# Databases

## What is data and information?

**Data**: Facts that can be recorded like name,  numbers, age, height, weight, etc.

**Information**: Information is processed or meaningful data.

## What is a database?

The database is a systematic and organized collection of data that represent some real-world entities. For example: In our phone directory, a database is maintained to store the contact details of any person.

The main aim is to access a large amount of information by storing/ retrieving/ managing the data.

There are many examples of databases like many of the websites that use databases to manage their data. Hotels maintain databases of check-ins and check-outs, etc.

## Database Model

A set of rules that define how the database stores/organizes/manages the data is called a database model. It also defines how the data will be visible to us in our database.

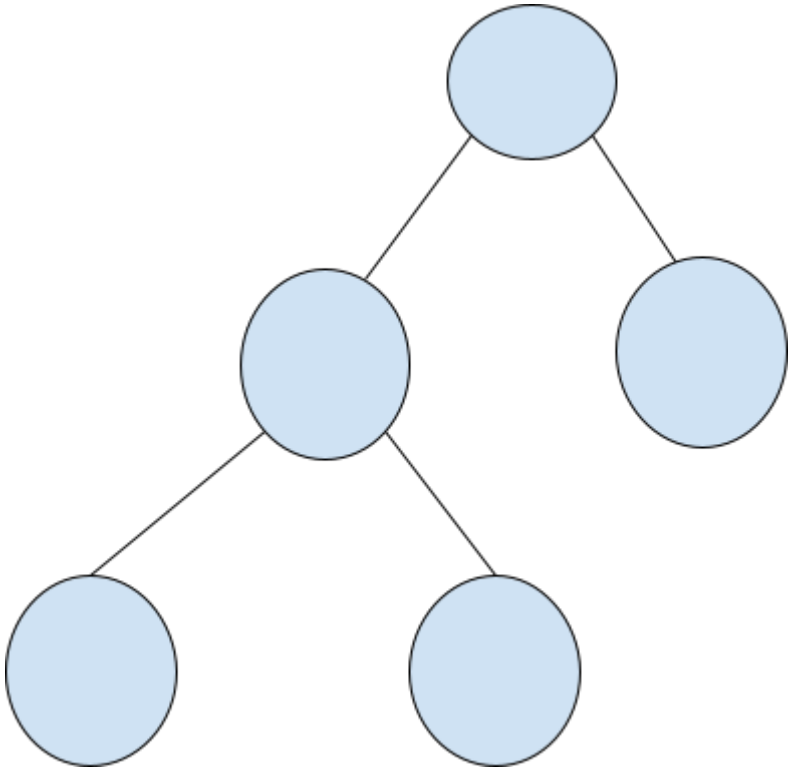
There are basically three types of database model:

1. Hierarchical Model
2. Relational Model
3. Network Model

## Hierarchical Model

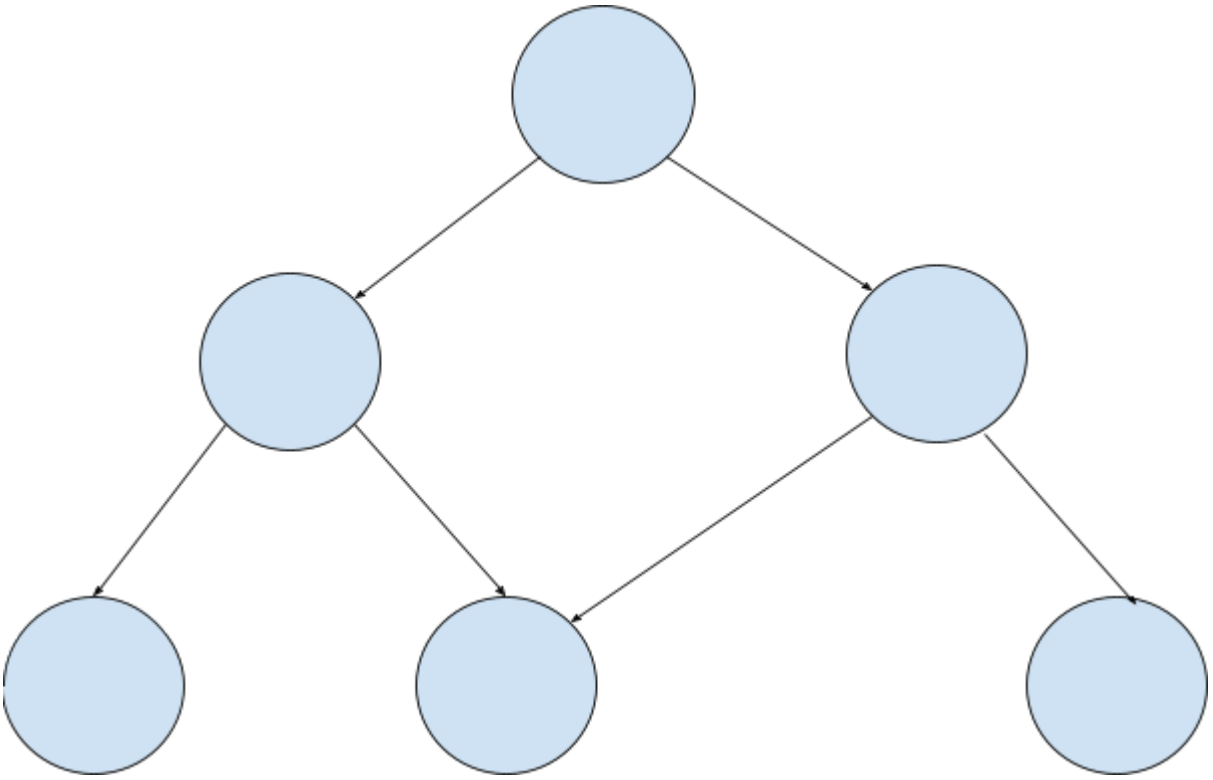
1. In this model, our data/record is stored in the form of a hierarchy.

2. Each record/data type in this model is called a node.
3. A node represents a particular entity.
4. The topmost node is called the root node.



## Network Model

1.It is similar to the Hierarchy model. The only difference in this model is that the children node can have more than one parent.
2.The child node is represented by an arrow.
3.This model has more flexibility than the previous model.



## Relational Model

1. It is the most commonly used database model.
2. It consists of simple relations (relations are used for table).
3. Relation represents a particular entity.

## What is RDBMS?

RDBMS basically stands for a Relational database management system. It is a software application that is used to store/ retrieve,/manage relational databases.

It is a type of management system which is used to manage our relational databases efficiently.

## What are Relational databases?

The databases that are based on relational data models are relational databases. In relational database models, databases are stored in the form of tables that have multiple rows and columns.
Each row in a table represents a record that consists of a number of data fields. The columns in a table represent the attribute for an entity.

**Table**: A table is a collection of related data in our database. This is the simplest form to store data in a relational database.
An example of a table is given below:

Employee table

| Employee Id | Name | Department | Salary( in Rs.) |
|---|---|---|---|
| 256109 | Stuti | Finance | 40,000 |
| 256110 | Aarav | Finance | 45,000 |
| 256111 | Rehan | Finance | 34,000 |

**Field**: Every table is made up of smaller entities known as fields. In the above table, Employee id, Name, department, salary are fields.

**Row**: A row in a table is the data of an individual entry. The row is also known as a record.

An example of a row from the Employee table is given below:

| | | | |
|---|---|---|---|
| 256109 | Stuti | Finance | 40,000 |

**Column**: A column in a table consists of all the information associated with a particular field.
An example of the column from the Employee table is given below:

| Employee Id |
|---|
| 256109 |
| 256110 |

256111

Some of the most used Relational Database Management System are:

1. MySQL
2. Oracle database
3. MongoDB
4. Microsoft Access
5. MariaDB

## SQL DATABASE

SQL basically stands for Structured Query Language. A user uses SQL to interact/communicate with the database. SQL is domain specific and declarative language.
We can use SQL to fetch data from the relational database where the data is stored in the form of tables. Using SQL, we can access and manipulate our database.

In a database, using SQL we can:

1. Execute queries
2. Insert new records
3. Update the data
4. Delete the records
5. Create new databases
6. Create new tables

Common SQL commands:

- SELECT - retrieves record from a database

  Syntax: Select * from TABLE;

- UPDATE - updates record in a database

  Syntax: UPDATE table SET columnA = valueA, columnB = valueB..... columnN = valueN where [condition];

- DELETE - deletes record from any database

Syntax: DELETE FROM TABLE where condition;

- INSERT INTO - inserts new record into a database

  Syntax: Insert INTO Table (columnA, columnB,..... columnN) Values (valueA, valueB, ....valueN);

- CREATE DATABASE - it will create a new database

  Syntax: create Database databasename;

- CREATE TABLE - it will create a new table

  Syntax:CREATE TABLE table__name (

  columnA datatype,

  columnB datatype,

  ........);

- ALTER TABLE - helps in modification of a table

  Syntax: ALTER TABLe table__name

  ADD column__name datatype;

- DROP TABLE -it will delete a table

  Syntax: DROP TABLE table__name ;

## NoSQL DATABASE

NoSQL stands for Not Only SQL.

There are Four types of NoSQL Database :

1. Key-value Pair Based
2. Column-oriented Graph
3. Graph based
4. Document-oriented

## Key Value pair based

In this type of database, our data is stored in key-value pairs. It is used to handle lots of data and heavy load.

Key-value pair based databases store data as a hash table where each key in the database is unique.

Example:

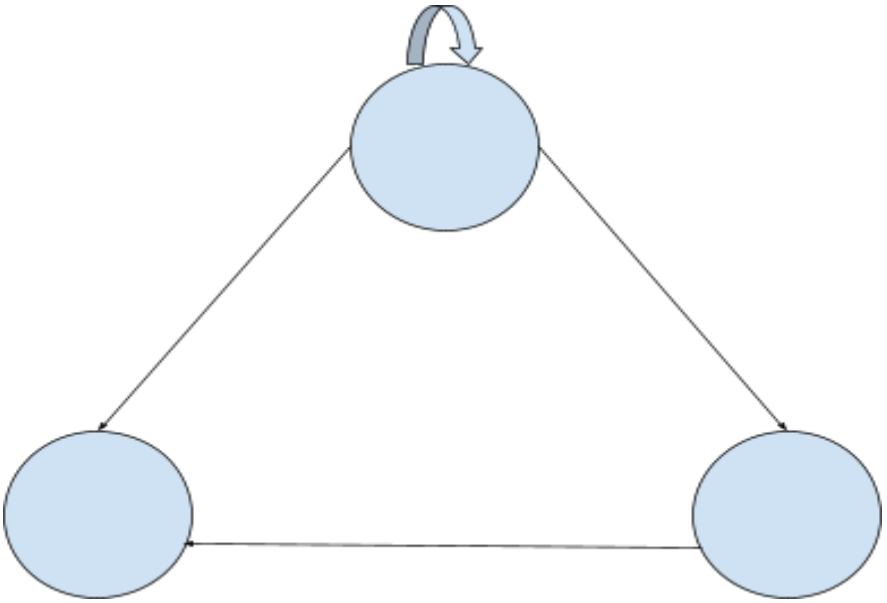
| Key | Value |
|---|---|
| Name | Stuti |
| Age | 31 |
| Address | New Delhi |

## Column oriented Graph

This type of database works on columns and each and every column is treated separately.
HBase, Cassandra, HBase, Hypertable are examples of column based databases.

## Graph Based

A graph type database stores entities and identifies the relationship amongst those entities. The entity is stored as a node and relationship as edges. An edge tells us the relationship between nodes. Each and every node and edge has a unique identifier.
Example:



## Document oriented

In this type of database, the key and values are stored in the form of a document.
Example:
Document1
{
“Property1” : data ,
“Property2” : data ,
“Property3” : data ,
}

## Difference between SQL and NoSQL database

| Differentiating Property | SQL | NoSQL |
|---|---|---|
| Type | RDBMS is the basis for SQL | Non-Relational or |

| | | |
|---|---|---|
| | | distributed database is the basis for SQL |
| Schema | SQL have a definite/ predefined schema | NoSQL do not have a definite schema |
| Scalability | SQL shows vertical scalability | NoSQL shows horizontal scalability |
| Property | It follows ACID( atomicity, consistency, isolation, durability) property | It follows CAP( consistency, availability, partition tolerance) |
| Type | SQL database is mainly table based | NoSQL databases can be of four types: document based, key-value pairs, graph databases, column oriented |
| Example | Oracle, MS-SQL | MongoDB, HBase |

## Types of database

There are various types of databases we use to store different kind of data:

1. Centralized Database
2. Distributed Database
3. NoSQL Database
4. Cloud Database
5. Relational Database
6. Network Database
7. Object-oriented Database
8. Hierarchical Database
9. Personal Database
10. Operational Database
11. Enterprise Database

## Centralized database

This type of database stores data at a centralized database system. It allows users to access the stored data from different locations through various applications. These applications use the authentication process to maintain the security of data. An example of a Centralized database is Library that carries a database of each student in a college/university.

## Distributed database

In distributed systems, data is distributed among different database systems of an organization and are connected via communication links. These links help the users to access the data conveniently. Examples of the Distributed database are Apache Cassandra, HBase, Ignite, etc.
There are two types of Distributed database:

1. Homogeneous DD: The database systems which execute on the same operating system are homogeneous DD.
2. Heterogeneous DD: The database systems which execute on different operating systems are heterogeneous DD.

## NoSQL database

NoSQL is a type of database that is used for storing a wide range of data . It is not a relational database as it does not have a definite schema. It shows horizontal scalability. NoSQL databases can be of four types: document based, key-value pairs, graph databases, column oriented.

## Relational database

This type of database is based on a relational data model which uses row and columns and forms tables to store data. It uses SQL to store, retrieve and manipulate data in databases.

## Cloud database

In this type of database, data is stored on a virtual cloud and executes over the cloud computing platform. It provides users with various cloud computing services (SaaS, PaaS, IaaS, etc.) for accessing the database in the system. There are various cloud platforms such as:

- Amazon Web Services(AWS)
- Microsoft Azure
- Kamatera

## Object oriented database

This type of database is based on an object oriented model and uses objects to store data.

## Hierarchical database

This type of database uses parent-child relationships to store data in the database. Data is organised in a tree like structure.

## Network database

This type of database follows a network data model which uses nodes to represent data. In this type of database, we can have multiple child- parent relationships.

## Personal database

Personal database is a database in which data is collected and stored on a user's system. It is designed for personal use only.

## Operational database

Operational databases are used to store or create real time based data. This type of database is used for daily operations or daily transactions in any organization.

## Enterprise database

Enterprise databases are used by Enterprises or huge firms to store their large amount of data and access that data easily and efficiently.