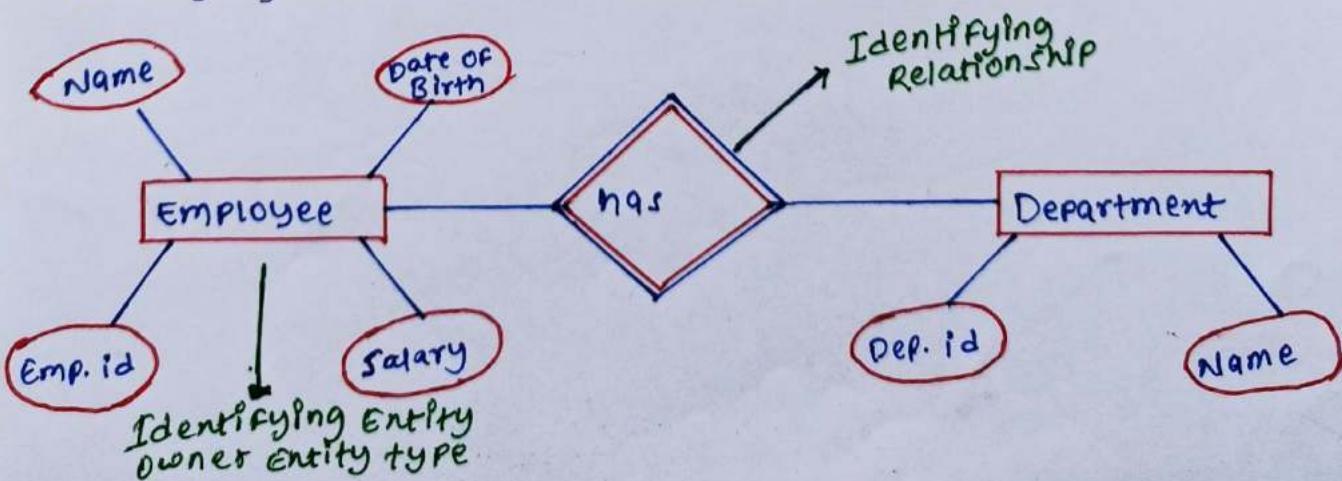
Many to one \rightarrow (N:1)

Many to Many \rightarrow (N:N)

Example :-



- Identifying Relationship :- We know that a weak entity type does have a key attribute, so what we do to relate such entity type with some other entity type. The weak entity type relate to another entity type in combination with some of their attributes value. We call this other entity type the identifying or the owner entity type and recall the relationship type that relates to its owner the identifying relationship.



Q. Make an E-R diagram for the company database with the following description.

- ① The company is organised into departments. Each department has a unique name and unique no. A department may have several locations.
- ② A department controls a no. of projects, Each of which has a unique name, unique no. and a single location.
- ③ We store each employee name, social security no., address and salary an employee is assigned to one department but may work on several projects, which are not necessarily controlled by the same department. We want to keep track of the dependence of each employee for insurance purposes.

Construct ER diagram for teacher student database .

