

# Database and Types of Databases

SEMINAR REPORT

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## **DECLARATION**

I hereby to declare that the seminar report entitled “**Database and Types of Databases**” which is being submitted to the National Institute of Technology Karnataka, Surathkal in partial fulfilment of the requirements for Mandatory Learning Course (MLC) of Master of Computer Applications in the department of Mathematical and Computational Sciences, is a bonafide report of the work prepared by me. This material is collected from various sources with utmost care and is based on facts and truth.

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## **CERTIFICATE**

This is to certify that the P.G. Seminar Report entitled “**Database and Types of Databases**” submitted AMAN SEHGAL (Roll No:- 224CA008) as the record of the work carried out by him is accepted as the P.G. Seminar Work Report submission in partial fulfilment of the requirements for mandatory learning of Master Of Computer Applications in the department of Mathematical And Computational Sciences.

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## 1- What is Database?

A **database** is a systematic or organized collection of related information that is stored in such a way that it can be easily accessed, retrieved, managed, and updated. The main purpose of the database is to operate a large amount of information by **storing**, **retrieving**, and **managing** data.

**MySQL**, **SQL Server**, **MongoDB**, **Oracle Database**, **PostgreSQL**, etc. are all examples of different databases.

A database is typically represented by a cylindrical structure.



## **2- Need of Database?**

### **Manages large amounts of data**

A database stores and manages a large amount of data on a daily basis. This would not be possible using any other tool such as a spreadsheet as they would simply not work.

### **Accurate**

A database is pretty accurate as it has all sorts of build in constraints, checks etc. This means that the information available in a database is guaranteed to be correct in most cases.

### **Easy to update data**

In a database, it is easy to update data using various Data Manipulation languages (DML) available. One of these languages is SQL.

### **Security of data**

Databases have various methods to ensure security of data. There are user logins required before accessing a database and various access specifiers. These allow only authorized users to access the database.

### **Data integrity**

This is ensured in databases by using various constraints for data. Data integrity in databases makes sure that the data is accurate and consistent in a database.

## **Easy to research data**

It is very easy to access and research data in a database. This is done using Data Query Languages (DQL) which allow searching of any data in the database and performing computations on it.

## **3- Types of Databases**

- i- Relational Databases.
- ii- Object Oriented Databases.
- iii- NoSQL Databases.
- iv- Hierarchical Databases.
- v- Network Databases.

## **4- Relational Databases**

A relational database organizes data into rows and columns, which collectively form a **table**. Data is typically structured across multiple tables, which can be joined together via a primary key or a foreign key. A relational database is the most commonly used database. It contains several tables, and each table has its primary key. Relational Databases commonly use Structured Query Language (SQL) for operations such as creating, reading, updating and deleting data. **MySQL**, **Microsoft SQL Server**, and **Oracle** are types of Relational Databases.

### **Pros of Relational Databases**

- Great for structured data
- Use of an existing query language (SQL)
- Great for complex queries
- High level of data integration, due to relationships and constraints among tables
- Transactions are secure
- High reliability

## **Cons of Relational Databases**

- Up-front schema definition
- No adaptation to changing requirements: dynamic changes to an item affect all the other items in the same table
- Data processing may be slow. High performance is possible with expensive hardware

## **5- Object Oriented Databases**

An object-oriented database is a type of database that is based on the principles of **object-oriented programming** (OOP). In an object-oriented database, data is organized and stored as objects, which are self-contained units that contain both data and the operations or methods that can be performed on that data. This allows for the efficient representation and management of complex data structures and relationships.

Similar to object-oriented languages, object-oriented databases follow many object-oriented programming paradigms, such as inheritance, polymorphism, and encapsulation.

**ObjectDB** – Object Oriented database that works with Java applications.

### **Advantages of Object-Oriented Databases**

- Improved code reuse and modularity.
- Flexibility and adaptability.

### **Drawbacks of Object Databases**

- Not many programming language support object databases.
- RDBMS have SQL as a standard query language. Object databases do not have a standard.



## 6- NoSQL Databases

**NoSQL database** technology stores information in **JSON** documents instead of columns and rows used by relational databases. To be clear, NoSQL stands for “**not only SQL**” rather than “no SQL” at all.

NoSQL is also type of distributed database, which means that information is copied and stored on various servers, which can be remote or local. This ensures availability and reliability of data. If some of the data goes offline, the rest of the database can continue to run.

The following defines the four most-popular types of NoSQL database:

- **Document databases** are primarily built for storing information as documents, including, but not limited to, JSON documents. These systems can also be used for storing XML documents, for a NoSQL database example.
- **Key-value stores** group associated data in collections with records that are identified with unique keys for easy retrieval. Key-value stores have just enough structure to mirror the value of relational databases (as opposed to non-relational databases) while still preserving the benefits of the NoSQL database structure.
- **Wide-column databases** use the tabular format of relational databases yet allow a wide variance in how data is named and formatted in each row, even in the same table. Like key-value stores, wide-column databases have some basic NoSQL structure while also preserving a lot of flexibility
- **Graph databases** use graph structures to define the relationships between stored data points. Graph databases are useful for identifying patterns in unstructured and semi-structured information.

## **Major advantages of NoSQL databases include:**

### **(i) Flexible Data Model:**

NoSQL databases are highly flexible as they can store and combine any type of data, both structured and unstructured, unlike relational databases that can store data in a structured way only.

### **(ii) Evolving Data Model:**

NoSQL databases allow you to dynamically update the schema to evolve with changing requirements while ensuring that it would cause no interruption or downtime to your application.

### **(iii) Open-source:**

NoSQL databases don't require expensive licensing fees and can run on inexpensive hardware, rendering their deployment cost-effective.

## **Major disadvantages of NoSQL databases are:**

### **(i) Backup of Database:**

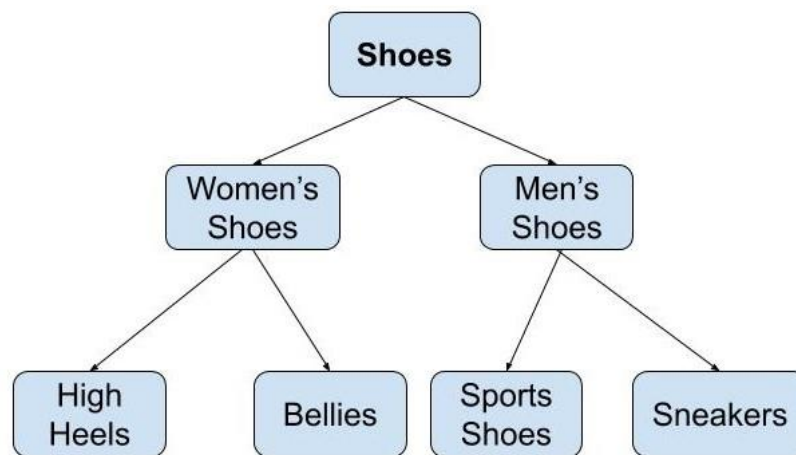
Backups are a drawback in NoSQL databases. Though some NoSQL databases like MongoDB provide some tools for backup, these tools are not mature enough to ensure proper complete data backup solution.

### **(ii) Consistency:**

NoSQL puts a scalability and performance first but when it comes to a consistency of the data NoSQL doesn't take much consideration so it makes it little insecure as compared to the relational database e.g., in NoSQL databases if you enter same set of data again, it will take it without issuing any error whereas relational databases ensure that no duplicate rows get entry in databases.

## 7- Hierarchical Databases

A hierarchical database is a type of database that is organized in a tree-like structure, with each record or data element being linked to one or more other records or data elements. In a hierarchical database, data is stored in a **parent-child relationship**, with a parent record being linked to one or more child records. This type of database is commonly used to represent data relationships, such as those found in organizational charts or family trees. This model easily represents some of the real-world relationships like food recipes, sitemap of a website etc. ***Example:*** We can represent the relationship between the shoes present on a shopping website in the following way:



*Hierarchical Model*

### Advantages of Hierarchical Model

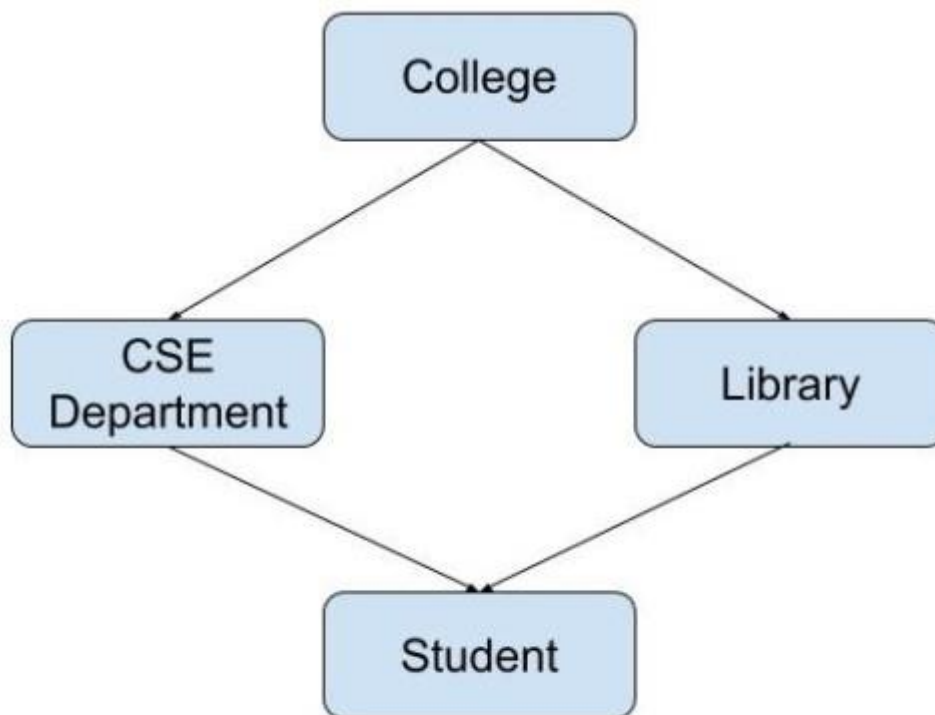
- It is very simple and fast to traverse through a tree-like structure.
- Any change in the parent node is automatically reflected in the child node so, the integrity of data is maintained.

## Disadvantages of Hierarchical Model

- Complex relationships are not supported.
- As it does not support more than one parent of the child node so if we have some complex relationship where a child node needs to have two parent node then that can't be represented using this model.
- If a parent node is deleted then the child node is automatically deleted.

## 8- Network Databases

This database is an extension of the hierarchical database. It was the most popular database before the relational database. This model is the same as the hierarchical model, the only difference is that a record can have more than one parent. It replaces the hierarchical tree with a graph. **Example:** In the example below we can see that node student has two parents i.e. CSE Department and Library. This was earlier not possible in the hierarchical model.



*Network Model*

## Features

The features of a Network Model are as follows –

- **Ability to Merge Relationships** – In this model, because of more relationships the data is more related. It has an ability to manage one-to-one relationships as well as many-to-many relationships.
- **Many paths** – There can be more than one path to the same record because of more relationships. It makes data access fast and simple.

## Advantages of Network Model

- The data can be accessed faster as compared to the hierarchical model. This is because the data is more related in the network model and there can be more than one path to reach a particular node. So the data can be accessed in many ways.
- As there is a parent-child relationship so data integrity is present. Any change in parent record is reflected in the child record.

## Disadvantages of Network Model

- As more and more relationships need to be handled the system might get complex. So, a user must be having detailed knowledge of the model to work with the model.
- Any change like updation, deletion, insertion is very complex.

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