2.1 Introduction

In our day to day life every person uses database in various ways. Like people use phone diary or phone book which contains name, address email id, phone number etc.

Doctor maintains medical history of patients. Librarian maintains records of their book details, issue date, return date. etc. Teacher keeps records of students like name, roll number, Marks etc. In these examples every one maintains records in a systematic manner.

In a computer system, we always maintain our records. At this point a database is very useful.

2.2 Definition of a Database

Database is collection of interrelated data which helps in efficient retrieval, inserting and deleting of data. In exams, marks obtained by the student in subjects is data before it is entered in the report card. In a report card, the combined (marks) data of all subjects speaks about students performance. Thus when data is maintained in an organized manner it becomes meaningful or organized information.

Data vs Information

Data	Information
Data is raw facts	Information is processed data
Data does not help in decision making	Information helps in decision making
Data could be relevant or irrelevant	Without data information cannot be processed
Each student's exam score is one piece of data.	The average score of a class or of the entire school is information that can be derived from the given data.

Table: 1 Data vs Information

✍ **Do it yourself**

- Collect five examples of data and information

2.3 Introduction to Database Management System (DBMS)

A database, often abbreviated as DB, is a collection of information organized in such a way that a computer program can quickly select desired pieces of data.

A Database Management System (DBMS) is a software for creating and managing databases. The DBMS provides users and programmers with a systematic way to create, retrieve, update and manage data. It stores data in such a way that it becomes easier to retrieve, manipulate, and update information.

Examples of popular DBMS are :

MySQL, PostgreSQL, Access, Oracle, SQL Server, IBM, DB2 and Sybase.

2.4 Some Applications of DBMS

- **Railway Reservation System :**
  Database is required to keep record of ticket booking, train's departure and arrival status, status of seats available etc.

- **Library Management System :**
  There are thousands of books in the library so it is very difficult to keep a record of all the books in a copy or register. So DBMS is used to maintain all the information related to book issue dates, name of the book, author and availability of the book.

- **Banking :**
  People make thousands of transactions through banks daily and they can do this without going to the bank. So now banking has become so easy that by sitting at home bank customers can send or get money through banks. All this is possible just because of DBMS that manages all the bank transactions.

- **Universities and Colleges :**
  Examinations are done online today and universities and colleges maintain all these records through DBMS. Student's registration details, results, courses and grades all the information is stored in a database.

- **Credit Card Transactions :**
  For purchase of credit cards and all the other transactions are made possible only by DBMS. A credit card holder knows the importance of his information that all are secured through DBMS.

- **Social Media Sites :**
  We all are on social media websites to share our views and connect with our friends. Daily, millions of users sign up for these social media accounts like Facebook, Twitter, Pinterest and Google plus. But how is all the information of users stored and how are we able to connect to other people? Yes, this is all because of DBMS.

2.5 Advantages of DBMS

- **Reducing Data Redundancy :**
  The file based data management systems contained multiple files that were stored in many different locations in a system or even across multiple systems. Because of this, there were sometimes multiple copies of the same file which lead to data redundancy.

This is prevented in a database as there is a single database and any change in it is reflected immediately. Because of this, there is no chance of encountering duplicate data.

- **Sharing of Data :**
  In a database, the users of the database can share the data among themselves. There are various levels of authorisation to access the data, and consequently the data can only be shared based on the correct authorisation protocols being followed.

  Many remote users can also access the database simultaneously and share the data between themselves.

- **Data Integrity :**
  Data integrity means that the data is accurate and consistent in the database. Data Integrity is very important as there are multiple databases in a DBMS. All of these databases contain data that is visible to multiple users. So it is necessary to ensure that the data is correct and consistent in all the databases and for all the users.

- **Data Security :**
  Data Security is vital concept in a database. Only authorised users should be allowed to access the database and their identity should be authenticated using a username and password. Unauthorised users should not be allowed to access the database under any circumstances as it violates the integrity constraints.

- **Privacy :**
  The privacy rule in a database means only the authorized users can access a database according to its privacy constraints. There are levels of database access and a user can only view the data. For example - In social networking sites, access constraints are different for different accounts a user may want to access.

- **Backup and Recovery :**
  Database Management System automatically takes care of backup and recovery. The users don't need to backup data periodically because this is taken care of by the DBMS. Moreover, it also restores the database after a crash or system failure to its previous condition.

- **Development and Maintenance Time :**
  DBMS reduces application development and maintenance time. It supports many important functions that are common to many applications, accessing data stored in the DBMS, which facilitates the quick development of application.

2.6 Data types in the DBMS

When you create a table or add a field to a table in the database, fields are created with specific data type. Data types are classifications that identify possible values for and operations that can be done on the data, as well as the way the data in that field is stored in the database.

Class	Data Type	Description
Text	CHAR	Holds a fixed length string (can contain letters, numbers, and special characters). The fixed size is specified in parenthesis.
	VARCHAR	Holds a variable length string (can contain letters, numbers, and special characters). The maximum size is specified in parenthesis.
Numeric	DECIMAL	It can represent numbers with or without the fractional part
	INT	It is used for storing integer values.
Date	DATE	It holds the date including day, month and year
Time	TIME()	It holds time. Format: HH:MM:SS

Table: 2 Data types in DBMS

✍ **Do it yourself**

- You have scored 75.56% in the recent examination. Which data type would you prefer to use for storing this data ?

2.7 Data model

Database is designed according to certain rules. This logical structure of database is known as a model. Data models define how the data is connected to each other and how they are processed and stored inside the system.

It describes the method of storing and retrieving the data. There are different models like network model, hierarchical model and relational model. Let us see relational model.

Relational Model :

The most popular data model in DBMS is the Relational Model. Relational data model is the primary data model, which is used widely around the world for data storage and processing. This model is simple and has all the properties and capabilities required to process data with storage efficiency.

- A transaction is a unit of work that is performed against a database. For example, if you are creating a record or updating a record or deleting a record from the table, then you are performing a transaction on that table. It is important to control these transactions to ensure the data integrity and to handle database errors.

Properties of Transactions :

Transactions have the following four standard properties, usually referred to by the acronym ACID.

- **Atomicity :** It ensures that all operations within the work unit are completed successfully. Otherwise, the transaction is aborted at the

point of failure and all the previous operations are rolled back to their former state.

- **Consistency :** It ensures that the database properly changes states upon a successfully committed transaction.

- **Isolation :** It enables transactions to operate independently of and transparent to each other.

- **Durability :** It ensures that the result or effect of a committed transaction persists in case of a system failure.

2.8 Introduction of RDBMS

RDBMS stands for Relational Database Management System. In RDBMS a database is considered as a collection of interrelated data.

Basic Database Concept

- **Table :** The table is the basic data storage unit in a Relational database. Table consists of columns and rows. A database consists of one or more tables according to which data is stored in a table. Database designer decides the name of the table and titles of columns.

- **Field :** A table consists of information which is stored under different headings, called as fields or columns. Columns are shown vertically in a table. Each field or column has an individual name. Two columns cannot have the same name. In Fig. no. 1, the first row represents the different field names or titles of columns.

- **Record :** All the columns in a table make a row. Each row contains information on individual topics. A record is composed of fields and contains all the data about one particular person, company, or item in a database. Record is also called as a Tuple.

- **Key :** A column or a combination of columns which can be used to identify one or more rows (tuples) in a table is called a key of the table.

Position Title	Education Requirements	Functional Area	Max Pay	Min Pay
Executive Assitant	Associate degree	Human Resource	60,000	40,000
Recruiter	Bachelor's degree	Human Resource	110,000	85,000
SW Engineer	Bachelor's degree	Engineering	140,000	110,000
SQA Engineer	Bachelor's degree	Engineering	140,000	110,000

Column (field)

Row (record)

Data Value

Table (object)

Fig. 1 : Table in Database

- **Primary Key :** The group of one or more columns used to uniquely identify each row of a relation is called its Primary Key.

- **Foreign Key :** It is a field (or collection of fields) in one table that refers to the Primary Key in another table.

Relationships in database :

Relationships link data from individual tables to increase the usefulness of the database.

A relationship in the context of databases, is a situation that exists between two relational database tables when one table has a foreign key that is used as a reference to the primary key of the other table.

For example, a table called Employees has a primary key called *employee_id.* Another table called *Employee Details* has a foreign key which references *employee_id* in order to uniquely identify the relationship between the two tables.

There are 3 types of relationships in relational database design. They are :

- One-to-One
- One-to-Many (or Many-to-One)
- Many-to-Many

These are explained below.

One-to-One :

In a one-to-one relationship, one record in a table is associated with one and only one record in another table. For example, in a company database, each employee has only one Person_ ID, and each Passport_ ID is assigned to only one person.

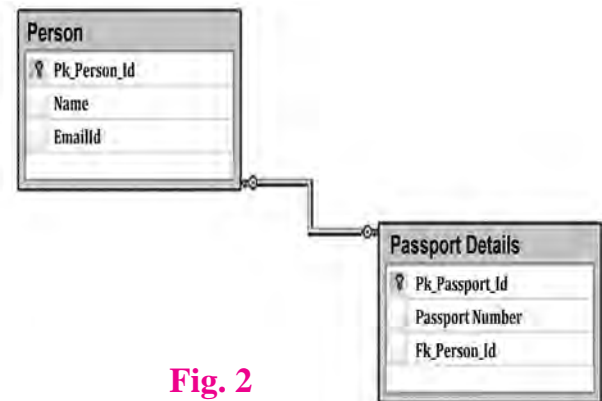A one-to-one relationship looks like below in the relationships graph :

Fig. 2

One-to-Many (or Many-to-One)

This is the most common relationship type. In this type of relationship, a row in table City can have many matching rows in table Customer, but a row in table Customer can have only one matching row in table City
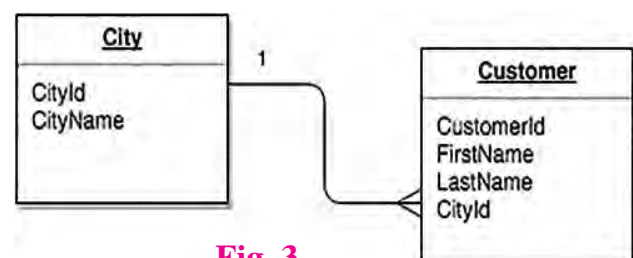

Fig. 3

Example of one-to-many relationship

One-to-Many relationships can also be viewed as Many-to-One relationships, depending on which way you look at it.

In the above example, the Customer table is the "many" and the City table is the "one". Each customer can only be assigned one city,. One city can be assigned to many customers.

Many-to-Many

A many-to-many relationship occurs when multiple records in a table are associated with multiple records in another table.

Multiple records in Table Product are linked to multiple records in Table Suppliers.

Fig. 4

2.9 Introduction to SQL

SQL is Structured Query Language, which is a computer language for storing, manipulating and retrieving data stored in a relational database. SQL is the standard language for Relational Database Management System. All relational database management systems like MySQL, Base, Oracle, Sybase, Informix, Postgres and SQL Server use SQL as standard database language.

SQL became a standard of the American National Standards Institute (ANSI) in 1986, and of the International Organization for Standardization (ISO) in 1987.

Using SQL You Can :
- ☞ Create new databases.
- ☞ Create new tables in a database
- ☞ Insert records in a database
- ☞ Retrieve data from a database
- ☞ Update records in a database

- ☞ Delete records from a database
- ☞ Execute queries against a database
- ☞ Create stored procedures in a database
- ☞ Create views in a database.

> ✍ **Do it yourself**
> - Explain the purpose of SQL

2.10 Categories of SQL Commands

Data Definition Language (DDL) Commands

DDL statements or commands are used to define and modify the database structure of your tables or schema. When you execute a DDL statement, it takes effect immediately.

Data Definition Language (DDL) commands	
COMMAND	**USED FOR**
CREATE DATABASE	Creates database
CREATE TABLE	Creates a new table
ALTER TABLE	Modifies a table
DROP TABLE	Deletes a table or Database
DROP DATABASE	

Table: 3 DDL Commands

Data Manipulation Language (DML) Commands

Data Manipulation Language (DML) statements or commands are used for managing data within tables.

Data Manipulation Language (DML) Commands	
COMMAND	**USED FOR**
SELECT	Extracts data from a table
UPDATE	Updates data in a table
DELETE	Deletes data from a table
INSERT INTO	Insert data into a table

Table: 4 DML Commands

Data Control Language (DCL) Commands

DCL is used to control user access in a database. it is related to security issue. it is also deals with the rights and permissions of the databse access.

| Data Control Language (DCL) commands	
COMMAND	**USED FOR**
GRANT	To provide access or privileges on the database objects.
REVOKE	To remove access rights or privileges on the database object.

Table: 5 DCL Commands

Summary

- Basic concepts of database.

- We get to know difference between Data and Information.

- Database management system(DBMS) is used to create, manipulate and retrieve database.

- DBMS is used in various fields like railway, library, schools, colleges, credit transactions, banking.

- Benefits of DBMS are data sharing, data integrity, security, consistency, recovery.

- RDBMS means relational database management system.

- Relations in database are one to one, one to many or (many to one) and many to many.
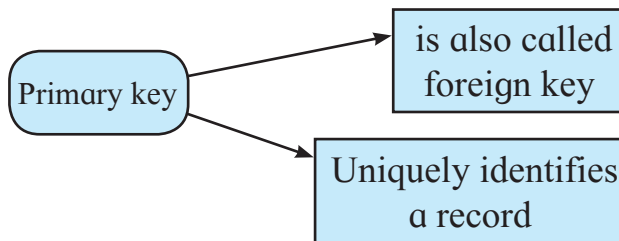
- Categories of SQL Commands : DDL, DML and DCL

Q. 1 Complete the following activity.

1. Tick whichever box is not valid.
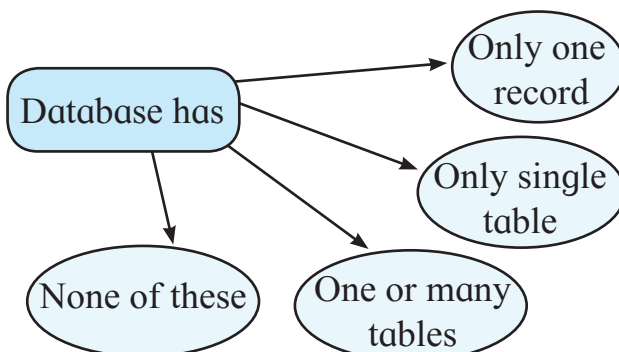
Data type → Graphic

Data type → Date

Data type → Number

Data type → Text
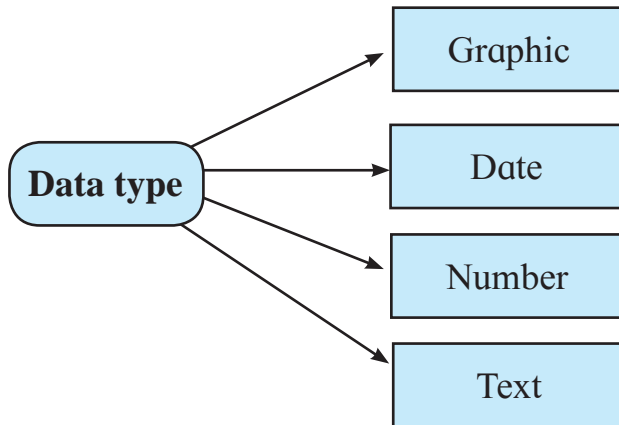
2. Student wants to create a field pincode in a table, which data type he will choose ?

3. Tick the appropriate box.

Primary key → is also called foreign key

Primary key → Uniquely identifies a record

4. Tick the appropriate circle.

Database has → Only one record

Database has → Only single table

Database has → None of these

Database has → One or many tables

Q. 2 Observe the field names of a database given below in 'Column A' related to Bus reservation. Write suitable data types for each field in front of the respective field in 'Column B'

Column A (Field Name)	Column B (Data Type)
Passenger Name	
Age	
Gender	
Mobile Number	

Q. 3 Write the use of following SQL command.

Command	Use
INSERT	
UPDATE	

Q.4 Create a table for the information given below by choosing appropriate data types. Specify proper primary key for the table 1) Movie 2) Actor

1. Movie (Registeration_no, movie_name, Realease_Date)

2. Actor (actor_id, Actor_name, birth_date)

Q. 5 Consider the following table Stationary. Write SQL commands for following statements.

Table : Stationary

| S_ID	S_Name	C_Name	Price	Quantity
001	NoteBook	ABC	20	50
002	Pencil box	XYZ	10	80
003	A4Pages rim	PQR	600	2

1) Write SQL command to create above Table

2) Write SQL command to insert above mentioned record in table

3) To delete above table.

Q.6 Answer the following questions.

1) What is a database ?

2) What are the advantages of a DBMS ?

3) What do you understand by Data Model ?

4) What is a primary key ?

5) What is DDL(Data Definition language)

Q.7 In a company the data is stored in a table under the following fields Employee number, Last name, Date of birth, Address. Which data type will you use for the above field.

Datatype??? — Employee Name

??? — last name

company table

??? — Address

??? — Date of birth
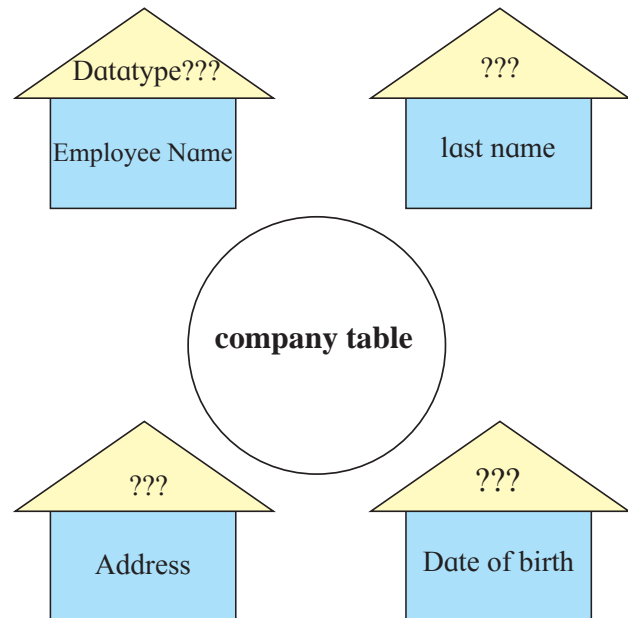
Q.8 Multiple choice select three correct answers.

1) Valid relationships in RDBMS are

a) one to one   b) one to two

c) one to many   d) many to two

e) many to many   f) one to three

Q.9 Complete the following.

Use	Command
To remove access rights or previleges from the database	
Extracts data from a table	