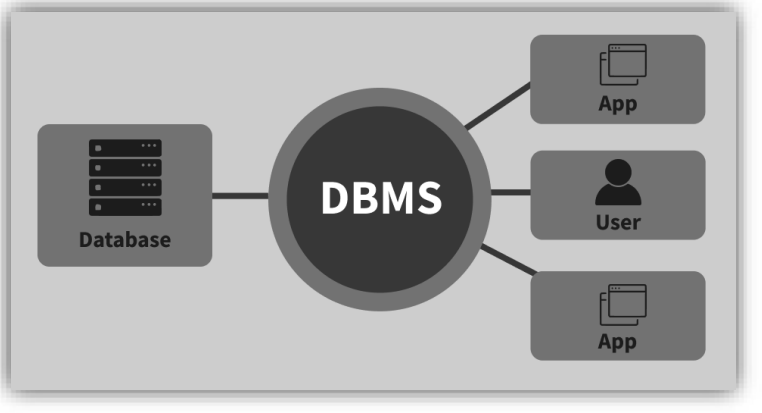
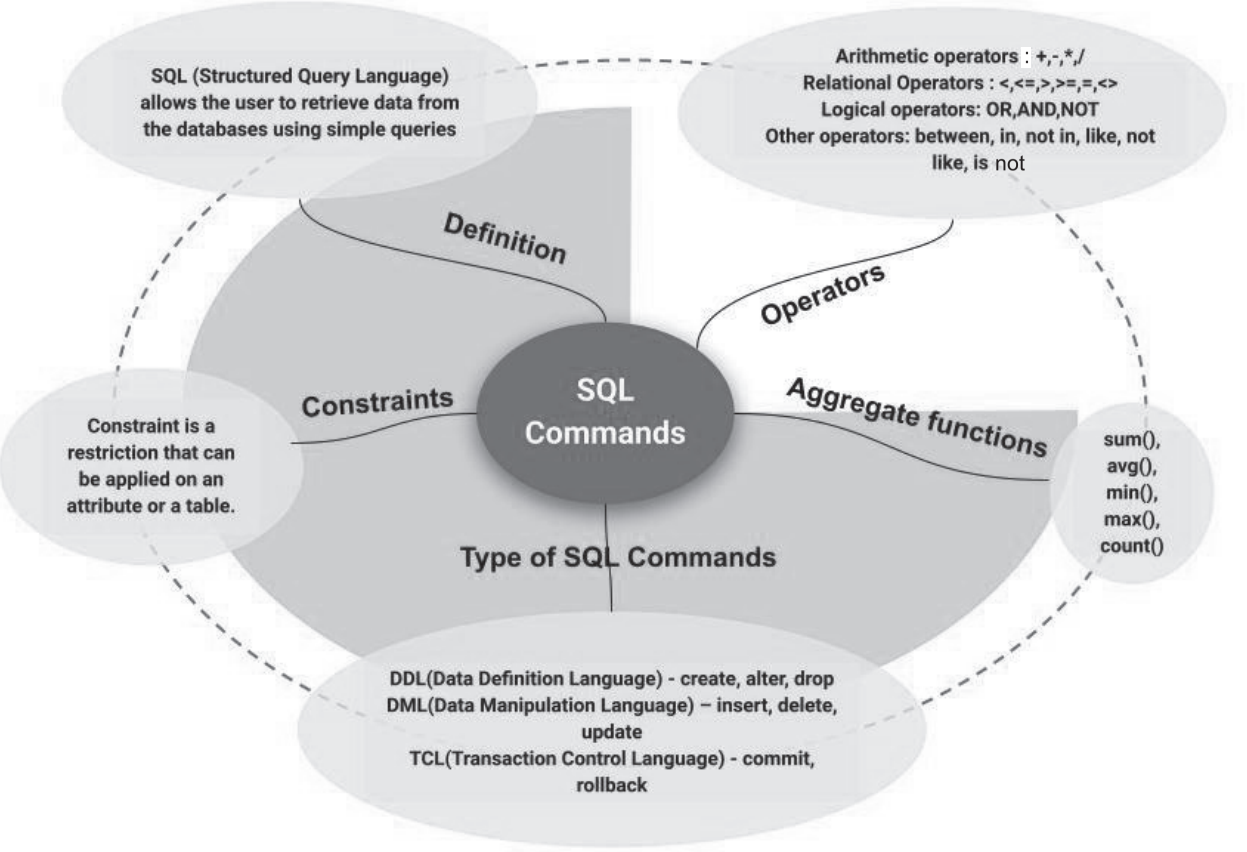
Database Management Systems



Topics to be covered

- ✓ Database concepts
- ✓ Relational data model
- ✓ Structured Query Language
- ✓ Interface of Python with an SQL database


SQL (Structured Query Language) allows the user to retrieve data from the databases using simple queries
Definition
Arithmetic operators : +,-,*,/
Relational Operators : <,<=,>,>=,=,<>
Logical operators: OR,AND,NOT
Other operators: between, in, not in, like, not like, is not
Operators
Constraints
SQL Commands
Aggregate functions
Constraint is a restriction that can be applied on an attribute or a table.
sum(), avg(), min(), max(), count()
Type of SQL Commands
DDL(Data Definition Language) - create, alter, drop
DML(Data Manipulation Language) – insert, delete, update
TCL(Transaction Control Language) - commit, rollback

UNIT-III

DATABASE MANAGEMENT:

DATABASE CONCEPT:

INTRODUCTION OF DATABASE:

Database is a word which is composed of two words: Data and Base. **Data** means raw facts and figures and **base** is the place or location where data is being stored.

Or we can say that a Database is a collection of **interrelated data or records** in an organized form. So, it can be easily accessed, managed and updated**. Interrelated data** means that the data is related or connected with respect to the given attribute/column.

The database uses various fields to manage and store large amounts of information in an organized and structured format.

DIAGRAM: 1
HOW DATABASE WORKS

Introduction of Database Management System (DBMS):

DBMS is a shortened name used for Database Management System. Now, as we are aware of databases now, we need to understand what DBMS actually is.

DBMS is a software system which is used to manage databases. DBMS acts as an interface between a user and a database which enables the user to create, insert, retrieve, update and delete the data.

Need of Database:

1. **Centralized Storage**: Storage of data in a single location or central database.
2. **Data Integrity**: Enforces data integrity rules which ensures that the information stored is accurate, valid and consistent.
3. **Data Security**: Control access to sensitive data and protect data from unauthorized access.
4. **Data Retrieval**: Authorized Users/Applications can access and retrieve the information as per their need.
5. **Efficient Data Retrieval**: Database helps users to retrieve data efficiently.

DBMS Model:

DBMS refers to the architecture/approach for how data is stored, organized and manipulated in a database. There are several types of DBMS Models.

1. **Relational Model:**
   Data is organized in tables with rows and columns.
2. **Hierarchical Model:**
   Data is organized in a Tree-like structure to the parent-child relationship.
3. **Network Model**:
   Similar to the hierarchical model. It uses pointers to navigate through data.
4. **Object-Oriented Model:**
   Data is represented as an object. This model uses object-oriented databases.

Now as per your CBSE syllabus, we will discuss the Relational Data Model in detail.

DBMS1 - QUESTION RELATED TO THE DATABASE CONCEPT

1 What is a database and how is it different from a database management system?
2 What do you mean by raw facts and figures in a database?
3 Why do we need a database?
4 In which DBMS model data is organized into rows and columns?

Relational Data Model:

The relation Data Model was proposed by E.F. Codd in 1970.

In simple words, we can say that a Relational data model is a model which uses **relation** to organize **data**. Here, **Relation means table** and table is composed of **rows** and **columns**.

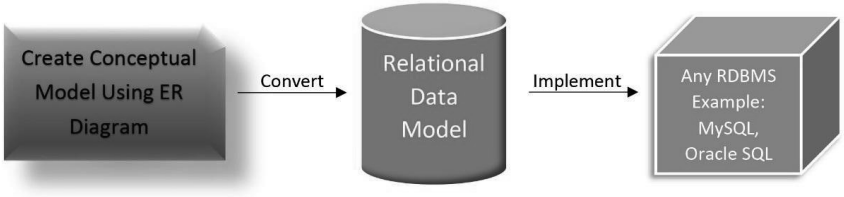


DIAGRAM: 2

ABOVE DIAGRAM SHOWS THAT HOW TO IMPLEMENT RELATIONAL DATA MODEL

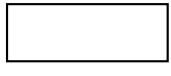
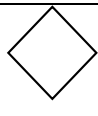
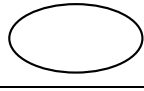
After creating a conceptual data model using an ER (Entity Relationship) Diagram we need to convert it into a Relational Data Model so that we can implement it using any RDBMS language like MySQL, Oracle SQL etc.

Before we proceed further, let's discuss some aspects of the Conceptual Data Model

Conceptual Data Model is used to capture the meaning of data from the viewpoint of the user and try to represent it using Data Model tools like ER diagrams and Object Oriented Diagram

Basic Terminology of ER Model:

ER stands for **Entity-Relationship Model**. ER Model tools are used to represent the Conceptual Data Model. Let's see some basic tools of the ER Model.

Entity	Any real-world object is known as an entity like a person, place, object or event.	
Relationship	Show interconnection between two or more entities.	
Attribute	Shows property/characteristics of an entity/relationship type	

Relation/Table:

Relation is also known as table and it is a collection of related data and information. The relation is composed of rows and columns.

Row/Tuple/Record:

Row represents the horizontal form of Table/Relation. A row is also known as a tuple/record.

Column/Attributes:

Columns represent the vertical form of the Table/Relation. The column is also known as an attribute.

Cardinality:

The total number of rows/records/tuples in a relation is called Cardinality.

Degree:

The total number of columns/attributes in a relation is called the Degree.

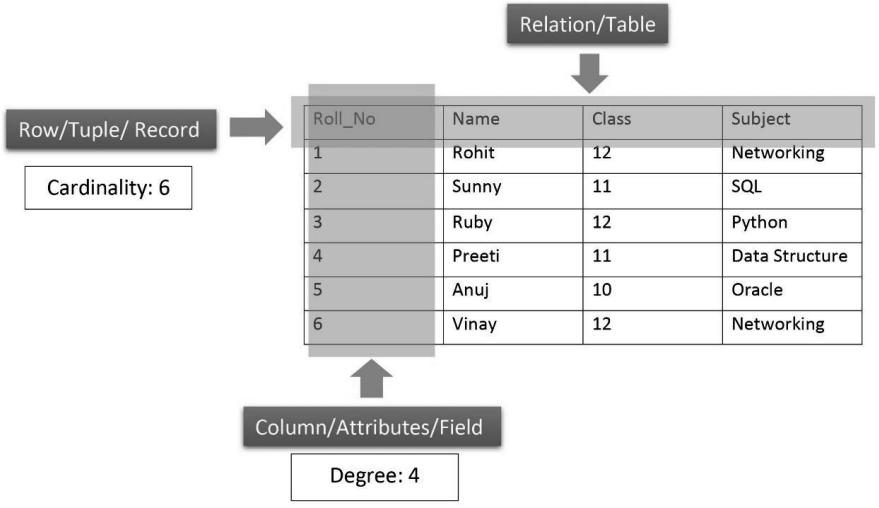


DIAGRAM: 3

RELATION/TABLE COMPOSED OF ROW/RECORD AND COLUMN/ATTRIBUTES

Domain:

Domain is a **setof possible values** or **range of valid values** or a **set of all unique values** that an attribute/column can hold.

A Domain of a database is a set of atomic values (which can't further be distributed) of a particular attribute/column.

For Example:

In the table Employee, Attribute/column 'gender' may have only 'M', 'F' and 'T' domains. Only these values are valid for that column.

The domain of 'S_No' contains a set of all possible roll numbers.

Domain of 'Martial_Status' contains a set of all possible values like 'Married', 'Widow', 'Unmarried' or 'Divorce'.

In the below diagram 4, table Employee contains 'S_No', 'Name', 'Address', 'Gender' and 'Marital_status'. Two domains are showing 'gender' and 'marital_status' which contain a set of possible values that an attribute can hold. Gender can only hold three possible values and marital status can only hold four possible values.

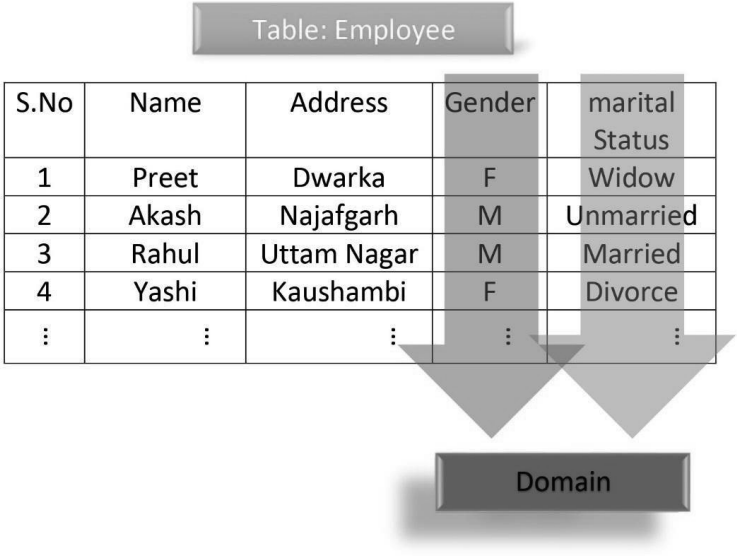


DIAGRAM: 4

DOMAIN IN A RELATION

DATATYPES IN SQL:

Before discussing commands in detail we need to learn about the datatype of column/attribute:

We need to assign a data type when we are declaring any column/attribute. Every column required a name and datatype. Data type is used to declare the type of data that will be stored in a particular column. There are lots of data types available in SQL. We will discuss some important data types here.

Commonly used datatype in SQL:

1. Numeric Type:

- INT: Integer type
- FLOAT: Floating-point number
- DECIMAL or NUMERIC: Fixed-point number

2. Character String Type:

- CHAR(n): Fixed-length character string with a maximum length of n
- VARCHAR(n): Variable-length character string with a maximum length of n
- TEXT Type : Variable-length character string with no specified maximum length

3. Date and Time Type:

- DATE : for date only
- TIME: for time only
- DATETIME or TIMESTAMP: for date and time combined

4. Other Data type:

- NULL: to represent a missing/unknown/empty value
- ENUM: An enumeration type for a set of predefined values

Now let's learn datatype in detail as per your syllabus

NUMERIC DATATYPE	INT/INTEGER	The signed range is from -2147483648 to 2147483647. The unsigned range is from 0 to 4294967295
	SMALLINT(SIZE)	The signed range is from -32768 to 32767. the unsigned range is from 0 to 65535
	TINYINT(SIZE)	The signed range is from -128 to 127. the unsigned range is from 0 to 255
	MEDIUMINT(SIZE)	The signed range is from -8388608 to 8388607. the unsigned range is from 0 to 16777215
	BIGINT(SIZE)	The signed range is from -9223372036854775808 to 9223372036854775807. the unsigned range is from 0 to 18446744073709551615
	FLOAT(SZ,D)	SZ is size and D is no. of digits after decimal
STRING DATATYPE	CHAR(SIZE)	char is a fixed-sized string as per the size defined in parenthesis. size of char datatype in the range of 0 to 255. by default size of the char is 1

	VARCHAR(SIZE)	varchar stands for a variable length character string. range of varchar is 0 to 65535
DATE AND TIME DATATYPE	DATE	As the name suggests it is used to store the date in any attribute supported format : YYYY-MM-DD
	TIME	Used to store time in any attribute supported format : HH:MM:SS

Keys:

In the database, the key applies some kind of constraint/restriction on the table (depending on the type of key applied) or we can say that keys are used to uniquely identify a tuple in a table/relation. To extract any particular row/record from a table, we need a key attribute which contains unique values.

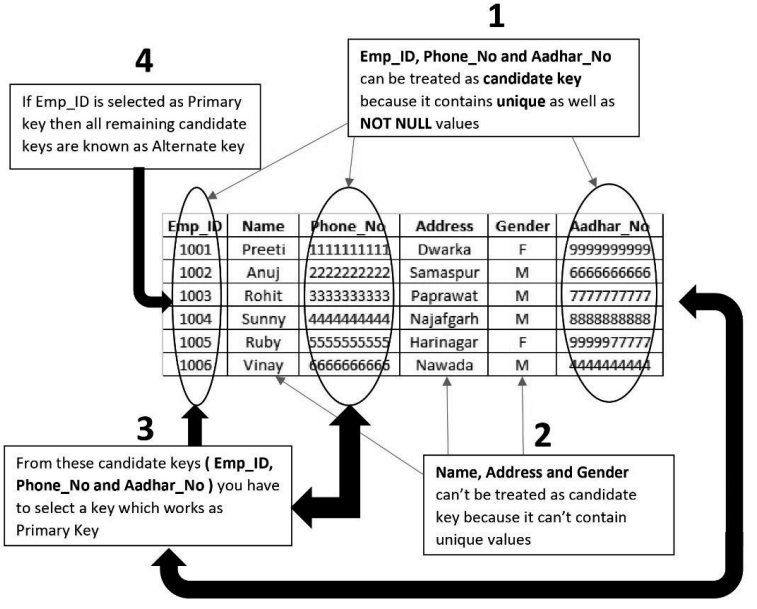


DIAGRAM: 5

KEYS IN TABLE (PLEASE READ IN ORDER OF NUMBER)

Primary Key:

Primary Key is a unique identifier which identifies a unique record in a particular table. It must contain unique values for each record and the Primary key attribute/column/field can't be NULL. A table can have only ONE primary key.

Note: A Primary key must be a candidate key but not all candidate keys are Primary key.

Candidate Key:

Candidate key is a set of one or more columns that could be used as primary key and from the set of these candidate keys, one column is selected as primary key.

From Diagram 5, Candidate keys can have more than one attribute like Emp_ID, Name, and Address etc.

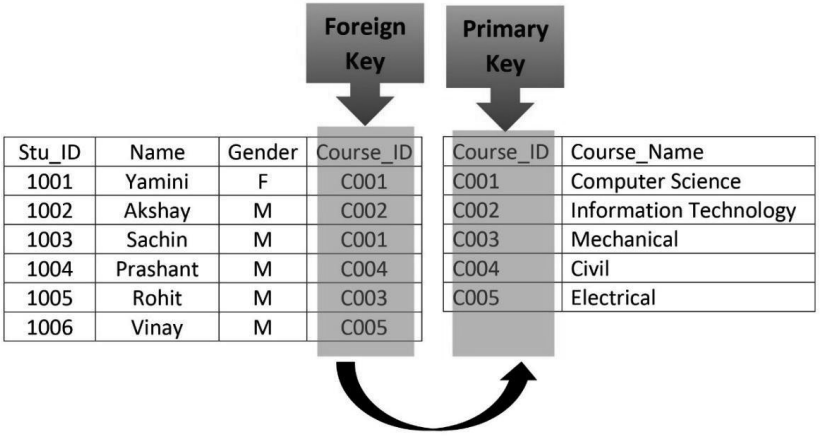
Alternate Key:

After selecting the primary key from the candidate key, the remaining keys (which are also eligible for the primary key) are called Alternate Key.

Foreign Key:

A Foreign key is a column or group of columns in a table that provides a link between two tables.

Let's see how foreign keys work on the table.



Stu_ID	Name	Gender	Course_ID
1001	Yamini	F	C001
1002	Akshay	M	C002
1003	Sachin	M	C001
1004	Prashant	M	C004
1005	Rohit	M	C003
1006	Vinay	M	C005

Course_ID	Course_Name
C001	Computer Science
C002	Information Technology
C003	Mechanical
C004	Civil
C005	Electrical

DIAGRAM: 6

HOW FOREIGN KEY WORKS BETWEEN TWO TABLES

It is an attribute whose values can be derived from the primary key of some other table.

It ensures **Referential Integrity**. Referential Integrity is a protocol that ensures that the relationship between record/row is valid and can't change in related data.

DBMS2 - QUESTION-RELATED TO RELATIONAL DATA MODEL

1 Who proposed the Relational Model?
2 What is a conceptual data model?
3 What do you understand from ER Model and what is the use of ER Model?
4 What do you mean by tuple and attribute in relation?
5 What is cardinality in relation?
6 What is a degree in relation?
7 What is Domain in relation?
8 What is a datatype in relation? Write some commonly used datatype in SQL.
9 What is the difference between char and varchar in SQL?
10 What is the role of keys in relation?
11 Write about the following keys :
    1. Primary Key
    2. Candidate Key
    3. Alternate Key
    4. Foreign Key

12 What do you understand by SQL? And writes its operation?
13 Which term is used in SQL to filter and analyse data quickly?
14 Write SQL Command :
    1. Write SQL Command to create the database with the name class12.
    2. Write SQL Command to show the database of the table named class12.
    3. Write SQL Command to select a database named class12.
    4. Write SQL Command to show a list of available tables in SQL.
    5. Write SQL Command to create a table with the name student12 with the following attribute as follows:

student_id -	integer
student_name-	char-size(30)
age-	integer
phone-	integer
address	varchar(50)

    6. Write SQL Command to view the structure of table name student12
    7. Write SQL syntax to insert into to table named student12.
    8. Write SQL Command to view data/content of table named student12.
    9. Write SQL Command to delete data as well as structure of table named student12.
15 What is Constraints? And Writes its types.
16 What is DDL Command? Give its example.
17 What is DML Command? Give its example.
18 What is the process of assigning a nick name to a table or column in SQL?
19 What is the difference between drop and delete in SQL?
20 Which clause is used to remove duplicate values from the table?
21 Which clause is used to filter the results of the SELECT statement by specifying one or more condition
22 Which string type has a fixed-length character string?
23 Which key is used to ensure that it must contain unique values for each record and can't have a NULL value?
24 Which key is eligible for the primary key?
25 Which clause is used to sort the result set in ascending order