M.Sc. IV Sem. (Mathematics)
Paper 2nd - Fundamentals of Computer Science - II
Unit IV

Reference Book :   C. J. Date, *An Introduction to Database Systems, Addison Wesley*

Topic : Structured Query Language

Structured Query Language (SQL) is a programming language that is typically used in relational database or data stream management systems. It was developed by IBM in the early 1970s and is now an official standard recognized by the American National Standards Institute (ANSI) and the International Organization for Standardization (ISO). Structured Query Language is a standard computer language for accessing and manipulating database systems. SQL comprises one of the fundamental building blocks of modern database architecture. SQL defines methods using which user can create and manipulate databases on all major platforms. SQL is a set based declarative programming language and not an imperative programming language like C or BASIC. SQL has remained a consistently popular choice for database administrators over the years primarily due to its ease of use and the highly effective manner in which it queries, manipulates, aggregates data and performs a wide range of other functions to turn massive collections of structured data into usable information. For this reason, it has been incorporated into numerous commercial database products, such as MySQL, Oracle, Sybase, SQL Server, Postgres and others.

Characteristics of SQL :

- SQL is an ANSI and ISO standard computer language for creating and manipulating databases.

- SQL allows the user to create, update, delete, and retrieve data from a database.

- SQL is very simple and easy to learn.

- SQL works with database programs like DB2, Oracle, MS Access, Sybase, MS SQL Sever etc.

Key features of SQL :

❖ High Performance.

❖ High Availability.

❖ Scalability and Flexibility

❖ Robust Transactional Support.

❖ High Security.

❖ Comprehensive Application Development.

❖ Management Ease.

❖ Open Source.

Advantages of SQL:

➢ **High Speed:** SQL Queries can be used to retrieve large amounts of records from a database quickly and efficiently.

➢ **Well Defined Standards Exist:** SQL databases use long-established standard, which is being adopted by ANSI & ISO. Non-SQL databases do not adhere to any clear standard.

➢ **No Coding Required:** Using standard SQL it is easier to manage database systems without having to write substantial amount of code.

➢ **Emergence of ORDBMS:** Previously SQL databases were synonymous with relational database. With the emergence of Object Oriented DBMS, object storage capabilities are extended to relational databases.

Disadvantages of SQL :

✓ **Difficulty in Interfacing:** Interfacing an SQL database is more complex than adding a few lines of code.

✓ **More Features Implemented in Proprietary way:** Although SQL databases conform to ANSI & ISO standards, some databases go for proprietary extensions to standard SQL to ensure vendor lock-in.

Basic SQL Queries :

SQL is a keyword based language. Each statement in SQL begins with a unique keyword. These keywords are not case-sensitive. Other elements that are parts of SQL Queries are:

- names - names of databases elements like table name, column name etc,.
- literals - quoted strings, numeric values, date time values
- delimiters - +, -, ( ), >, <, >=, <=, <>, * etc,.

With SQL we can query a database and have a result set returned.

The basic SQL queries are given below:

* select

* create

* delete

* update

* insert

* alter.

SQL Views :

In SQL, a view is a virtual table based on the result-set of an SQL statement. A view contains rows and columns, just like a real table. The fields in a view are fields from one or more real tables in the database. You can add SQL functions, WHERE, and JOIN statements to a view and present the data as if the data were coming from one single table.

SQL CREATE VIEW Statement :

CREATE VIEW Syntax :

CREATE VIEW view_name AS

SELECT column1, column2, ...

FROM table_name

WHERE condition;

A view always shows up-to-date data. The database engine recreates the data, using the view's SQL statement, every time a user queries a view.

SQL Integrity Constraints -

Integrity Constraints are used to apply business rules for the database tables. SQL constraints are used to specify rules for the data in a table. Constraints are used to limit the type of data that can go into a table. This ensures the accuracy and reliability of the data in the table. If there is any violation between the constraint and the data action, the action is aborted.

Constraints can be column level or table level. Column level constraints apply to a column, and table level constraints apply to the whole table.

The following constraints are commonly used in SQL:

• NOT NULL - Ensures that a column cannot have a NULL value

• UNIQUE - Ensures that all values in a column are different

• PRIMARY KEY - A combination of a NOT NULL and UNIQUE. Uniquely identifies each row in a table

• FOREIGN KEY - Uniquely identifies a row/record in another table

• CHECK - Ensures that all values in a column satisfies a specific condition

• DEFAULT - Sets a default value for a column when no value is specified

• INDEX - Used to create and retrieve data from the database very quickly

SQL Key -

A key is a single or combination of multiple fields in a table. It is used to fetch or retrieve records/data-rows from data table according to the condition/requirement. Keys are also used to create a relationship among different database tables or views.

Types of SQL Keys

We have following types of keys in SQL which are used to fetch records from tables and to make relationship among tables or views.

1. Super Key

Super key is a set of one or more than one keys that can be used to identify a record uniquely in a table. Example: Primary key, Unique key, Alternate key are a subset of Super Keys.

2. Candidate Key

A Candidate Key is a set of one or more fields/columns that can identify a record uniquely in a table. There can be multiple Candidate Keys in one table. Each Candidate Key can work as Primary Key.

3. Primary Key

Primary key is a set of one or more fields/columns of a table that uniquely identify a record in a database table. It can not accept null, duplicate values. Only one Candidate Key can be Primary Key.

4. Alternate key

An Alternate key is a key that can be work as a primary key. Basically, it is a candidate key that currently is not a primary key.

5. **Composite/Compound Key**

Composite Key is a combination of more than one fields/columns of a table. It can be a Candidate key, Primary key.

6. **Unique Key**

A unique key is a set of one or more fields/columns of a table that uniquely identify a record in a database table. It is like Primary key but it can accept only one null value and it cannot have duplicate values. For more help refer to the article Difference between primary key and unique key.

7. **Foreign Key**

Foreign Key is a field in a database table that is Primary key in another table. It can accept multiple null, duplicate values. For more help refer to the article Difference between primary key and foreign key.