UNIT 3
DATABASE MANAGEMENT

Database Concepts

▶ A database (DB) is an organized collection of interrelated data stored together to serve multiple application

▶ It is computer based record keeping system.

▶ It not only allows to store but also allows us modification of data as per requirements.

▶ In other words, a database is used by an organization as a method of storing, managing and retrieving information.

▶ Modern databases are managed using a database management system (DBMS).

DBMS

▶ A DBMS refers to Database Management System

▶ It is software that is responsible for storing, manipulating, maintaining and utilizing database.

▶ A database along with the DBMS is referred to as a database system.

▶ There are various DBMS software available in the market like :-

► Oracle, MS SQL Server, MySQL, Sybase, PostgreSQL, SQLite

Purpose of Database Concepts

► Database systems reduce data redundancy to large extent.

► Database systems reduce data inconsistency to large extent.

► Databases facilitate sharing of data.

► Centralized databases can ensure data security.

► Integrity can be maintained through databases

Relational Data Model

► A Data models define how the logical structure of a database is modeled.

► Data models define how data is connected to each other and how they are processed and stored inside the system.

► Relational Model is the most widely used model.

► In this model, the data is maintained in the form of a two-dimensional table.

► All the information is stored in the form of row and columns.

► The basic structure of a relational model is tables. So, the tables are also called relations in the relational model. Example: In this example, we have a Department Table.

DEPTNO	DNAME	LOCATION
10	HR	NEW YORK
20	ACCOUNTS	BRAZIL
30	SALES	CANADA
40	IT	INDIA

General Terminology of Relational Data Model

▶ Concept of Domain

It defines the kind of data represented by the attribute. It is the set of all possible permissible values that an attribute may contain. For example in above department table, domain for the field DNAME is HR, ACCOUNTS, SALES, IT.

▶ Relation/Table

In the Relational model the, relations are saved in the table format. It is stored along with its entities. A table has two properties rows and columns. Rows represent records and columns represent attributes.

▶ Tuple

It is nothing but a single row of a table, which contains a single record.
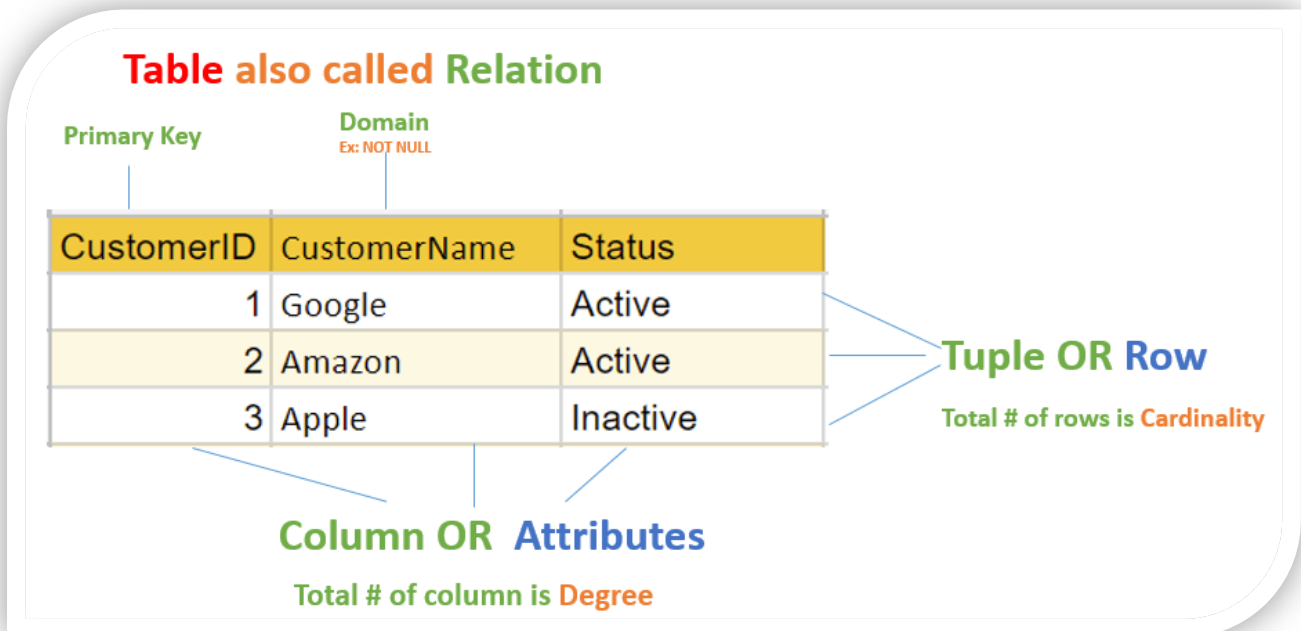
▶ Attribute

Each column in a Table. Attributes are the properties which define a relation. e.g., Student_Rollno, NAME, etc.

▶ Degree

The total number of attributes in the relation is called the degree of the relation/table.

▶ Cardinality

Total number of rows present in the Relation/Table is called Cardinality.

Table also called Relation

Primary Key		Domain Ex: NOT NULL
CustomerID	CustomerName	Status
1	Google	Active
2	Amazon	Active
3	Apple	Inactive

Tuple OR Row
Total # of rows is Cardinality

Column OR Attributes
Total # of column is Degree

▶ Keys

- ❖ It helps you to identify any row of data in a table.
- ❖ In a real-world application, a table could contain thousands of records. Moreover, the records could be duplicated.
- ❖ Keys ensure that you can uniquely identify a table record despite these challenges.

▶ Primary Key

- ❖ It is an attribute or set of attributes which are used to identify a tuple uniquely.
- ❖ The Primary Key can't be a duplicate meaning the same value can't appear more than once in the table.
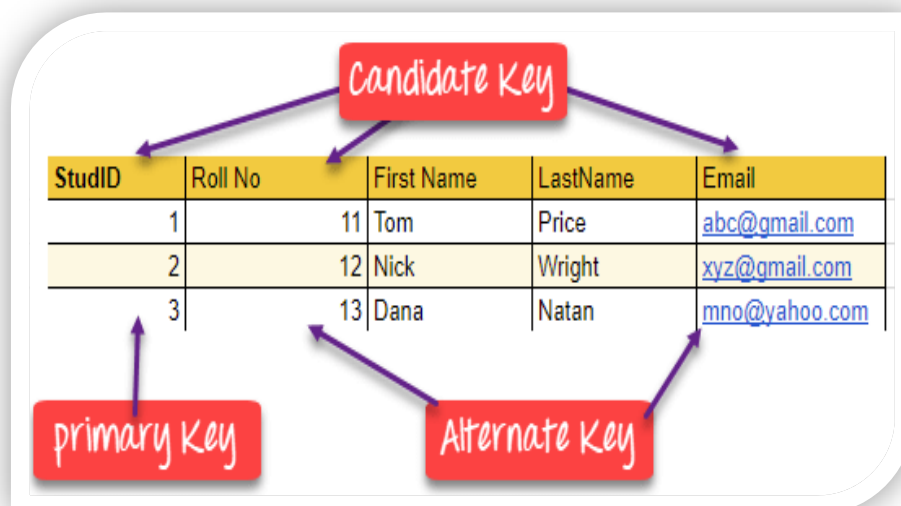
❖ A table cannot have more than one primary key
❖ It also forces mandatory entry (NOT NULL) i.e. we cannot leave it blank.

▶ Candidate Key

❖ It is an attribute or set of attributes that can be used as a primary key.
❖ Candidate Key is a super key with no repeated attributes. The Primary key should be selected from the candidate keys.
❖ Every table must have at least a single candidate key.
❖ A table can have multiple candidate keys but only a single primary key.

▶ Alternate Key

❖ Candidate key/keys which is/are not a primary key are known as Alternate Key.
❖ A table can have multiple choices for a primary key but only one can be set as the primary key. All the keys which are not primary key are called Alternate Key.

Candidate Key				
StudID	Roll No	First Name	LastName	Email
1	11	Tom	Price	abc@gmail.com
2	12	Nick	Wright	xyz@gmail.com
3	13	Dana	Natan	mno@yahoo.com

Primary Key   Alternate Key

▶ Foreign Key

- ❖ It is a non-key attribute whose value is derived from the Primary key of another table.
- ❖ It is used to create relationship between two tables.
- ❖ Foreign key column will fill values from the values of Primary Key of another table, if present then entry will be allowed otherwise data will be rejected.
- ❖ Primary Key column table from where values will be derived is known as Primary Table or Master Table or Parent Table.
- ❖ Foreign key column table will be Foreign Table or Child table.

EMPLOYEE TABLE

EMPNO	ENAME	GENDER	DEPTNO	SALARY	COMM
1	ANKITA	F	10	20000	1200
2	SUJEET	M	20	24000	2000
3	VIJAYA	F	10	28000	2000
4	NITIN	M	30	18000	3000
5	VIKRAM	M	30	22000	1700

DEPARTMENT TABLE

DEPTNO	DNAME	LOCATION
10	HR	NEW YORK
20	ACCOUNTS	BRAZIL
30	SALES	CANADA
40	IT	INDIA

From the Above table definition we can observe that the DEPTNO column of EMPLOYEE table is deriving its values from DEPTNO of table DEPARTMENT. So we can say that the DEPTNO of EMPLOYEE table is a foreign key whose value is dependent upon the Primary key column DEPTNO of table DEPARTMENT

Quick Revision

Table- Customer

Acc_No	Cust_Name	Cust_City	Cust_Phone	Open_Bal	
2101001	Sunita	Ambala	9710557614	10000	
2201002	Sandhya	Patna	8223545233	15000	
2301003	Vivek	New Delhi	9972136576	13000	
2401004	Meena	New Delhi	9321305453	10000	

Table- Transaction

Trans_Id	Acc_No	Transaction_Type	Amount
Tr001	2301003	Credit	15000
Tr002	2201002	Credit	20000
Tr003	2101001	Debit	3500
Tr004	2301003	Credit	26000
Tr005	2301003	Credit	24000

1. Identify the candidate keys of Customer table.
2. Identify the primary key from the selected candidate keys.
3. Write degree and cardinality of Customer table.
4. If 3 rows and 2 new columns are added in this table than what will be the impact on degree and cardinality of the table.
5. Which column can be considered as foreign key column in Transaction table?
6. Identify Primary Key column of Transaction table.

Structured Query Language (SQL)

- It is a language that enables you to create and operate on relational databases

- It is the standard language used by almost all the database software vendors.
- Pronounced as SEQUEL
- Original version was developed by IBM's Almanden Research Center

- Latest ISO standard of SQL was released in 2008 and named as SQL:2008

SQL Features

- Allows creating/modifying a database's structure

- Changing security settings for system

- Permitting users for working on databases or tables

- Querying database

- Inserting/modifying/deleting the database contents

- ❖ Ease of use
- ❖ No coding required
- ❖ Portable
- ❖ Not case sensitive
- ❖ Reliable
- ❖ Freedom of data abstraction
- ❖ Standard for database connectivity

My SQL

- ❖ MySQL is freely available open source RDBMS
- ❖ Can be downloaded from www.mysql.org
- ❖ In MySQL information is stored in Tables.
- ❖ Provides features that support secure environment for storing, maintaining and accessing data.
- ❖ It is fast, reliable, scalable alternative to many of the commercial RDBMS today.
- ❖ Create and supported by MySQL AB, a company based in Sweden. This company is now subsidiary of Sun Microsystems. On April 2009 Oracle Corp acquires Sun Microsystems.
- ❖ The chief inventor of MySQL was Michael Widenius (a.k.a Monty). MySQL has been named after Monty's daughter My. The logo of MySQL is dolphin and name of that dolphin is 'Sakila'

Classification of SQL Statements

- ❖ DDL
- ❖ DML

Data Definition Language(DDL)

❖ DDL is abbreviation of Data Definition Language.
❖ It deals with the structure of the database.
❖ It is used to create, remove and modify the structure of database objects in database. It provides following commands
  ✓ CREATE – Creates objects in the database
  ✓ ALTER – Alters objects of the database
  ✓ DROP – Deletes objects of the database

Data Manipulation Language(DML)

❖ DML is abbreviation of Data Manipulation Language.
❖ It deals with the data of the database.
❖ It is used to retrieve, store, modify, delete, insert and update data in database. It provides following commands
  ✓ SELECT – Retrieves data from a table
  ✓ INSERT – Inserts data into a table
  ✓ UPDATE – Updates existing data into a table
  ✓ DELETE – Deletes all records from a table

Data Types

❖ Data types are means the type of value and type of operation we can perform on data. For example on numeric value we can store numbers and perform all arithmetic operations and so on.

❖ MySQL support main three categories of data types:
  ▪ Numeric
  ▪ Date and time
  ▪ String types

Numeric Data Types

❖ Data type	❖ Description
❖ INT /NUMBER	Numbers without decimal. Store up to **11 digits. -2147483648 to 2147483647**
❖ DECIMAL	It is used to store exact numeric value that preserves exact precision for e.g. money data in accounting system. **DECIMAL(P,D)** means P no. of significant digits (1-65), D represent no. of digit after decimal(0-30), for e.g **DECIMAL(6,2)** means **4 digit before decimal** and **2 digit after decimal**. Max will be 9999.99

Date and YearTypes

• Data type	❖ Description
❖ DATE	A date in **YYYY-MM-DD** format between 1000-01-01 to **9999-12-31** In oracle data format is DD-MON-YYYY for e.g 10-SEP-2019
❖ YEAR(M)	To store only year part of data where M may be 2 or 4 i.e. year in 2 digit like **18** or 4 digit like **2018**

String Types

❖ Data type	❖ Description
❖ CHAR(M)	❖ Fixed length string between 1 and 255. it always occupy M size for each data for example if size is CHAR(20) and we store value 'MOBILE' , although the size of MOBILE is 6 but in a table it will occupy 20 size with space padded at right side for remaining place. ❖ Mostly use in the case where the data to be insert is of fixed size like Grade (A,B,C,..) or Employee code as E001, E002, etc. In this case CHAR will give better performance than varchar
❖ VARCHAR(M)	❖ Variable length string between 1 and 65535 (from MySQL 5.0.3) , earlier it was 255. It takes size as per the data entered for example with VARCHAR (20) if the data entered is MOBILE then it will take only 6 byte. It is useful for the data like name, address

	where the number of character to be entered is not fixed.
❖ VARCHAR2	❖ It is supported in ORACLE; both are almost same with minor difference. The difference is in the way they are handling Empty String and NULL, for VARCHAR these two are different where as VARCHAR2 treats both same.

Quick Revision

Table- Library

Bid	Name	Author	Price	Mem_name	Issue_Date	Status	
B01	Wings of Fire	A.P.J Abdul Kalam	550	Sarita	2018-05-20	Returned	

- **Look at the table library and identify the correct datatype for all the columns**
- **One Computer Shopkeeper wants to create table to store records related to the material in his shop. Help him in identifying the columns with their datatypes.**

SQL Commands

DDL Commands

▶ **TO SEE LIST OF DATABASES**

    show databases;

▶ **TO CREATE A DATABASE**

    create database mydb;

▶ **TO OPEN A DATABASE**

    use mydb;

▶ **TO DELETE A DATABASE**

    drop database mydb;

▶ **TO CREATE A TABLE**

CREATE TABLE is used to create a table in a database.

    Syntax:

    Create Table   TableName

    (ColumnName1 datatype(size) constraint,

ColumnName2 datatype(size) constraint,......);

Example:

Create Table Employee

(empno   int   primary key,

name   varchar(20)   not null,

dept   varchar(20)   unique,

salary   int   check(salary>=5000));

Different Constraints:

❖Primary Key

It ensures unique value in any column, also forces data entry mandatory. Only one primary key can be applied in one table

❖Unique

It also allows unique value in any column but it allows NULL values and can be applied to n times

❖Not Null

It will make data entry mandatory for applied column i.e. NULL will not be allowed

❖Default

It allows to specify any value which will be auto-matically inserted in applied column if we not specify applied column at the time of data entry using INSERT

❖CHECK

It allows to specify range of values that can be entered in applied column like salary must be greater than 5000; marks must be greater than 0 or dept must be in given list of values etc.

► TO MODIFY A TABLE

ALTER TABLE command is used to modify the structure of the table. It performs the following operations:

      a) Adding new column in existing table
      b) Dropping existing column from table
      c) Modifying column definition in table

  a)   Adding new column in existing table

Syntax:

Alter Table TableName add

(ColumnName1 datatype(size) constraint);

Example:

Alter Table Employee add

(designation   varchar(15)   not null);

  b)   Dropping existing column from table

Syntax:

    Alter Table TableName drop ColumnName;

Example:

    Alter Table Employee drop salary;

c) Modifying column definition in table

Syntax:

Alter Table TableName
modify (ColumnName datatype(size)) ;

Example:

Alter Table Employee modify (designation varchar(20));

▶ TO REMOVE A TABLE

DROP TABLE command is used to remove the structure of the table.

Syntax:

Drop Table TableName ;

Example:

Drop Table Employee;

Quick Revision

Table- Library

Bid	Name	Author	Price	Mem_name	Issue_Date	Status
B01	Wings of Fire	A.P.J Abdul Kalam	550	Sarita	2018-05-20	Returned

Write the commands to perform following operations:

- Create the above table, set Bid as Primary key.
- Add a new column to store no of pages
- Modify the range of Author, increase it by 5 characters.
- Remove a column named
- Remove the column named price.

SQL Operators

Relational Operators

SQL is providing various relational operators to apply conditions in different commands. Such as

<, >, <= ,>=, <> (not equal to), =

Example :

- salary>2000
- dept ='Sales'
- rollno =121 etc.

Logical Operators

SQL is also providing various logical operators to merge different relational expressions to apply conditions in different commands. Such as

AND, OR, NOT

Example :

- salary>2000 and salary< 50000
- dept ='Sales' or designation='manager' etc.

DML Commands

▶ TO ADD RECORDS IN TABLE

Insert command is used to insert data into the table.

a) In selected columns.

    Syntax:

    Insert Into table_name (column1,column2,column3, ..)
    VALUES(value1, value2, value3, ..);

    Example :

    Insert into Employee (empno, name, dept) values
    (2,'dipanker','IT');

b) In all columns.

    Syntax:

    Insert Into table_name VALUES(value1, value2, value3, ..);

    Example :

    Insert into Employee values (2,'dipanker','IT',20000);

▶ TO CHANGE THE VALUES OF RECORDS

Update command is used to change the record of the table. You can change all the rows or particular row from the table. The **Update** command specifies the row with **where** clause and new data is written into respective record using set keyword.

  a) Change all rows.

    Syntax:

    Update table_name set column1= newvalue ;

    Example :

Update Employee set dept= 'Sales';

or

Update Employee set salary = salary +2000;

b)Change specific rows as per condition

Syntax:

Update table_name set column1= newvalue where (condition) ;

Example :

Update Employee set dept= 'Sales' where empno =101;

or

Update Employee set salary = salary +2000 where salary < 15000;

▶ TO DELETE RECORDS

Delete Command is used to delete all rows or particular row from the table using where clause.

a) Delete all rows.

Syntax:

Delete from table_name ;

Example:

Delete from Employee;

b) Delete specific rows as per condition

Syntax:

Delete from table_name where (condition) ;

Example :

Delete from Employee where empno =101;

or

Delete from Employee where salary >= 500 and salary <=1000;

Quick Revision

Table: PharmaDB

RxID	DrugID	DrugName	Price	PharmacyName	Location
R1000	5476	Amlodipine	100.00	RxPharmacy	Pitampura
R1001	2345	Paracetamol	15.00	RajMedicos	Bahadurgarh
R1002	1236	Nebistar	60.00	MyChemist	RajGarden
R1003	6512	VitaPlus	150.00	MyChemist	Gurgaon
R1004	5631	Levocitrezine	110.00	RxPharmacy	SouthExtension

Write command to perform the following operations:
1. Create the table PharmaDB
2. Add 5 rows in it as shown above.
3. Update the price of all drugs 50/-Rs.
4. Change the location Pitampura to Rohini
5. Delete the information of DrugID 5631
6. Remove the complete table.