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Backend development Class 01, Series 03

Database

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CLASS 01

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What is a Database?

A database is a collection of related data which represents some aspect of the real world. A database system is designed to be built and populated with data for a certain task.

What is DBMS?

Database Management System (DBMS)

- Database Management System (DBMS) is a software for storing and retrieving users' data while considering appropriate security measures.
- It consists of a group of programs which manipulate the database.
- The DBMS accepts the request for data from an application and instructs the operating system to provide the specific data. In large systems, a DBMS helps users and other third-party software to store and retrieve data.

DBMS allows users to create their own databases as per their requirement. The term "DBMS" includes the user of the database and other application programs. It provides an interface between the data and the software application.

Characteristics of DBMS

Here are the characteristics and properties of Database Management System:

- Provides security and removes redundancy
- Insulation between programs and data abstraction
- Support of multiple views of the data
- Sharing of data and multi-user transaction processing
- Database Management Software allows entities and relations among them to form tables, views and functions.
- It follows the ACID concept (Atomicity, Consistency, Isolation, and Durability).
- DBMS supports multi-user environment that allows users to access and manipulate data in parallel.

Types of Databases

There are two main database types: **Relational & Non-Relational.** So, what's the difference?

A relational database, or relational database management system (RDMS), stores information in tables. Often, these tables have shared information between them, causing a relationship to form between **tables**. This is where a relational database gets its name from.

Non-Relational Databases are also called No-SQL databases, are completely different from SQL databases and work differently. It has to deal with semi-structured or unstructured data. Rather than containing tables, it consists of files within various folders. They can possess any kind of data, whether **JSON, XML, etc.** So, creating and managing data in NoSQL is easy and faster.

Relational Database

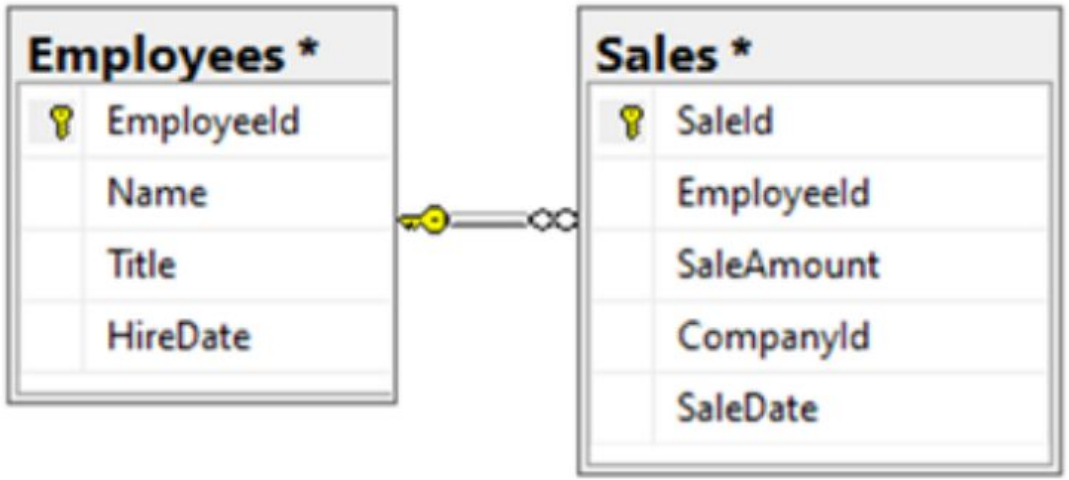
A relational database works by linking information from multiple tables through the use of **“keys.”**

A key is a unique identifier which can be assigned to a row of data contained within a table. This unique identifier, called a **“primary key,”** can then be included in a record located in another table when that record has a relationship to the primary record in the main table.

When this unique primary key is added to a record in another table, it is called a **“foreign key”** in the associated table. The connection between the primary and foreign key then creates the **“relationship”** between records contained across multiple tables.

Relational Database

One significant advantage to using an RDBMS is **“referential integrity.”** Referential integrity refers to the accuracy and consistency of data. This data integrity is achieved by using these primary and foreign keys.



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referential integrity

Referential integrity preserves data integrity through **“constraints.”**

Constraints are the rules that enforce the data’s accuracy by preventing a related record from being deleted without first deleting the primary record in the main table.

For Example:

If a primary-foreign key relationship has been properly added, then attempting to delete a primary record without first removing related records from other tables will block the transaction until the related records are removed. This prevents what is referred to as “orphaned records,” which are referenced records in a table that no longer have a primary record in the main table.

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referential integrity

The **three** **rules** that referential integrity enforces are:

1. A foreign key must have a corresponding primary key. **(“No orphans” rule.)**
2. When a record in a primary table is deleted, all related records referencing the primary key must also be deleted, which is typically accomplished by using **cascade delete.**
3. If the primary key for a record changes, all corresponding records in other tables using the primary key as a foreign key must also be modified. This can be accomplished by using a **cascade update.**

SQL

Querying the data in a relational database management system is done by using **Structured Querying Language (SQL)**

SQL has the capabilities to create, retrieve, update and delete records and heavily relies on this primary/foreign key relationship to identify related data across multiple tables

```
CREATE TABLE table_name (
  column_1 datatype,
  column_2 datatype,
  column_3 datatype
```

```
SELECT column_name
FROM table_name;
```

```
DELETE FROM table_name
WHERE some_column = some_value;
```

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Popular relational databases

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NoSQL database

The non-relational database, or NoSQL database, stores data. However, unlike the relational database, there are **no** tables, rows, primary keys or foreign keys. Instead, the non-relational database uses a storage model optimized for specific requirements of the type of data being stored.

There are four popular non-relational types: **document data store, column-oriented database, key-value store and graph database.** Often combinations of these types are used for a single application.

Document data stores

A document data store manages a set of named string fields and object data values in an entity referred to as a “document” typically stored in the form of JSON documents, which can be encoded in a variety of ways, including XML, YAML, JSON, BSON or as plain text. The fields within documents are exposed, allowing an application to query and filter data using field values.

Popular databases include MongoDB, ArangoDB, Couchbase, Amazon Dynamodb ..

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Columnar data stores

A columnar data store organizes data into **columns**, which is conceptually similar to the row-oriented database. The true advantage of a column-family database is in its denormalized approach to structuring sparse data, which comes from its column-oriented approach to storing data.

It's more of how the data is stored on disk, Row-oriented databases store the data for each row together, while columnar databases store the data for each column together.
Popular databases include Google Cloud BigQuery, Amazon Redshift, Snowflake …

Key-value stores

This is the least complicated of the NoSQL databases and, as the name would indicate, the key-value store is simply a collection of **key-value pairs contained within an object.**

Popular key-value stores include Redis, Apache Cassandra, Memcached …

Graph databases

Last is the most complex non-relational database type. It's designed to efficiently store relations between entities. When data is **greatly interconnected**, such as purchasing and manufacturing systems or referencing catalogs, graph databases are a good solution.

The possibilities for graph NoSQL databases are **infinite**, and with the data we collect becoming increasingly interconnected, graph databases are going to continue to gain in popularity, including the still-dominant relational database.

Popular graph databases include Neo4j, OrientDB, AllegroGraph …

Popular non-relational databases

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Thank you!

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