

Relational Database

A database system is basically a computer base record keeping system. The collection of data usually referred to as the database, contains information about one particular enterprise. A database may also be defined as a collection of interrelated data stored together to serve multiple applications ; the data is such stored so that it is independent of programs which use the data ; a common and controlled approach is used in adding new data and in modifying and retrieving existing data with in the database. The data is structured so as to provide a foundation for future application [www.cbsepythonedu.com] development.

Purpose of DBMS

A database system should be a repository of the data needed for an organization's data processing. That data should be accurate, private, and protected from damage. It should be organized so that diverse applications with different data requirements can employ the data. A DBMS (Data base management system) refers to a software that is responsible for storing, maintaining and utilizing databases. A database along with a DBMS is referred to as a database system.

In a typical file-processing system, permanent records are stored in various files. A number of different application programs are written to extract records from and add records to the appropriate files. But this scheme has a number of [www.cbsepythonedu.com] major limitations and disadvantages, such as data redundancy (duplication of data), data inconsistency (multiple copies of same data but not matching with one another), unsharable data, unstandardized data, insecure data, incorrect data etc. A database management system is answer to all these problems as it provides a centralized control of the data thereby minimizing these problems in the database.

Relational Database Model

In relational data model, the data is organized into tables (i.e., rows and columns). These tables are called relations. A row in a table represents a relationship among a set of values. The sample data base being shown here has three tables (relations) : Supplier, Item, Shipments.

Suppliers (SuppNo, Supp_Name, Status, City)

Item (Item no, Item_Name, Price)

Shipments (SuppNo, ItemNo, Qty_supplied)

Rows of relations are finally referred to as tuples and the columns are usually referred to as attributes

Components of a Table

These are :

Byte

A byte is a group of eight bits and is used to store a character.

Data Item(Field)

A data item is the smallest unit of named data. It may consist of any number of bits or bytes. A data item represents one type of information and is often [www.cbsepythonedu.com] referred to as a field or data element

Record

A record is a named collection of data items which represents a complete unit of information.

Table

A table is a named collection of all occurrences of given type of logical record.

Examples of common Relational Database Management Systems include oracle database Microsoft SQL Server, MYSQL, IBM DB2, IBM Informix SAP Sybase Adaptive Server Enterprise, SAP Sybase IQ, Teradata, PostgreSQL, SQLite etc.

Out of these, MySQL, PostgreSQL, and SQLite are open source implementations.

MySQL is a relational dbms that can run on virtually all platforms, including Linux, Unix and Windows. Popular for web-based applications and online publishing, MySQL is part of open-source enterprise [www.cbsepythonedu.com] stack LAMP (Linux, Apache, MySQL, PHP)

SQLite is a relational database management system. SQLite is not a client-server database engine, rather, it is embedded into the end program. It is arguably the most widely deployed database engine, as it is used today by several widespread browsers, operating systems, and embedded systems (such as mobile phones), among others.

PostgreSQL is a general purpose and object-relational database management system, the most advanced open source database system. PostgreSQL is free and open source software. Its source code is available under PostgreSQL license, a liberal open source license. Common database management tools for mobile devices include SQLAnywhere, DB2 Everywhere, IBM Mobile Database, SQL Server Compact, SQL Server Compact, SQL Server Express, Oracle DatabaseLite, SQLite, SQLBase etc. Out of these SQLite is a public domain open source implementation. There are some other database models namely network data model, hierarchical data model and object oriented [www.cbsepythonedu.com] data model.

The Relational Model Terminology

The relational model was propounded by E.F. Codd of the IBM and has since been acknowledged as a very important concept in DBMS (Data Base Management Systems) technology. Different [www.cbsepythonedu.com] terms used in the relational model are. Relation. In general, a relation is a table i.e., data arranged in rows and columns.

A relation has the following properties :

1. In any given column of a table, all items are of the same kind whereas items in different columns may not be of the same kind.
2. For a row, each column must have an atomic (indivisible) value and also for a row, a column cannot have more than one value.
3. All rows of a relation are distinct. That is, a relation does not contain two rows which are identical in every column. That is each row of the relation can be uniquely identified by its contents.
4. There is no order maintained for rows inside a relation. That is, we cannot retrieve any thing by saying that from row number 5, column name is to be accessed.
5. The columns of a relation are assigned distinct names and the ordering of these columns is immaterial.

Domain. A domain is pool of values from which the actual values appearing in a given column are [www.cbsepythonedu.com] drawn.

A crucial feature of relational data model is that associations between rows are represented solely by data values in columns drawn from a common domain. A domain is said to be atomic if elements

of the domain are considered to be indivisible units.

Tuple. The rows of tables (relations) are generally referred to as Tuples (usually pronounced to rhyme with “couples”)

Attributes. The columns of tables (relations) are generally referred to as attributes.

Degree. The number of attributes in a relation determine the degree of a relation. A relation having 3 attributes is said to be a relation of degree 3.

Cardinality. The number of tuples (row) in a relation is called the cardinality of the relation.

Views

A view is kind of table whose contents are taken from other tables depending upon a condition.

Views do not contain data of their own. A View is a (virtual) table that does not really exist in its own right but is instead derived from [www.cbsepythonedu.com] one or more underlying base table(s)

Key :

Primary Key

The primary key is non-redundant i.e. it does not have duplicate values in the same relation.

The non-primary-key attributes of a table can be referred to as non-key attributes.

Candidate Key

Occasionally we may encounter a relation in which there is more than one attribute possessing the unique identification property. In the case of two or more candidate keys, the database analyst decides one of them as the [www.cbsepythonedu.com] primary key for the relation.

Alternate key

In case of two or more candidate keys, only one of them serves as the primary key. The rest of them are [www.cbsepythonedu.com] alternates only.

Foreign Key

A foreign key is used to represent the relationship between two tables. A foreign key is a non-key attribute (or a group of non-key attribute) whose value is derived from the primary-key of another table. Or in other words, a non-key attribute of a table, which is the primary-key of some other [www.cbsepythonedu.com] table is known as foreign-key.

Referential Integrity

A referential integrity is a system of rules that a DBMS uses to ensure that relationship between records in related tables are valid, and that users don't accidentally delete or change related data

You can set referential integrity when all of the following condition are met :

- * The matching field from the primary table is a primary key or has a unique index.
 - * The related fields have the same data type. [www.cbsepythonedu.com]
 - * Both tables belong to the same database. If the tables are linked tables, they must be of same DBMS format, and you must open the database in which they are stored to set referential integrity.
- Referential integrity can't be enforced for linked tables from databases in other formats.

Brief History of MySQL

MySQL is a freely available open source Relational Database Management System (RDBMS) that uses structured Query Language (SQL). It is down loadable form site in a MySQL database,

information is stored in tables. A Single MySQL database can contain many tables at once and store thousands of individual records. MySQL provides you with a rich set of features that support a secure environment for storing, maintaining, and accessing data. MySQL is a fast, reliable, scalable alternative to many of the commercial RDBMSs available today.

MySQL Database System

The key role of a database management system is information management. A database server is the key to solving the problems of information management. [www.cbsepythonedu.com] In general, a server must reliably manage a large amount of data in a multi-user environment so that many users can concurrently access the same data. A database server must also prevent unauthorized access and provide efficient solutions for failure recovery.

MySQL database system refers to the combination of a MySQL server instance and a MySQL database. MySQL operates using client/server architecture in which the server runs on the machine containing the databases and clients connect to the server over a network. MySQL is a multi-user database system, meaning several users can access the database simultaneously.

* The server (MySQL server) listens for client requests coming in over the network and accesses database contents according to those requests and provides that to the clients.

* Clients are programs that connect to the database server and issue queries in a pre-specified format. MySQL is compatible with the standards based SQL (Structured Query Language). The client program may contact the server programmatically (meaning a program call the server [www.cbsepythonedu.com] during execution) or manually.

Some of the key features of MySQL are :

1. Speed. If the server hardware is optimal, MySQL runs very fast. It supports clustered servers for demanding applications.
2. Ease of use. MySQL is high-performance, relatively simple database system. From the beginning, MySQL has typically be configured, monitored, and managed from the command line. However, [www.cbsepythonedu.com] several MySQL graphical interfaces are also available.
3. Cost. MySQL is available free of cost. MySQL is a “Open Source” database. MySQL part of LAMP (Linux, Apache, MySQL, PHP/Perl / Python) environment, a fast growing open source enterprise software stack.
4. Query Language Support. MySQL understands standards based SQL (Structured Query Language).
5. Portability. MySQL provides portability as it has been tested with a broad range of different compilers and can work on many different platforms. It is fully multi-threaded using kernel threads. It can easily use multiple CPUs if they are available.
6. Data Types. MySQL provides many data types to support different types of data. It also supports fixed-length and variable-length records.
7. Security. MySQL offers a privilege and password system that is very flexible and secure, and that allows host-based verification. Passwords are secure because all password traffic is encrypted [www.cbsepythonedu.com] when you connect to a server.
8. Scalability and Limits MySQL can handle large databases. Some real life MySQL databases

contain 50 million records, some have up to 60,000 tables and about 5,000,000,000 rows.

9. Connectivity. Clients can connect to MySQL server using several protocols :

10. Localization. The server can provide error messages to clients in many languages.

11. Clients and Tools. MySQL provides several client and utility programs. These include both command-line programs such as mysqldump and mysqladmin, and graphical programs such as MySQL Administrator and MySQL Query Browser. MySQL server has built-in support for SQL [www.cbsepythonedu.com] statements to check, optimize, and repair tables.

MySQL and SQL

In order to access data within the MySQL database, all programs and users must use, structured Query Language (SQL) . SQL is the set of commands that is recognised by nearly all RDBMSs. Usage of SQL has become a standard for most of RDBMSs. Though application program and MySQL tools often allow users to access database without directly using SQL, but these applications in turn must use SQL when executing the user's request. [www.cbsepythonedu.com]

The structured Query Language (SQL) is a language that enables you to create and operate on relational databases, which are sets of related information stored in tables.

Processing Capabilities of SQL

The various processing capabilities of SQL are :

1. Data Definition Language (DDL) . The SQL DDL provides commands for defining relation schemas, deleting relations, creating indexes, and modifying relation schemas.
2. Interactive Data Manipulation Language (DML). The SQL DML includes a query language based on both the relational algebra and the tuple relational calculus. It also includes commands to [www.cbsepythonedu.com] insert, delete, and modify tuples in the database.
3. Embedded Data Manipulation Language. The embedded SQL is designed for use with in general-purpose programming languages such as PL/1, COBOL, Fortran, Pascal, and C, C++ [www.cbsepythonedu.com] etc.
4. View definition. The SQL DDL also includes commands for defining views.
5. Authorization. The SQL DDL includes commands for specifying access rights to relations and views.
6. Integrity. The SQL provides (limited) forms of integrity checking. Future products and standards of SQL are likely to include enhanced features for integrity checking.
7. Transaction Control. SQL includes commands for specifying the beginning and ending of transactions along with commands to have a control over transaction processing.

Data Definition Language

A database scheme is specified by a set of definitions which are expressed by a special language called a data definition language (DDL) . The result of compilation of DDL statements is a set of tables which are stored in a special file called data dictionary (or directory).

A Data Dictionary is a file that contains “metadata” i.e., “data about data” Whenever data is read or modified in the database system, the data directory is consulted.

An ideal DDL should perform the following functions :

1. It should identify the types of data division such as data item, segment, record, and database file.
2. It should give a unique name to each data-item-type, record-type, file-type, database, and other data subdivision.

3. It should specify the proper data types.
4. It should specify how the record types are related to make structures.
5. It may define the type of encoding the program uses in the data items (binary, character, bit, string, etc) This should not be confused with the encoding employed in physical representation.
6. It may define the [www.cbsepythonedu.com] length of the data items.
7. It may define the range of values that a data-item can assume.
8. It may specify means of checking for errors in the data.
9. It may specify privacy locks for preventing unauthorized reading or modification of the data.
10. A logical data definition should not specify addressing, indexing, or searching techniques or specify the placement of data on the storage units, because these topics are in the domain of physical, not logical, [www.cbsepythonedu.com] organization.

Classification of SQL Statements

SQL provides many different types of commands used for different purposes. SQL commands can be divided into following categories.

- (i) Data definition Language (DDL) commands
- (ii) Data Manipulation Language (DML) Commands
- (iii) Transaction control Language (TCL) Commands
- (iv) Session Control commands
- (v) System control commands

DDL Commands

The Data Definition Language (DDL) commands, as the name suggests, allow you to perform tasks related to data definition. That is, Through these commands, you perform tasks like :

- (i) Create, alter, and drop schema objects. This section of DDL commands is used to create, or define, or change, or delete objects such as a table, a view, an index etc. CREATE commands are used to create schema objects, ALTER commands are used to modify or change the definition of [www.cbsepythonedu.com] already existing scheme objects and DROP commands are used to delete or remove schema objects. Some examples of such DDL statements are. CREATE TABLE, ALTER TABLE, DROP TABLE, CREATE INDEX, DROP INDEX, RENAME TABLE, TRUNCATE etc.
- (ii) Grant and revoke privileges and roles. This section of DDL commands is used to grant or revoke permissions or privileges to work upon schema objects. For example, a user (say scott) who creates a table (say table1) becomes the owner of the table. The owner of the table can allow others to work on his/her table this can be achieved by GRANTing privilege for the same to other. To revoke already granted privileges, REVOKE commands is used this section of DDL commands is also known as Data Control Language (DCL) Commands.
- (iii) Maintenance commands. This section of DDL commands is used to information on a table with an aim of maintaining it. Examples of table maintenance commands are : ANALYZE TABLE, CHECK TABLE, REPAIR TABLE, RESTORE TABLE etc.

DML COMMANDS

- * the retrieval of information stored in the database.
- * the insertion of new information into the database.
- * the deletion of information from the database.

* the modification of data stroed in the database.

The DMLs are basically of two types.

- (i) Procedural DMLs require a user to specify what data is needed and how to get it.
- (ii) Non-procedural DMLs require a user to specify what data is needed without specifying how to [www.cbsepythonedu.com] get it.

The data manipulation Language (DML) commands, as the name suggests, are used to manipulate data. That is, DML commands query and manipulate dat in existing schema objects. For example, to insert a tuple in a table, a DML statement (INSERT INTO) Is used ; to modify a tuple in a table, another DML statement (UPDATE) is used : to delete a tuple in table, the DML statement DE-LETE is used. other examples of DML commands are : SELECT, LOCK TABLE etc.

TCL commands

A transaction is one complete unit of work e.g., preparing report-card for student is a transaction, but it involves many steps like -open student's table, read data from it, open marks' table, read data from it, calculate percentage and grade, write the computed result to result file and finally close these three (student table, marks table and result table) A transaction is successfully completed (known as COMMIT) if and only all its constituent [www.cbsepythonedu.com] steps are successfully completed. To manage and control the transations, the transaction control commands are used. These commands manage changes made by DML commands.

Some examples of TCL commands are :

COMMIT	it makes all the change made by statements issued, permanent
ROLLBACK	it undoes all changes since the beginning of transaction or since a savepoint
SAVEPOINT	it marks a point upto which all earlier statements have been successfully completed and if required in case of failure one may undo the changes it.e., rollbak up to this very point.
SET TRANSACTION	it establishes properties for the current transactions.