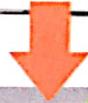# 1 Database Management System

Storing data and retrieving information has been a necessity of all businesses. Data can be anything such as, name of a person, a number, images, sound, etc. For example, Ravi, 4, student, etc. When the data is processed and converted into a meaningful and useful form, it is known as information.

For example, Ravi *is 4 years old and he is a* student is information.

Earlier, the data was stored manually in the form of files, books and ledgers. Storing data and retrieving information from them was a very tiring and time-consuming task. With computers, this problem has been resolved. Computers have replaced paper, files and ledgers as the principal media for storing important information. Computers help manage and organize the data so that useful information can be accessed easily and efficiently.

A database is a collection of related data from which users can efficiently retrieve the desired information. A database can be a simple collection of text data in a simple tabular form to a complex collection of images, audio or video.

Database Management System

DBMS is a collection of programs that enables users to create, maintain database and control all the access to the database. The primary goal of the DBMS is to provide an environment that is both convenient and efficient for user to retrieve and store information.

Some popular database management systems are Microsoft Access, Microsoft SQL Server, MySQL, MongoDB, Oracle DB, IBM DB2, SAP Sybase ACE, Teradata, Informix, SQLite etc.

The basic concepts behind a DBMS are:

a) Specification of data types, structures and constraints to be considered.
b) Storing the data and manipulating it as required.
c) Querying the database to retrieve desired data.
d) Updating the content of the database.

Need for Database Management System

Database approach came into existence due to the drawbacks and limitations of file processing system. In file processing systems; updating, deleting and maintaining the data is difficult. A number of application programs are written by programmers to maintain the data. In the database approach, the data is stored at a central location and is shared among multiple users. Thus, the main advantage of DBMS is centralization of data.

Advantages of Database Management System

a) **The ability to update and retrieve data:** This is the fundamental feature of a DBMS. Without the ability to view or manipulate data, there would be no point to using a database system. Updating data in a database includes adding new records, deleting existing records and changing information within a record.

b) **Support Concurrent Updates:** Concurrent updates occur when multiple users make updates to the database simultaneously. Supporting concurrent updates is also crucial to database management as this ensures that updates are made correctly. Otherwise it would lead to the loss of important data and/or inaccurate data stored.

c) **Recovery of Data:** DBMS provides ways to backup and recover database. There are times computers may crash, a fire or other natural disaster may occur, or a user may enter incorrect information invalidating or making records inconsistent.

d) **Security:** To prevent unauthorized access to the database, DBMS uses features like encryption, authentication, authorization and views to provide security to the database.

e) **Data Integrity:** Data integrity is a set of rules that DBMS provides to see that data incorrect or inconsistent data is not stored.

f) **Controlled data redundancy:** During database design, various files are integrated and each logical data item is stored at central location. This removes replicating the data item in different files, and ensures consistency and saves the storage space.

g) **Data sharing:** The data stored in the database can be shared among multiple users or application programs. Due to shared data, it is possible to integrate new applications without having to create any additional data or with minimal modification.

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h) Ease of application development: The application programmer needs to develop the application programs according to the users' needs. The other issues like concurrent access, security, data integrity, etc., are handled by the DBMS itself. This makes the application development an easier task.

Application Areas of Database System

Database systems support businesses of almost every nature now a days. Some of the most common database applications are listed here.

- **Travel Industry:** Airlines, railways, hotels and cab industry use online databases for reservation, room bookings and for displaying the schedule information.
- **Banking & Finance:** Databases are used for storing information such as sales, purchases of stocks and bonds or data useful for online trading, customers, accounts, loans, and other transactions.
- **Education:** Schools and colleges use databases for course registration, result, and other information.
- **E-commerce:** Integration of heterogeneous information sources (for example, catalogues) for business activity such as online shopping, booking of holiday package, consulting a doctor, etc.
- **Health Care Industry:** Databases are used for maintaining the patient health care details.
- **Digital libraries & publishing:** Databases manage bulk text & multimedia data.
- **Human resources:** Organizations use databases for storing information about their employees, salaries, benefits, taxes, and for generating salary cheques.

Relational Database

Relational databases store the data in one or more tables called relations.

Table

A Table is a collection of data related to a single topic and a database is a collection of tables. A table organizes the information about a single topic into rows and columns.

AuthorCode	AuthorName
A001	Ken Follet
A002	John Grisham
A003	Tom Clancy
A004	Frederick Forsyth

AuthorCode	BookCode	Title
A001	B001	Eye of the Needle
A003	B002	The Hunt for Red October
A004	B003	The Day of the Jackal
A001	B004	The Third Twin
A004	B005	The Cobra
A002	B006	The Firm
A003	B007	Clear and Present Danger
A002	B008	The Innocent Man

Parts of a Table

- **Columns:** The columns of a table are also called attributes. The column is the vertical part of a table.

- **Rows:** This is the horizontal part of the table. One row represents one record of the table. The row of a table is also called tuple.
- **Cell:** Cell is a small rectangular box that contains a value in the table. It is an intersection point of row and column.
- **Degree:** The number of attributes in a table is called the degree of the table. Degree of the table Author is 2 while that of the table Book is 3.
- **Cardinality:** The number of rows in the table is called its cardinality. Cardinality of the table Author is 4 while that of table Book is 8.

Tables are related in such way that information is taken out from them. For example, consider the following 2 tables. Here, the tables are related on the basis of common field AuthorCode.

Table: AUTHOR

AuthorCode	AuthorName
A001	Ken Follet
A002	John Grisham
A003	Tom Clancy
A004	Frederick Forsyth

Table: BOOK

AuthorCode	BookCode	Title
A001	B001	Eye of the Needle
A003	B002	The Hunt for Red October
A004	B003	The Day of the Jackal
A001	B004	The Third Twin
A004	B005	The Cobra
A002	B006	The Firm
A003	B007	Clear and Present Danger
A002	B008	The Innocent Man

Primary Key and Foreign Key

Primary Key

Notice that table Author contains exactly one record of each author. So, each record in the table Author is unique. What if two authors have same name? What if, there were two John Grishams?

To handle such cases, records are given codes. One field of the table is created to store unique values. Each such unique value identifies the record uniquely. Such field is called Primary key field. *Primary key uniquely identifies each record in a table.*

In table Author, the field AuthorCode is primary key field.

In some cases, combination of two or more fields is used as primary key.

Properties of Primary Key

- It should always store some value. No null values are allowed in primary key field.
- It should store unique value.
- Once decided, the value must not change as long as that record remains in the database.

AuthorCode	AuthorName
A001	Ken Follet
A002	John Grisham
A003	Tom Clancy
A004	Frederick Forsyth

Table containing a primary key is also called *Parent table.*

Foreign Key

Now, let us have a look at table Book. In this table, can we keep the Author Codes unique? No. We cannot. The reason is that one author may have written many books so, for that author, the value of the field AuthorCode will repeat. Refer to the table shown.

So, in the table Book, the field AuthorCode is not a primary key. There is no field in the table Book as primary key.

It is not necessary to have primary key in every table in a database.

But the field AuthorKey is helping in relating this table with the table Author. Such fields are called foreign key fields. The field AuthorKey in the table Book is foreign key.

A foreign key in child table refers to a matching primary key value in parent table.

AuthorCode	BookCode	Title
A001	B001	Eye of the Needle
A003	B002	The Hunt for Red October
A004	B003	The Day of the Jackal
A001	B004	The Third Twin
A004	B005	The Cobra
A002	B006	The Firm
A003	B007	Clear and Present Danger
A002	B008	The Innocent Man

BOOK

Foreign key can store duplicate values. Table having a foreign key is called child table.

Query

Data is organised as several records in one or more tables. Tables store the data. One of the most important feature of the database is that we can ask questions from it. We can take out information we desire from the database. The process of looking up and taking out information from the database is called *querying* the database.

A query is used for extracting information from one or more tables. This is called *selection*.

Introduction to MS-Access

MS Access is a RDBMS (Relational Database Management System). It has many in-built features to create, organize and manipulate data. Different types of data objects like table, forms, queries, reports, etc. can be created in MS Access to add, delete, update, find and view data. Each object has a specific use in respect to add, delete, modify, update and view the data. Other popular RDBMS are Oracle, SQL Server, MySql, DB2, MemSQL, Apache Derby, Amazon Aurora etc.
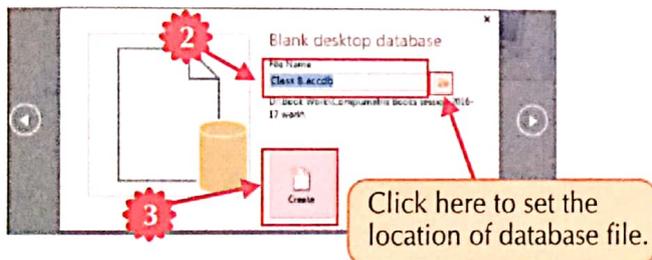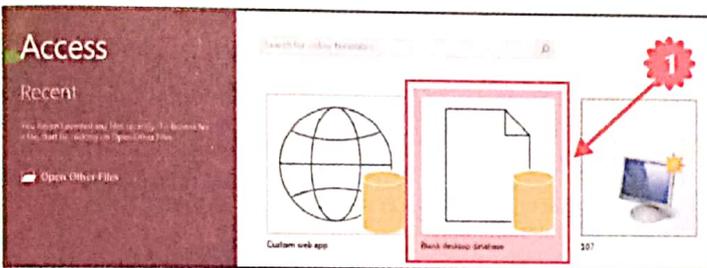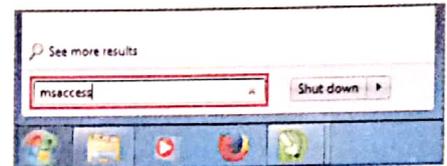
Creating a New Blank Database

Click on **Start** button → **All Programs** → **Microsoft Office 2013** → **Access 2013**.
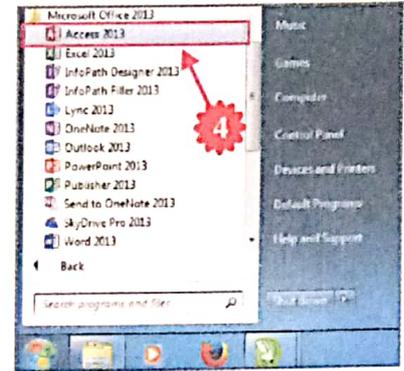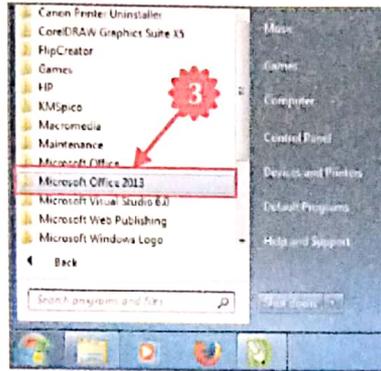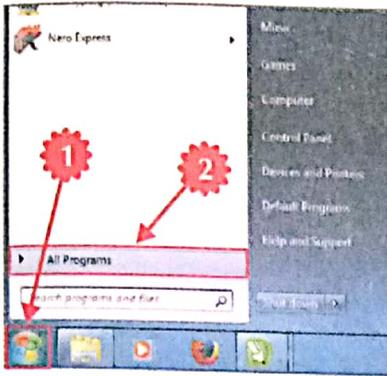
OR

Type 'msaccess' in the **Search** text box as shown here and press **Enter** key.

Let us create a new/blank database.

1. Click on **Blank desktop database** option.

2. A pop-up window appears. Give a name for your file in **File name** box.

   You can select the location to save your file by clicking on Browse button.

3. Click on **Create** button.

Click here to set the location of database file.

The new database is created with given database name. The extension of database file in MS Access is .accdb (2007 and higher versions). Older versions are .mdb files.

Creating Table in Design View

Tables can be created using **Table Wizard**, **Table Data View** or **Table Design View**. Table Design view gives complete control to the user in designing the structure of the table by specifying the field names, data types and the properties of each column. The steps to create a table using design view are:

1. Click on **Create** tab.
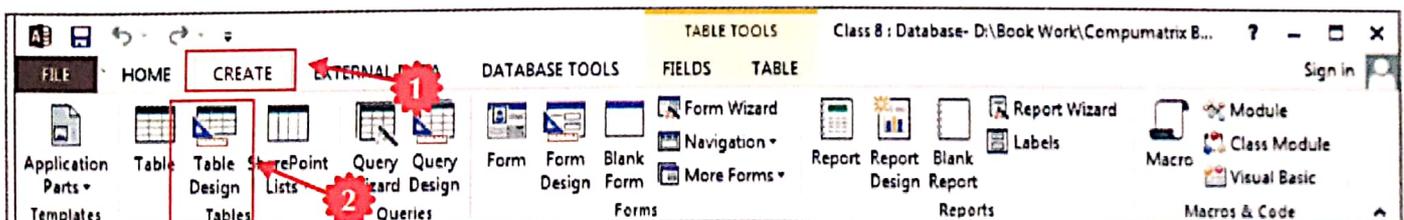
2. In Tables group, click on Table Design.

3. Table creation window appears.

4. Type the column name under Field Name section.

5. Set a suitable data type for field name in Data Type section.
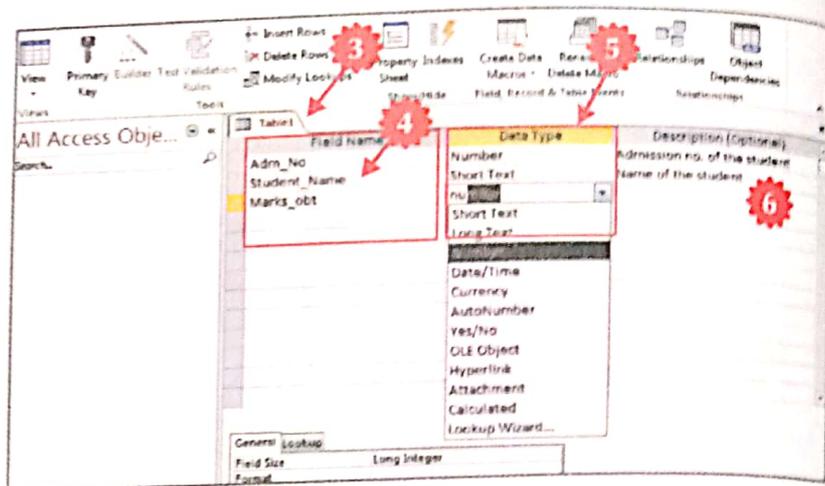
Note

Data Type

The Data Type describes the type of value that can be stored in a column. Some of the common data types are explained below:

Data Type	Description
Short/Long Text	It stores the text which might be an alphabet, a number or both.
Number	It stores the numbers that can be used for calculations.
Auto Number	It stores auto-generated numbers and automatically increases the value.
Date/Time	It stores the date and time values in different formats.
Currency	It specifies the currencies and displays them in different formats.
Yes/No	It stores only those values which have two answers: True/False.
OLE Object	It stores the data from other software like Word, Excel etc.

Note

The default Data Type for a field is Short Text, with the field size '255'.

6. You can also give the description of the field in Description section. It helps a new user of the table to understand the aim of a field.

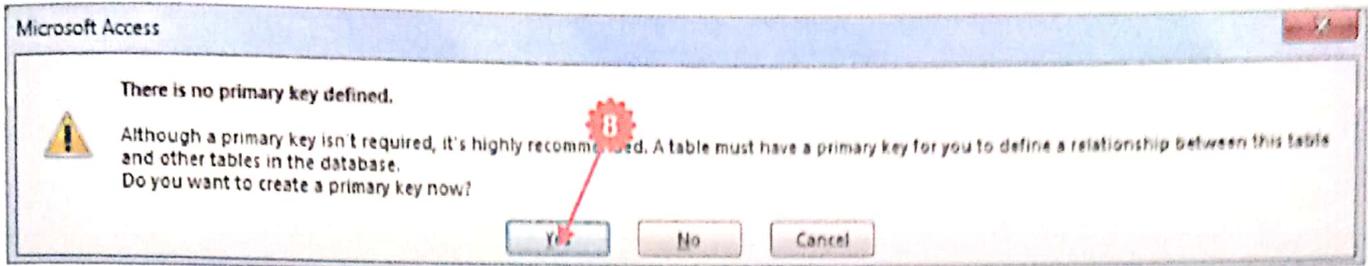7. Click on Save button on the Quick Launch Toolbar. Or, click on File → Save option.

In the Save As dialog box, type the table name and click on OK button.

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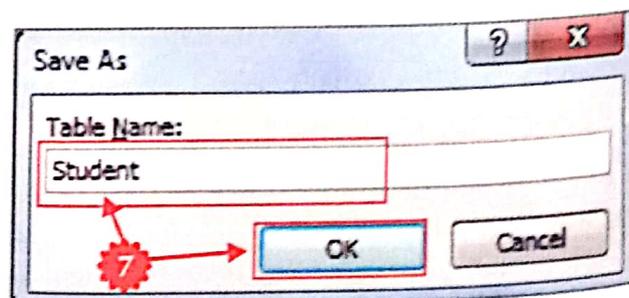
8. A warning message appears to set the primary key in the table.

- If you don't want to create a primary key, click on No button.
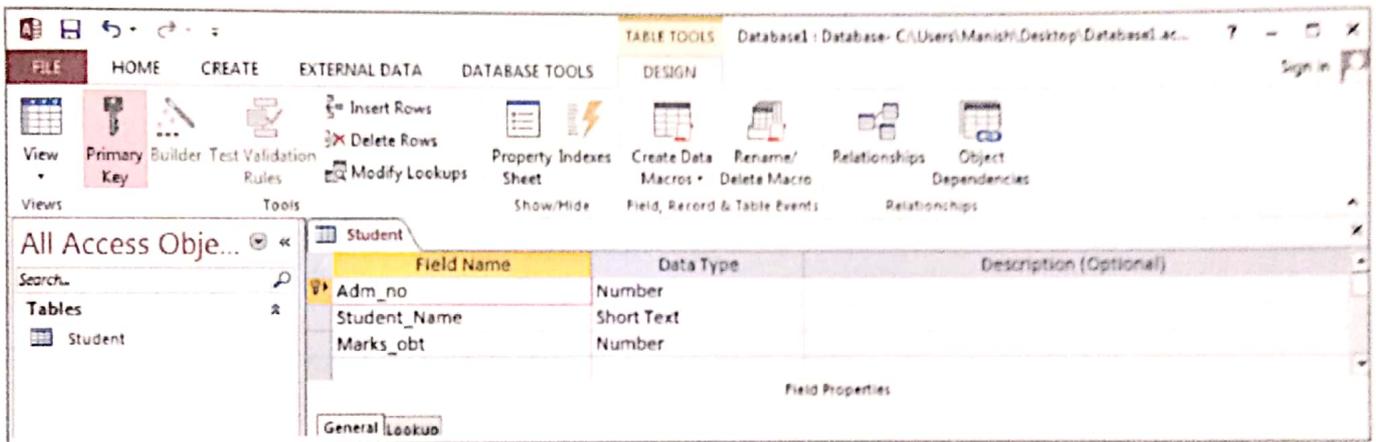- If you want to crate a primary key, click on Yes button. It creates a primary key on a column on its own.

Setting primary key manually

1. Select the desired field. On the Design tab, in Tools section, click on Primary Key.

A 'key' icon appears before the field name which is now set as primary key.

Enter data in a Table

The steps to enter data in a table are:

1. In the navigation pane, under Tables section, double-click on the desired table name.

2. The table opens in the working area, in a tab.

3. Click on any cells and use arrow keys to browse in the table. Go to the last blank row and enter data. To start a new row, press Enter key.

When you close the table, all the data entered by you will be saved automatically.
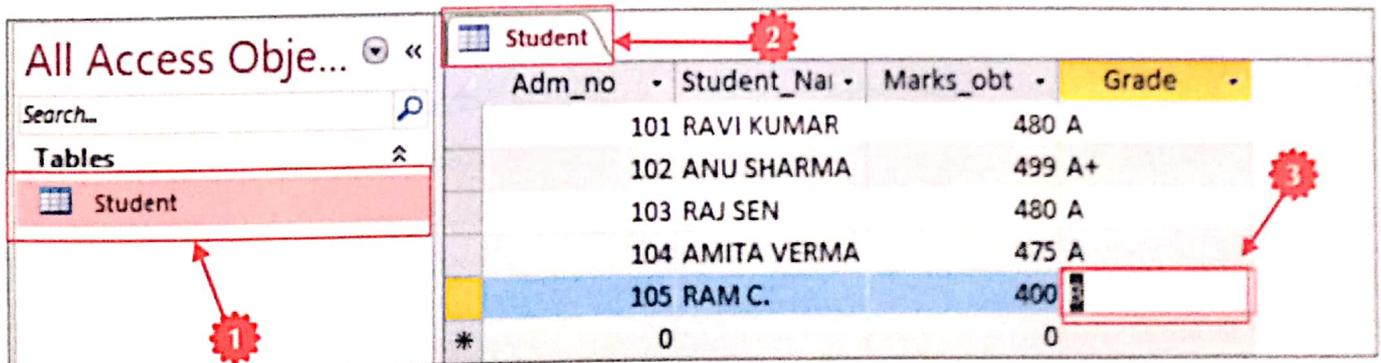
Glossary ·····

Data	:	Data can be defined as a raw fact with an incomplete meaning.
Database	:	A database is a collection of related data.
DBMS	:	Database Management System
Primary Key	:	Primary key uniquely identifies each record in the table.
Foreign Key	:	A foreign key refers to a matching primary key value in parent table.
Table	:	Collection of related data for any object, transaction or event.
Query	:	A tool to extract desired information from the tables in a database.

Quick Review

⤵ DBMS is a collection of programs that enable users to create, maintain database and control all the access to the database.

⤵ In relational database, the data and relations between them are organized in tables.

⤵ Table is a collection of data related to a single topic.

⤵ Primary key identifies a record uniquely in a table.

⤵ Foreign key in a child table refers to a matching primary key value in a parent table.

⤵ A query can be used for selection of information in one or more tables.

⤵ Access database objects are Table, Queries, Forms, Reports, Macros and Modules.

⤵ MS Access is a RDBMS (Relational Database Management System).

⤵ The extension of database file in MS Access is .accdb (2007 and higher versions). Older versions are .mdb files.

⤵ Tables can be created using Table Wizard, Table Data view or Table Design view.

⤵ The Data Type describes the type of value that can be stored in a column.

Exercise

A. Choose the correct answer.

1. The term _____ can be defined as a raw fact.

   a) Data
   b) Database Administrator
   c) Information
   d) All of these

2. Primary key uniquely identifies each _____ in a table.

   a) Record
   b) Row
   c) Both a) and b)
   d) Field

3. The process of taking out information using a query is called _____.

a) Extraction ⃝ b) Selection ⃝

c) Manipulation ⃝ d) Formation ⃝

4. A foreign key in _____ table refers to a matching primary key value in _____ table.

a) parent, child ⃝ b) primary, foreign ⃝

c) foreign, primary ⃝ d) child, parent ⃝

5. A query can be created using _____.

a) Query Wizard ⃝ b) Query Design view ⃝

c) Both a) and b) ⃝ d) None of these ⃝

B. Fill in the blanks.

Files, Fields, Field, .mdb, Data, .accdb

1. "Amit", "15", "Male" - these are examples of _____.

2. The extension of MS Access 2007 and above files is _____ and older versions are _____ files.

3. It is easier to update, delete and maintain data in a database than in _____.

4. Both primary and foreign key concepts refer to the _____ of a table.

5. We decide data type for a _____ while creating a table.

C. Tick (✓) the correct statement and cross out (X) the incorrect one.

1. A table is a collection of related data. ⃝

2. Relational databases store the data in one or more tables called *relations*. ⃝

3. Foreign key should not store duplicate values. ⃝

4. The process of querying tables is called *selection*. ⃝

5. A query works only on one table. ⃝

6. Degree refers to the number of rows in a table. ⃝

D. Answer the following questions.

1. Define the terms *Data* and *Information*.

_____

_____

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2. What is the significance of a DBMS?

_____

_____

_____

3. What is the use of a table and a query in a database?

_____

_____

_____

_____

_____

4. What is the significance of Primary key in a database?

_____

_____

_____

5. Explain foreign key with a small example.

_____

_____

_____

_____

6. Describe any 5 data types in MS Access.

_____

_____

_____

_____

_____

_____

_____

Lab Activity

1. Your school library runs on the database of books. Try to find out how your librarian uses that database.

2. Design a table BOOK with fields namely: Book_No, Book_Title, Author.

   Design another table BOOK_ISSUE with the fields namely: Book_No, Student_name, Issue_Date, Return_Date.

   Now, decide the primary key and foreign key in the above tables.

3. Create the above tables in MS Access in a database named SCHOOL_LIBRARY.

Teacher's Signature : _____

Teacher's Remark : ☆☆☆☆☆

WEB LINKS

https://en.wikipedia.org/wiki/Database
https://www.geeksforgeeks.org/dbms/

Teacher's Corner ...

The analogy of books organised in the library is a good example for explaining DBMS concepts. Students can be given a practical task to create a sample database showing books issued to them.