

DATABASE CONCEPT

DATA ?

Data means any Raw facts and figures that are incomplete by themselves, such as —

- Numbers (123, 45.6)
- Words (names, place names)
- Images
- Videos
- Audio
- Symbols
- Facts

DBMS

A database Management System is an organized collection of data, stored in a way that makes it easy to access, manage, and update.

Database Element

- **Data** - Raw facts and figures is called Data.
- **DBMS (Database management system)** -Software that helps create, manage, and access the database. Examples include MySQL, Oracle, and SQL Server.
- **Table** -Data is organized into tables with rows and columns.
- **Schema** - The structure of the database that defines how the data will be organized.

Type of Database

- **Relational Database** - Data is organized in tables, and relationships (relations) are established between different tables. Examples: SQL, PostgreSQL.
- **NoSQL Database** - Data is stored in formats other than tables, such as documents, graphs, or key-value pairs. Examples: MongoDB, Cassandra.

DBMS SOFTWARE

- MySQL
- Office access
- Oracle
- FoxPro
- DB2

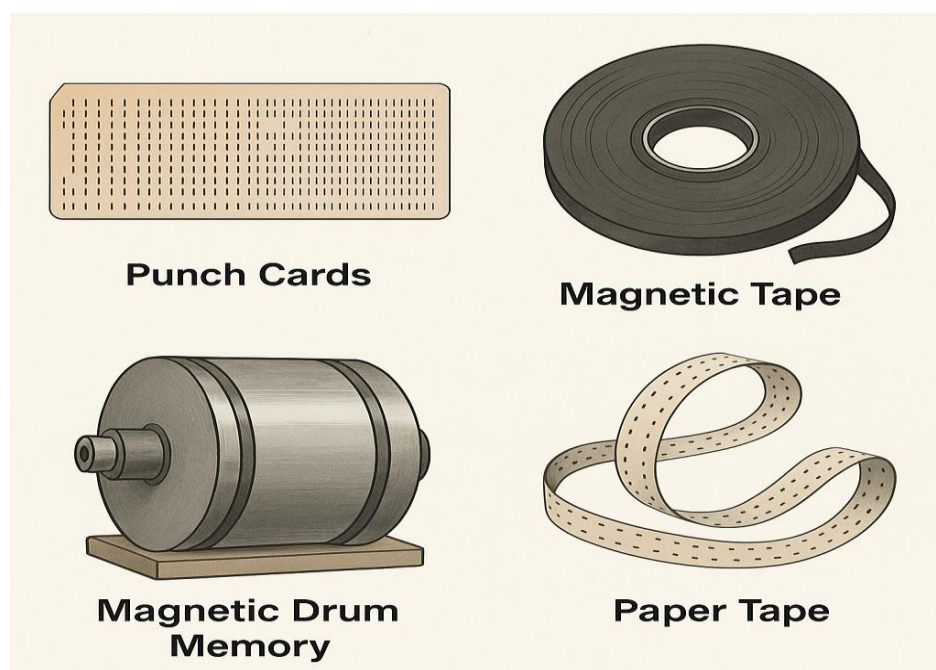
HISTORY OF DBMS

It began in the 1950s when data was stored and managed manually using file-based systems. As the volume and complexity of data grew, the need for a more efficient, organized, and systematic approach to data management led to the development of DBMS.

Development Timeline of DBMS

1950s - The Era of File-Based Systems

- Data was stored in **file-based systems**, where information was organized into separate files.
- These systems were manual and lacked a centralized management system, making it difficult to share or integrate data.
- There were no standard rules for accessing or managing the data.



The Birth of the Relational Model

- **Dr. Edgar Frank Codd** introduced the **Relational Database Model** in 1970 through his paper, *"A Relational Model of Data for Large Shared Data Banks.."*
- The relational model organized data into **tables (relations)**, using rows (tuples) and columns (attributes)
- The model was based on **set theory and relational algebra**, making it logical and easy to use.
- **SQL (Structured Query Language)** was developed to query relational databases.

DATA Model

- A **data model** is a conceptual framework that defines how data is structured, organized, and interrelated in a database.

Types of Data Model

- **Hierarchical data model**
- **Network data model**
- **Relational model**
- **Object-Oriented Data Model**
- **Document Data Model**
- **Entity-Relationship Model (ER Model)**

Hierarchical data model

- In this model, data is organized in a tree-like structure with a hierarchy of parent-child relationships.
- Each child node has only one parent, but a parent can have multiple children.
- **Example:** Organizational structures, file systems.

Network Data Model

- Similar to the hierarchical model, but allows more complex relationships with multiple parent nodes.
- Uses a graph structure where entities are represented as nodes, and relationships are edges.
- **Example:** Social networks, transport routes.

Relational Data Model

- In this model, data is organized into tables (also called relations), with rows (records) and columns (attributes).
- Each table represents an entity, and tables can be related to each other through primary and foreign keys.
- **Example:** Most modern databases like MySQL, PostgreSQL, Oracle

Object-Oriented Data Model

- Data is represented as objects, similar to object-oriented programming.
- Supports data types, methods, and inheritance, allowing complex data structures
- **Example:** Databases used in complex applications, like CAD (Computer-Aided Design) and multimedia systems.

Document Data Model

- Commonly used in NoSQL databases, where data is stored as documents in formats like JSON, XML, or BSON.
- Documents can store nested data structures and are flexible with schema changes.
- **Example:** MongoDB, CouchDB.

Entity-Relationship Model (ER Model)

- This is a high-level, conceptual data model that defines data elements as entities, attributes, and relationships.
- Often used in the design phase to map out how entities relate to each other.
- **Example:** Designing a relational database schema.

DBA

A **Database Administrator (DBA)** is a professional responsible for managing, maintaining, and securing an organization's databases. The DBA ensures that the database is functional, efficient, and accessible while safeguarding its integrity and security.

Role of DBA

- **Database Design and Implementation:**
- **Performance Tuning and Optimization:**
- **Backup and Recovery:**
- **Security Management:**
- **Database Maintenance:**
- **Data Integrity and Consistency:**
- **Collaboration with Teams:**

Types of DBAs

- **System DBA:** Focuses on the technical aspects of database management, such as installing, configuring, and maintaining the DBMS software.
- **Application DBA:** Works closely with application developers to optimize database queries and ensure compatibility with software applications.
- **Development DBA:** Involved in designing, developing, and testing new database systems.
- **Operational DBA:** Handles routine tasks like backups, recovery, and system monitoring.

Database Users

Database users are individuals or groups who interact with a database system to perform various operations like storing, retrieving, updating, and managing data.

Types of Database Users

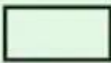




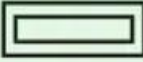
- Database Administrators (DBA)
- End Users
- Application Programmers

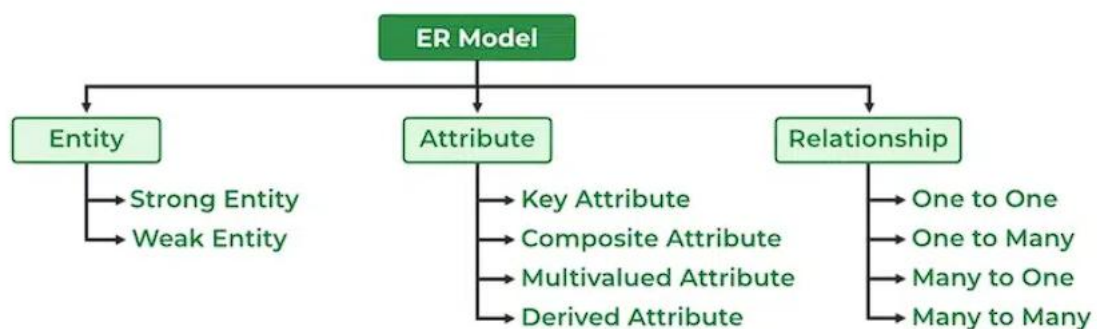
- System Analysts
- Database Designers
- Data Scientists and Analysts
- Testers

E.R. MODEL

Entity Relationship

The Entity Relational Model is a model for identifying entities to be represented in the database and representation of how those entities are related. The ER data model specifies enterprise schema that represents the overall logical structure of a database graphically.

Figures	Symbols	Represents
Rectangle		Entities in ER Model
Ellipse		Attributes in ER Model
Diamond		Relationships among Entities
Line		Attributes to Entities and Entity Sets with Other Relationship Types
Double Ellipse		Multi-Valued Attributes
Double Rectangle		Weak Entity



Roll.no	Name	Dob	Mobile	Email	Address
1	Abhishek	09-05-2001	7856985624	xyzj@gmail.com	Delhi
2	Vijay	01-08-2000	8824414632	xyzd@gmail.com	Mumbai
3	Ajay	06-09-2001	7856248218	xyzs@gmail.com	Howrah
4	Satish	17-03-1998	9912542482	xyzq@gmail.com	Ayodhya
5	Navin	16-04-1999	7812545552	xyji@gmail.com	Jodhpur
6	Suraj	07-12-1997	8615236524	xzjk@gmail.com	Banaras
7	Suneel	25-11-1993	8812458795	yz@gmail.com	Jaipur

ENTITY

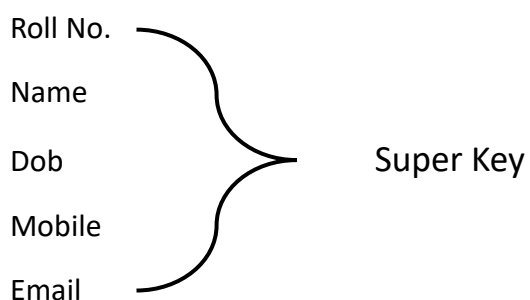
An Entity may be an object with a physical existence – a particular person, car, house, or employee – or it may be an object with a conceptual existence – a company, a job, or a university course.

Strong → **Key Attributes**

Weak → **Attributes**

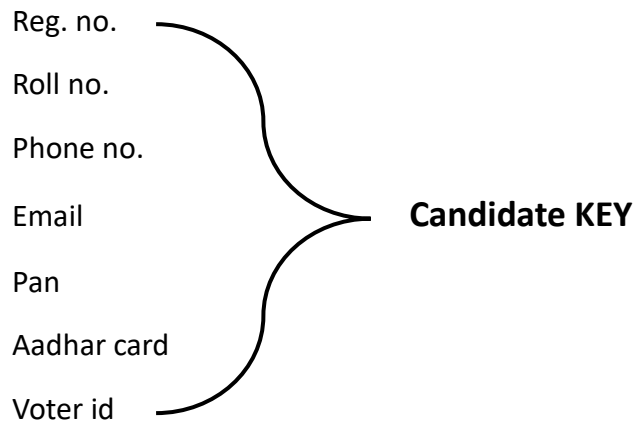
STRONG ENTITY

Super key is a set of one or more attributes that uniquely identifies each record within a table.



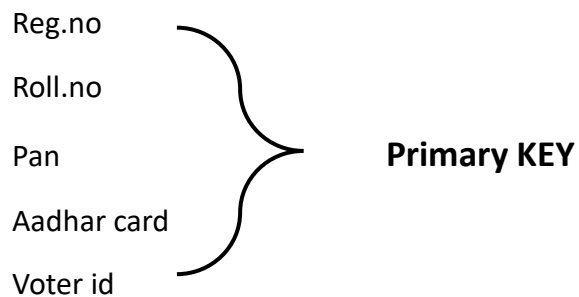
Candidate KEY

It consists of maximum possible attributes, which is Uniquely identifies.



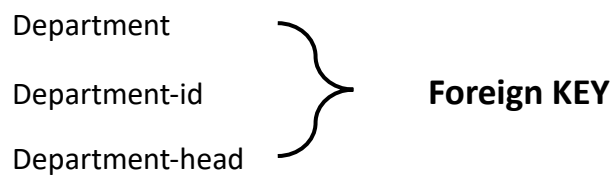
Primary Key

Unique + Not Null



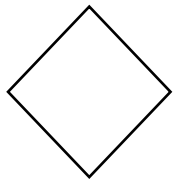
Foreign Key

A foreign key are attributes in a table, whose value match as primary key in another table.

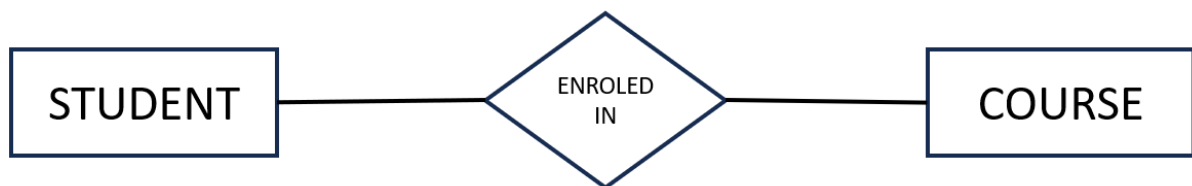


RELATIONSHIP

A Relationship Type represents the association between entity types.



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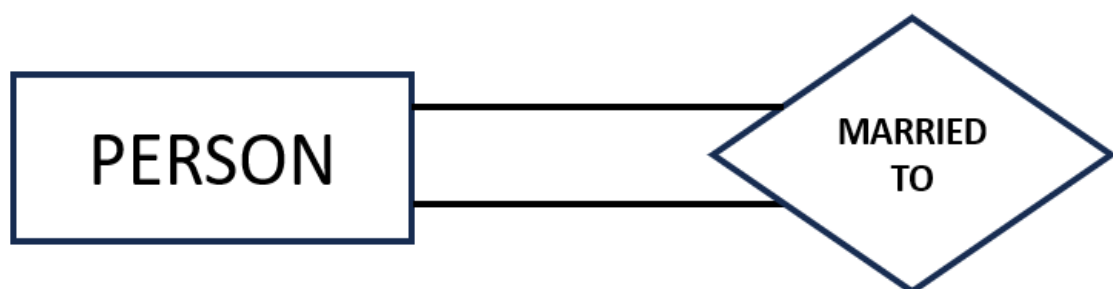
DEGREE OF A RELATIONSHIP SET

The number of different entity sets participating in a relationship set is called the degree of a relationship set.

- Unary Relationship
- Binary Relationship
- Ternary Relationship
- N-ary Relationship

Unary Relationship

When there is only ONE entity set participating in a relation, the relationship is called a unary relationship. For example, one person is married to only one person.



Binary Relationship

When there are TWO entities set participating in a relationship, the relationship is called a binary relationship.

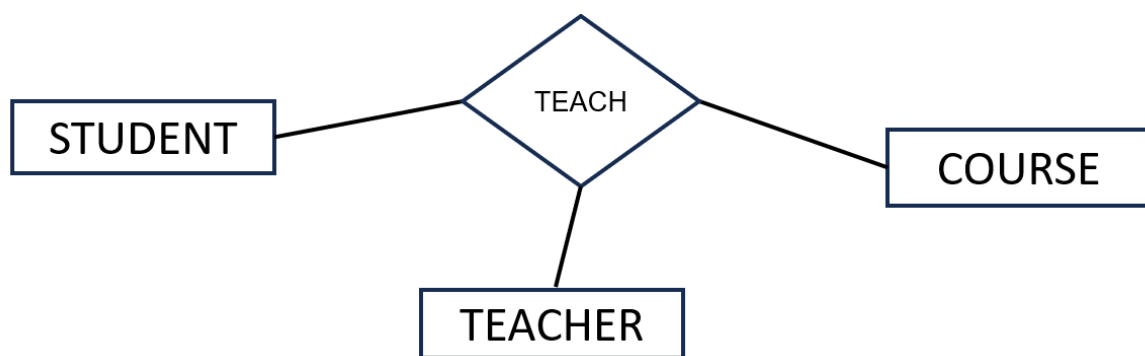
For example, a Student is enrolled in a Course.



Ternary Relationship

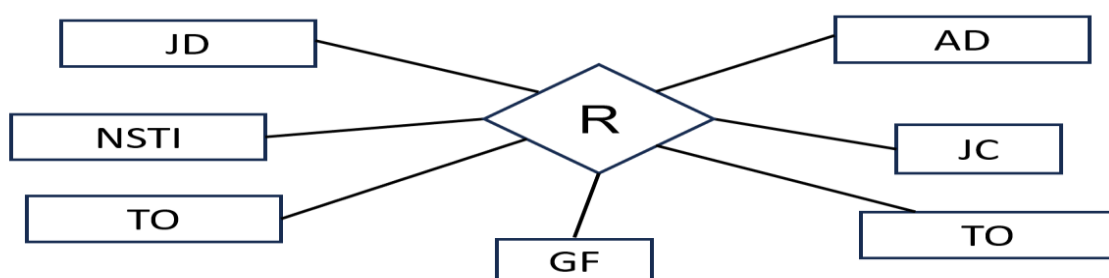
The Ternary relationship, there are three types of entity associates.

So, we can say that a Ternary relationship exists when there are three types of entity and we call them a degree of Relationship.



N-ary Relationship

When there are n entities set participating in a relation, the relationship is called an n-ary relationship.



RELATIONSHIP

CARDINALITY

Defines the numerical attributes of the relationship between two entities or entity sets.

- ONE TO ONE
- ONE TO MANY
- MANY TO ONE
- MANY TO MANY

CARDINALITY

ONE TO ONE

When a single instance of an entity is associated with a single instance of another entity then it is called one to one relationship.

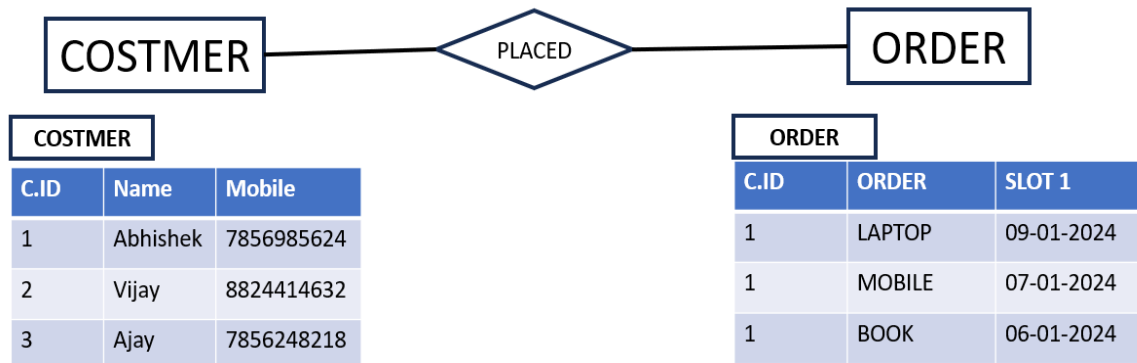


STUDENT	
Roll.no	Name
1	Abhishek
2	Vijay
3	Ajay

AADHAR	
ROLL.NO.	AADHAR NO.
1	111111111111
2	222222222222
3	333333333333

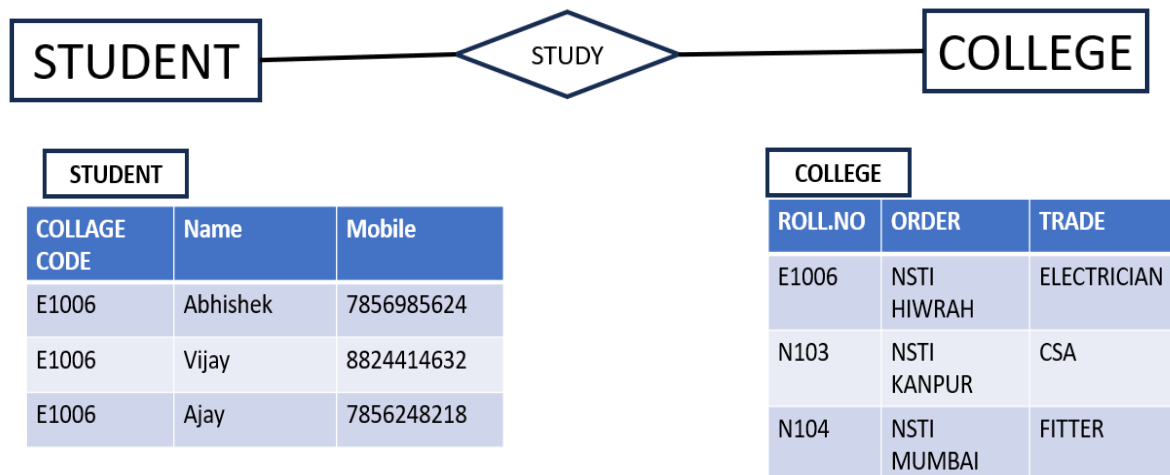
ONE TO MANY

When a single instance of an entity is associated with more than one instances of another entity then it is called one to many relationship.



MANY TO ONE

When more than one instances of an entity is associated with a single instance of another entity then it is called many to one relationship.



MANY TO MANY

When more than one instances of an entity is associated with more than one instances of another entity then it is called many to many relationships.

