Data and Information

- **Data**:
    - Data is the collection of raw facts and figures.
    - It has no proper meaning until it is processed.
    - It can be numbers, words, symbols, or pictures.
    - Example: *85, 90, 75, Ajay, 102.*
- **Information**:
    - When data is processed, organized, and presented in a meaningful way, it becomes information.
    - Information is useful for decision-making.
    - Example: *Ajay (Roll No 102) scored 85, 90, and 75 in three subjects.*

 Relation: Information = Data + Processing + Meaning

Databases and DBMS

- **Database**:
    - A database is an organized collection of related data stored in a structured format.
    - The data is arranged in tables (rows and columns).
    - Example: Student Database with fields like Roll No, Name, Class, Marks.
- **DBMS (Database Management System)**:
    - DBMS is software that helps in creating, storing, managing, and retrieving data from a database.
    - It provides tools to add, update, delete, and search data easily.

Examples of DBMS: LibreOffice Base, MS Access, MySQL, Oracle, SQL Server.

Main functions of DBMS:

1. **Data Storage** – Stores large amounts of data safely.
2. **Data Retrieval** – Fetches specific information quickly using queries.
3. **Data Manipulation** – Insert, update, and delete records easily.

4. **Data Security** – Protects data from unauthorized access.
5. **Data Integrity** – Maintains accuracy and consistency.
6. **Backup and Recovery** – Restores data if lost.
7. **Multiple User Access** – Many users can use the database at the same time.

Advantages of Database (Over File System)

Earlier, people used the **file system** to store data. But it had problems like data duplication, difficulty in searching, and no proper security. DBMS solved these issues.

Advantages of DBMS:

1. **Reduced Data Redundancy** – Data is stored only once, not repeated.
2. **Data Consistency** – Same data is available for all users, no mismatch.
3. **Data Security** – Password protection and user access rights are available.
4. **Easy Backup and Recovery** – Lost data can be restored easily.
5. **Multi-user Access** – Many users can use the same database at the same time.
6. **Efficient Searching** – Queries make searching very fast.
7. **Data Sharing** – Data can be shared among different applications.

Data Models

 A **data model** is a way to organize and represent data in a database. It shows how data is connected and how it will be stored.

(i) Hierarchical Data Model

- Data is stored in a **tree-like structure**.
- It follows **Parent-Child relationship**.
- Each child can have only one parent, but a parent can have multiple children.
- Example: *Company → Departments → Employees.*

 Advantages: Easy for one-to-many relationships, fast access.

 Disadvantage: Difficult to modify structure, not flexible.

(ii) Network Data Model

- Data is stored in records and connected using **links (pointers)**.
- Each record can have **multiple parent and child records**.
- Allows **many-to-many relationships**.
- Example: *Students ↔ Courses (One student can take many courses, and one course can have many students).*

 Advantages: Flexible and handles complex relationships.
 Disadvantage: Structure is complicated, difficult to maintain.

(iii) Relational Data Model

- Data is stored in the form of **tables (rows and columns)**.
- Each table is called a **Relation**.
- Very simple and widely used model in modern databases.
- Example: *Student Table → Roll No, Name, Marks.*

 Advantages: Easy to use, flexible, supports queries.
 Disadvantage: Slower for very large databases compared to hierarchical.

Relational Database Model (RDBMS)

A **Relational Database Management System (RDBMS)** stores data in tables and maintains relationships between them. It is the most popular type of DBMS used today.

(a) RDBMS Terminology

1. **Table (Relation):** Collection of data in rows and columns.
2. **Row / Record / Tuple:** A single complete entry in the table. Example: *(101, Ajay, 95).*
3. **Column / Field / Attribute:** A property of data. Example: Roll No, Name, Marks.
4. **Primary Key:** A field that uniquely identifies each record. Example: Roll No.
5. **Foreign Key:** A field that links two tables. Example: Class ID in Student Table linking to Class Table.
6. **Query:** A tool to ask questions and get answers from the database.
7. **Form:** User-friendly way of entering and editing data.

8. **Report:** Used to display and print data in a formatted manner.

(b) Objects of an RDBMS

1. **Tables:** Store the actual data in rows and columns.
2. **Queries:** Retrieve, filter, and sort data.
3. **Forms:** Provide a simple way to input and update data.
4. **Reports:** Present information in a readable and printable format.

Introduction to LibreOffice Base

- **LibreOffice Base** is a **Database Management System (DBMS)** software.
- It is used to **create, store, manage, and retrieve data** in an organized way.
- Base helps you **enter data, organize it, query it, and present it in reports**.
- LibreOffice Base is **free, open-source**, and works on Windows, Linux, and macOS.

Why we use LibreOffice Base:

1. To **store large amounts of data** safely in tables.
2. To **find information quickly** using queries.
3. To **enter and update data easily** using forms.
4. To **generate reports** for analysis or printing.

Example: A school can use LibreOffice Base to maintain a **Student Database** with Name, Roll No, Class, Marks, etc.

Data Types in LibreOffice Base

Every field (column) in a table must have a **data type**. It determines what kind of data can be stored.

Data Type	Description	Example
Text (VARCHAR)	Letters, numbers, symbols	Name, Address
Integer	Whole numbers	Roll No, Age

Decimal / Float	Numbers with decimals	Marks, Price
Date	Dates	13-09-2025
Time	Time values	10:30 AM
Boolean / Yes-No	True/False or Yes/No	Pass/Fail

Tip: Choosing the correct data type helps in **preventing errors** and maintaining **data integrity**.

Starting LibreOffice Base

Steps to start LibreOffice Base:

1. Open LibreOffice → Click **Base** icon.
2. You will see a **Database Wizard**:
    - Option 1: **Create a new database** → Start from scratch.
    - Option 2: **Open an existing database** → Work with saved data.
3. The wizard guides you step-by-step to create a database.

User Interface of LibreOffice Base

The Base window has several sections:

1. **Menu Bar:** Contains commands like File, Edit, View, Tools.
2. **Toolbar:** Quick access to New, Open, Save, Print, etc.
3. **Database Objects Pane (Left side):** Shows:
    - Tables
    - Queries
    - Forms
    - Reports
4. **Workspace (Right side):** The area where you work with tables, forms, queries, or reports.

5. **Status Bar:** Displays info about the database and selected object.

Tip: Learn the icons – e.g., New Table, Run Query, Form Wizard – it makes work faster.

Opening a Database

- To open a saved database:
    1. Click File → Open
    2. Select the .odb file from your computer
    3. The database opens in the LibreOffice Base window
- After opening, you can **view tables, queries, forms, and reports**.

Creating a Table

A **table** stores all the data in a database in **rows (records) and columns (fields)**.

(a) Using Table Wizard

The **Wizard** is a beginner-friendly method.

Steps:

1. Go to Tables → Use Wizard to Create Table
2. Select **fields** from the suggested list (e.g., Name, Roll No, Marks)
3. Arrange the fields in proper order
4. Set **data types and sizes** automatically
5. Click **Finish** → Table is created

Example: Student Table

| Roll No | Name | Class | Marks |

(b) Using Design View

Design View is an advanced method giving **full control over table structure**.

Steps:

1. Go to Tables → Create Table in Design View
2. Add **fields (columns)** one by one:

- Field Name: Roll No → Data Type: Integer
- Field Name: Name → Data Type: Text
- Field Name: Marks → Data Type: Decimal

3. Set **Field Properties**: size, default value, validation rules
4. Set **Primary Key** if required (unique identifier for records)
5. Save the table with a suitable name

Setting Primary Key

- **Primary Key** ensures that each record in the table is **unique**.
- Usually used on fields like Roll No, Employee ID, etc.

Steps to set Primary Key:

1. Open table in Design View
2. Select the field (e.g., Roll No)
3. Right-click → Select **Primary Key**
4. A **key icon** appears next to the field → Primary key set

Why Primary Key is important:

- Prevents duplicate records
- Helps in creating **relationships between tables**

Saving a Table

- After creating a table, it must be **saved**.

Steps:

1. Click File → Save
2. Enter a **Table Name** (e.g., Student)
3. Click **OK** → Table is saved

Tip: Always save before closing LibreOffice Base to avoid losing data.

Example of Table Creation (Step by Step)

1. Open LibreOffice Base → Create new database → Save
2. Go to Tables → Use Wizard to Create Table
3. Select fields: Roll No, Name, Class, Marks
4. Click **Next**, arrange fields, set data types
5. Set **Primary Key = Roll No**
6. Click **Finish**, table is created
7. Enter sample data:

Roll No	Name	Class	Marks
101	Ajay	10A	95
102	Deepak	10B	88
103	Ramesh	10A	90

Entering Data into a Table

- After creating a table, you need to **enter data (records)**.
- Each **row = one record**, each **column = one field**.

Steps to enter data:

1. Open the **table** by double-clicking its name in the Tables pane.
2. The table opens in **Data View** (also called **Table View**).
3. Click on the **first empty row**.
4. Type the data for each field.
    - Example: Roll No → 101, Name → Ajay, Class → 10A, Marks → 95
5. Press **Enter** or **Tab** to move to the next row.

Tips:

- Always enter data in the correct column type.

- Example: Don’t type text in a number field.

- Base automatically **saves each record** after entering.

Navigating Through the Table

- When a table has many records, you need to **move through the table** efficiently.

Navigation Options:

1. **Arrow Keys:** Move one cell up, down, left, or right.
2. **Tab Key:** Move to the next field in the same record.
3. **Shift + Tab:** Move to the previous field.
4. **Navigation Bar (Bottom of Table View):**
    - **First Record:** Goes to the first record
    - **Previous Record:** Moves one record up
    - **Next Record:** Moves one record down
    - **Last Record:** Goes to the last record
    - **New Record Button (+):** Add a new record

Tip: Navigation bar is very useful when working with **large tables**.

Editing Data in a Table

- Sometimes you need to **update or correct data** in the table.

Steps to edit a record:

1. Open the table in **Data View**.
2. Click on the **cell** you want to edit.
3. Type the new value.
4. Press **Enter** → Base **automatically saves** the change.

Example:

- Original: Marks = 88
- Edit: Marks = 90 → Updated automatically

Tip: Be careful when editing **primary key values**, as it may affect table relationships.

Deleting Records from a Table

- To remove **unwanted or incorrect records** from a table:

Steps to delete a record:

1. Select the **entire row** of the record to delete.
2. Right-click → Select **Delete Record**
3. A confirmation message appears → Click **Yes**
4. Record is removed permanently from the table

Tip: Deleted records **cannot be recovered** unless you have a backup.

Sorting Data in a Table

- Sorting helps to **arrange records** in ascending or descending order.

Steps to sort data:

1. Open the table in **Data View**.
2. Select the **column** to sort (e.g., Marks).
3. Click Data → Sort Ascending → Lowest to highest
4. Click Data → Sort Descending → Highest to lowest

Example: Sorting students by Marks:

- Ascending: 75, 85, 90, 95
- Descending: 95, 90, 85, 75

Tip:

- Sorting does **not delete records**, it only **rearranges the view**.
- You can sort by **multiple columns** (e.g., Class first, then Marks).

Editing and Deleting Tables

Editing a Table

- Sometimes you need to **change the structure** of a table (add/remove fields, change data types, etc.).
- Steps to edit a table:

1. Open LibreOffice Base → Go to **Tables** pane.
2. Right-click on the table → Select **Edit**
3. You can:
    - **Add new fields** (e.g., add “Email” column)
    - **Change field names** or **data types**
    - **Reorder fields** if needed
4. Save changes → Table is updated

Deleting a Table

- To **permanently remove a table** from the database:

1. Go to **Tables** pane
2. Right-click on the table → Select **Delete**
3. Confirm deletion → Table is removed permanently

Tip: Always backup the database before deleting tables.

Relationships Between Tables

- A **relationship** links **two or more tables** to show how their data is connected.
- Helps **avoid duplicate data** and maintain **data consistency**.

Example:

- **Student Table:** Roll No, Name, Class
- **Class Table:** Class ID, Class Name, Teacher
- Relationship: Student.Class → Class.Class ID

Types of Relationships

(a) One-to-One (1:1)

- One record in Table A is related to **only one record** in Table B.
- Example:
    - Student → Student ID
    - Student Profile → Each student has **only one profile**

(b) One-to-Many (1:N)

- One record in Table A is related to **many records** in Table B.
- Example:
    - Class → Class ID
    - Student → Many students belong to **one class**
- Most common type of relationship in databases

(c) Many-to-Many (M:N)

- Many records in Table A are related to **many records** in Table B.
- Example:
    - Student ↔ Courses
    - One student can take many courses, and one course can have many students
- Requires a **junction table** to manage the relationship

Advantages of Relating Tables

1. **Avoid Data Redundancy:** Store information only once
2. **Ensure Data Consistency:** Changes in one table automatically reflect in related tables
3. **Easier Data Management:** Add, delete, or update data without affecting other tables
4. **Faster Queries and Reports:** Fetch related information easily
5. **Better Organization:** Data is structured and clear

Creating Relationships Between Tables in LibreOffice Base

Steps:

1. Open the database → Go to Tools → Relationships
2. The **Relationships window** opens → All tables are listed
3. Drag the **field from Table A** (e.g., Class ID) → Drop it onto the **related field in Table B**
4. The **Edit Relationship** dialog appears → Check settings:
    - Enforce **Referential Integrity**
    - Choose **Relationship type**: One-to-One or One-to-Many
5. Click **OK** → Relationship is created

Example:

- Drag **Class ID** from Class Table → Drop onto **Class field** in Student Table → One-to-Many relationship

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Referential Integrity

- **Referential Integrity** ensures that **relationships between tables remain consistent**.
- Rules:

1. You **cannot delete a record** from the primary table if it has related records in another table
2. You **cannot enter a value** in the foreign key field that does not exist in the primary table
3. It ensures **data accuracy and consistency** across related tables

Example:

- Student Table → Class field (foreign key)
- Class Table → Class ID (primary key)
- Referential Integrity prevents a student from being assigned to a non-existent class

Introduction to Queries

- A **Query** is a tool to **retrieve specific information** from one or more tables in a database.
- It acts like a **question** to the database: “Give me all students with marks above 90.”
- **Important:** Queries **do not change the original table**, they just **display filtered or sorted data**.

Uses of Queries:

1. Filter data based on conditions
2. Sort data in ascending or descending order
3. Perform calculations on numerical data (like sum, average)
4. Combine data from multiple tables

Creating a Query Using Query Wizard

Query Wizard is the easiest way to create queries step-by-step.

Steps:

1. Open database → Go to Queries → Use Wizard to Create Query
2. Select **Table or Query** as the data source (e.g., Student Table)
3. Select **Fields to include** (e.g., Roll No, Name, Marks)
4. Set **Filter criteria** (optional)
    - Example: Marks > 90
5. Choose **Sort order** (optional)
    - Example: Sort by Marks descending
6. Name the query and click **Finish**
7. Query result shows the filtered or sorted data

Tip: The wizard is **user-friendly** and best for beginners.

Creating a Query Using Design View

Design View gives more **control and flexibility** for advanced queries.

Steps:

1. Go to Queries → Create Query in Design View
2. Add **tables** you want to use in the query
3. Drag fields from tables into the query grid
4. Set **criteria** in the "Criteria" row
    - Example: Marks > 90
5. Set **sort order** in the "Sort" row
6. Save and run the query

Example Grid:

Field	Table	Criteria	Sort
Name	Student		
Marks	Student	>90	Desc

Editing a Query

- To change an existing query:

1. Open the **Queries** pane
2. Right-click the query → Select **Edit**
3. Modify fields, criteria, or sort order as needed
4. Save the changes → Run the query to see updated results

Tip: Editing queries does **not affect the original table**.

Working with Numerical Data in Queries

- Queries can **perform calculations** on numerical data.

Common Operations:

1. **Sum:** Total of all values in a column
2. **Average:** Mean of numerical values
3. **Count:** Number of records that meet a condition
4. **Min / Max:** Find smallest or largest value

Example:

- Query: Average Marks of students in Class 10A
- Steps:
    1. Add **Marks** field
    2. Choose Function → Average
    3. Set criteria (Class = 10A)
    4. Run query → Result shows average marks

Forms in Base

- A **Form** is a **user-friendly interface** for entering, viewing, and editing data in a database.
- Forms make it easier to **add records** without opening the table directly.
- Forms can include: **text boxes, drop-down lists, buttons, checkboxes**, etc.

Uses of Forms:

1. Simplify **data entry**
2. Reduce errors by restricting input types
3. Make database more **interactive and professional**

Creating a Form Using Wizard

Form Wizard allows beginners to create forms **step-by-step**.

Steps:

1. Go to Forms → Use Wizard to Create Form
2. Select **Table or Query** as data source

- Example: Student Table

3. Select **fields** to include in form (e.g., Roll No, Name, Marks)
4. Choose **layout style** (Columnar, Tabular, etc.)
5. Set **form title**
6. Click **Finish** → Form is created
7. The form opens → You can **enter new records** easily

Tip: Columnar layout is most common for data entry forms.

Modifying a Form

- Forms can be customized in **Design View** to improve appearance or add functionality.

Steps to modify a form:

1. Right-click the form → Select **Edit**
2. Add/remove fields, move controls, resize text boxes
3. Change font, color, and style of labels and fields
4. Save the modified form

Tip: Always test the form by entering a few records to ensure it works properly.

Form Controls Toolbar

- The **Form Controls Toolbar** provides tools to add interactive elements:

Control	Use
Text Box	Input or display text
Label	Display field name
Combo Box	Drop-down list selection
Check Box	Yes/No input

Option Button	Multiple-choice selection
Command Button	Perform actions (e.g., save record)

Tip: These controls improve **data entry accuracy and speed**.

Reports in Base

- A **Report** is used to **present database information** in a **readable and professional format**.
- Reports are mainly for **printing or sharing data**.

Uses of Reports:

1. Summarize information from one or more tables
2. Include **titles, headings, and formatted data**
3. Display **totals and calculations**

Inserting Other Controls in Reports

- In **Report Design View**, you can add:

1. **Text boxes** → Show field values
2. **Labels** → Describe fields
3. **Lines or rectangles** → Separate sections visually
4. **Images or logos** → School logo or watermark

Tip: Adding controls makes the report **more professional and easier to read**.

Inserting Titles & Headings in Reports

- **Titles and headings** make reports **organized and clear**.

Steps:

1. Open the report in **Design View**
2. Use the **Label control** from Form Controls toolbar
3. Type the **title or heading** (e.g., “Student Marks Report”)

4. Change **font size, color, and style** for visibility

Inserting Date & Time in Reports

- Date and time provide **context** for reports.

Steps:

1. In Design View → Insert → Field → Date/Time
2. Select **format** (e.g., DD-MM-YYYY or HH:MM AM/PM)
3. Position it in the **header or footer**

Tip: Including date/time is useful for **official reports and printing**.