

MODULE FOUR

INTRODUCTION TO DATABASE

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1.0 Introduction

The goal of this chapter is to introduce how to design a database using Microsoft Access (MS Access) which is a relational database management system (DBMS) developed by Microsoft. A database is a structured collection of related data. The data could be that of an organization such as the records of all employees in an establishment.

2.0 Learning Outcomes

At the end of this unit, you should be able to:

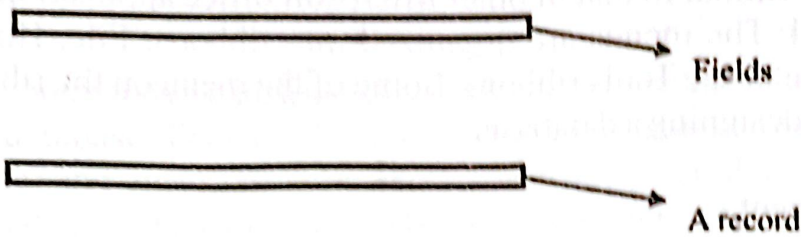
- i. Design database form
- ii. Generate database Report
- iii. Design Database Table

3.0 Main Content

Database

A database (DB) is most often electronic which can be saved on computer memory, retrieved and sorted or processed electronically.

A relational database management system comprise of data organized into tables. The tables are made of tuples called records which represent (semi) complete information about an entity. The records are made up of fields which are the attributes of an entity represented as a record. Figure 1 depicts a typical Table in a relational DB. The table contains 12 records with 5 fields each: ID, Name, CountryCode, District and Population.



ID	Name	CountryCode	District	Population
1	Kabul	AFG	Kabul	1780000
2	Qandahar	AFG	Qandahar	237500
3	Herat	AFG	Herat	186800
4	Mazar-e-Sharif	AFG	Balkh	127800
5	Amsterdam	NLD	Noord-Holland	731200
6	Rotterdam	NLD	Zuid-Holland	593321
7	Haag	NLD	Zuid-Holland	440900
8	Utrecht	NLD	Utrecht	234323
9	Eindhoven	NLD	Noord-Brabant	201843
10	Tilburg	NLD	Noord-Brabant	193238
11	Groningen	NLD	Groningen	172701
12	Breda	NLD	Noord-Brabant	160398

Figure 1: Relation DB Table

As shown in the table, collection of fields make up a record and collection of records make up a table. A collection of tables make up a database.

Figure 2 depict the interface of MS Access for the creation and management of a relational database. Similar to other Microsoft office applications, MS Access can be launched by selecting the start menu -> All Programs -> Microsoft Office [X] -> Microsoft Access [X]. where [X] is the version of office package installed on the computer. For instance to launch Microsoft Access 2010:

start menu -> All Programs -> Microsoft Office 2010 -> Microsoft Access 2010

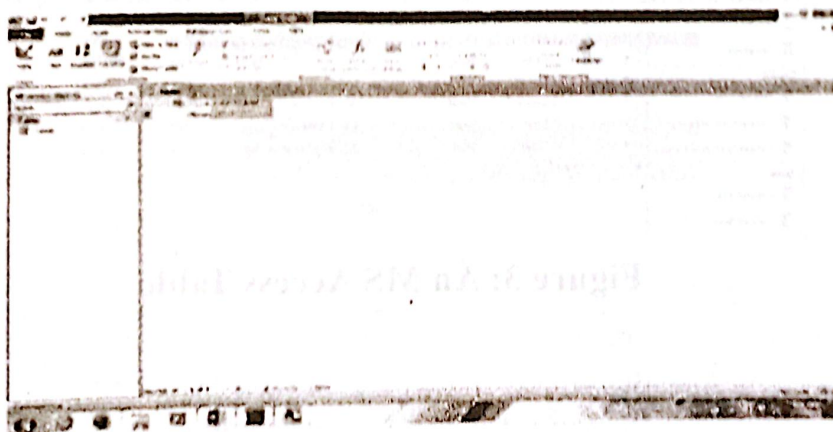


Figure 2: MS Access Interface

The interface is very similar to that of other Microsoft office application such as MS Word and MS Excel. The menus are organized into ribbons: File, Home, Create, External Data and Database Tools ribbons. Some of the menu on the ribbons will be used in the course of designing a database.

3.2 Database component

A typical relational database management system such as MS Access contains four components:

- i. Tables
- ii. Queries
- iii. Forms
- iv. Report

3.2.1 Tables

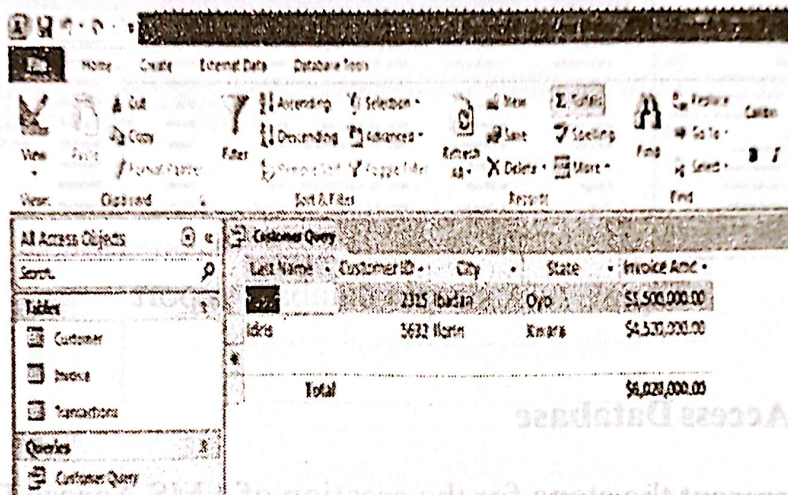
Tables are the store in which data are kept in a database. Accessing data requires direct access to the tables in a database. All Queries, Forms and Reports pull from the data saved in the tables. In MS Access, there are two views for Tables (and other components as well): the Data View and the Design View. The Design view can be used to build the structure of a table by specifying the fields, their data types, size and other information. The Data View can be used for record manipulations: entry, sorting, filtering, editing, and deleting. Figure 3 depicts a Customer table in the data view. New records can be entered by clicking on the (New) line with * and typing the values for the various fields of the table.

First Name	Last Name	Customer ID	Street Address	City	State	Zip
Abdul	Ades	2554	5075 Road	Osaka	Osaka	Japan
1 Emma	Isaac	2223	1 Marana on Road	Osaka	Osaka	Japan
7 Abdul	Almehani	4235	42 Pohn Street	Pohn	Pohn	Japan
2 Abdul	Ades	3612	2 Uniform Row	Osaka	Osaka	Japan
8 Ahmed	Musa	1453		Katata	Katata	Japan
8 Ahmed	Sarah	4534	M. Road	Osaka	Osaka	Japan
8 Ahmed	Osman	2011	1 Aynde Street	Osaka	Osaka	Japan
5 Eason	Sawa	4621	413 Nalome	Osaka	Osaka	Japan
8 Abdul	Stad	1801	101 Road	Osaka	Osaka	Japan
(New)						

Figure 3: An MS Access Table

3.2.2 Queries

Queries are commands or instructions designed to retrieve data from one or more tables in the database. They can be designed to fetch data that satisfy certain criteria from the tables and also to perform some computation on data retrieved from some fields in the tables. Queries can also be accessed both in Design view and the data view. The design view provides the features for creating queries while the data view executes and display the results of queries. Figure 4 depicts a query in the data view. It shows a result that consist of two records with a calculated field labelled **Total**.



Last Name	CustomerID	City	State	Invoice Amt
2315	164214	Oyo		\$1,500,000.00
5632	164214	Xinara		\$4,520,000.00
Total				\$6,020,000.00

Figure 4: A query result in data view

3.2.3 Forms

Forms are well-organized medium for entering data into a database. Similar to the conventional form filled by humans, database forms arranges database fields with corresponding text boxes for entering data for the fields. It main purpose is for users to enter data into the database without accidentally altering the structure or design of the database tables. It is also used to view the records in the tables of a database. Figure 4.5 shows a simple form designed for viewing and entering data into Customer table in Figure 3. The form consist of the fields in the customer table and thus can be used to view old records and enter new records in the customer table.

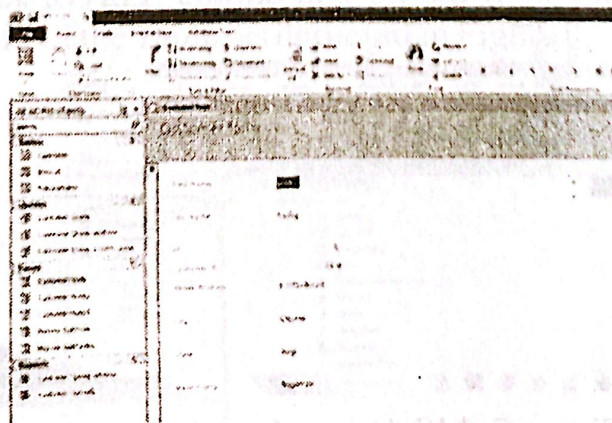
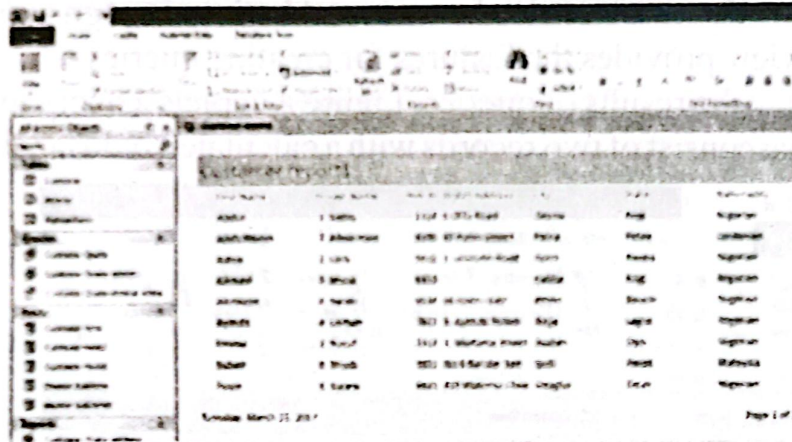


Figure 5: A Database Form

3.2.4 Reports

Reports are the output of data in an organized form for human consumption. It is simply the print out of data in one or more tables or the results of queries. Figure 6 shows a simple report generated from Customer table. The report consists of the eight fields of the Customer table. Reports can also be created from query result.



Customer Name	Customer Address	Customer City	Customer State	Customer Zip	Customer Phone	Customer Email	Customer Age
John Doe	1234 Main St	Anytown	CA	90210	(555) 123-4567	john.doe@email.com	35
Jane Smith	5678 Elm St	Springfield	IL	62701	(555) 987-6543	jane.smith@email.com	42
Bob Johnson	9101 Oak St	Chicago	IL	60601	(555) 555-5555	bob.johnson@email.com	28
Alice Brown	2345 Pine St	Los Angeles	CA	90001	(555) 234-5678	alice.brown@email.com	55
Charlie Davis	6789 Maple St	New York	NY	10001	(555) 678-9012	charlie.davis@email.com	30
Diana Evans	1011 Birch St	San Francisco	CA	94101	(555) 101-2345	diana.evans@email.com	45
Frank Green	4321 Cedar St	Seattle	WA	98101	(555) 432-1098	frank.green@email.com	38
Grace Hall	8765 Birch St	Portland	OR	97201	(555) 876-5432	grace.hall@email.com	50

Figure 6: A simple database report

3.3 Creating MS Access Database

This section will present the steps for the creation of a MS Access DB by designing DB tables, queries, forms and reports. To demonstrate these concepts, a MS Access database will be designed for a shop where varieties of goods are sold. The database will be named **BusinessDB**.

3.3.1 Creating the DB

The following steps can be taken to create a database

Step 1: Open Microsoft Access by selecting

Start -> All Programs -> Microsoft Office -> Microsoft Access 2010.

The interface in Figure 4.7 will be displayed.

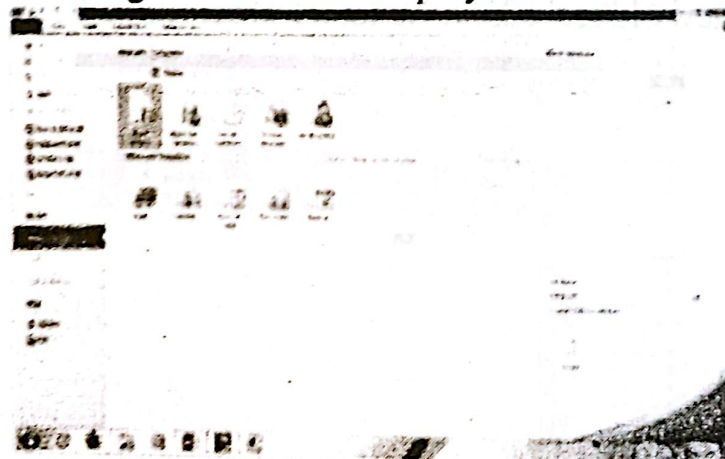


Figure 7: MS Access Interface creation

Step 2: Click on Blank Database button on the top center panel.

Step 3: Enter the name of the database, BusinessDB in the File Name text box and select the directory where the database should be saved after it has been created.

Step 4: Click the Create button to create the database using the name entered.

A new blank table will be automatically created as depicted in Figure 8. Notice that the table has a default field name, ID which uniquely identifies each record that will be entered into the table.

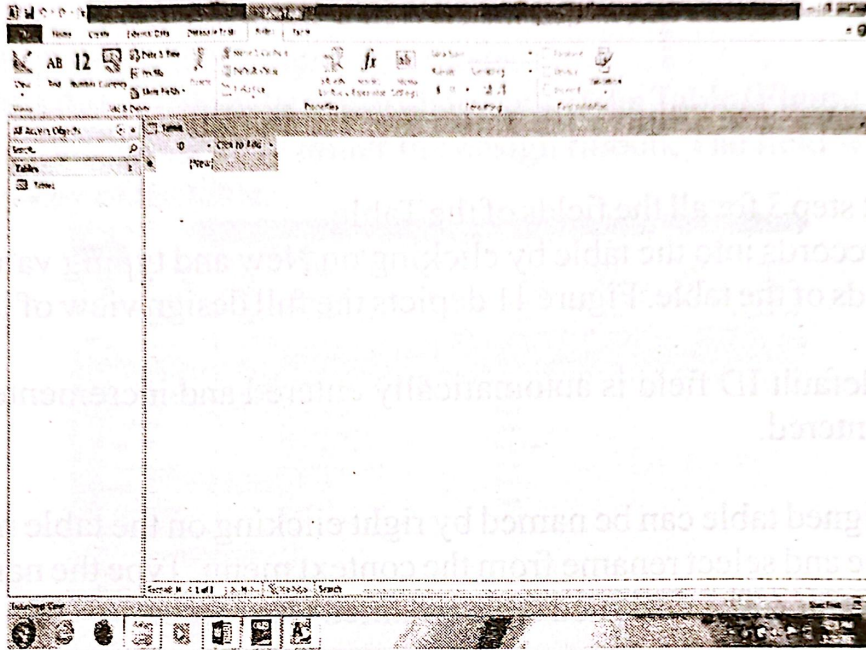


Figure 8: A Table automatically created

The table can be discarded or edited into a table for the **BusinessDB** database. The step for designing table is discussed in the following section.

3.3.2. Designing Table

Step 1: Select Table on the Create ribbon on the MS Access interface depicted in Figure 8

Step 2: Click on “click to Add” combo box on the Table interface to select the data type of the field of the Table, as depicted in Figure 9.

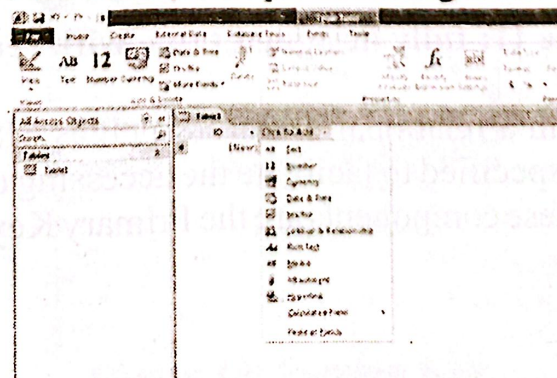


Figure 9: Selecting the field data type

Step 3: Enter the name of the field in the highlighted text as depicted in Figure 4.10.

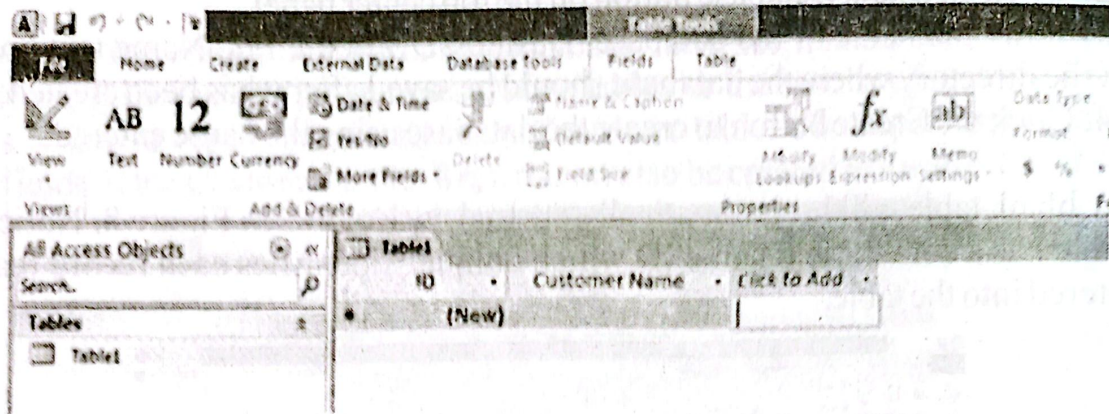


Figure 10: Entering Table fields

Step 4: Repeat step 3 for all the fields of the Table.

Step 5: Enter records into the table by clicking on New and typing values for each of the fields of the table. Figure 11 depicts the full design view of the Table.

Note that the default ID field is automatically entered and incremented whenever a new record is entered.

Step 6: the designed table can be named by right clicking on the table name at the left hand pane and select rename from the context menu. Type the name of the table and press enter. The designed table is named **Customer**.

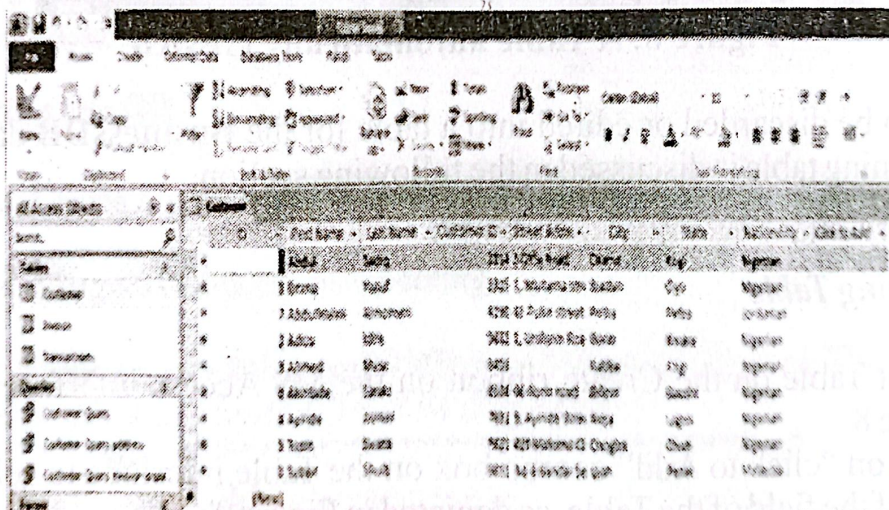


Figure 11: fully designed table with records

In the design of Tables in a relational database such as MS Access, two principal components need to be specified to facilitate the accessing of data from one or more tables in the database. These components are the Primary Key and the Foreign Key.

Primary Key

The primary key is the field in a Table that is unique in value for each of the records in the Table. It is used to identify each record from among others. Fields such as Employee ID and Student Matric Number are good primary for Employee and Students Tables respectively.

In MS Access, to set a field as the primary key, the following steps can be taken:

Step 1: Open the Table in the design view mode.

Step 2: Select the field to be made the primary key of the Table (Figure 12).

Step 3: Click on the Primary key under the design ribbon. The field will be set as the primary key of the table.

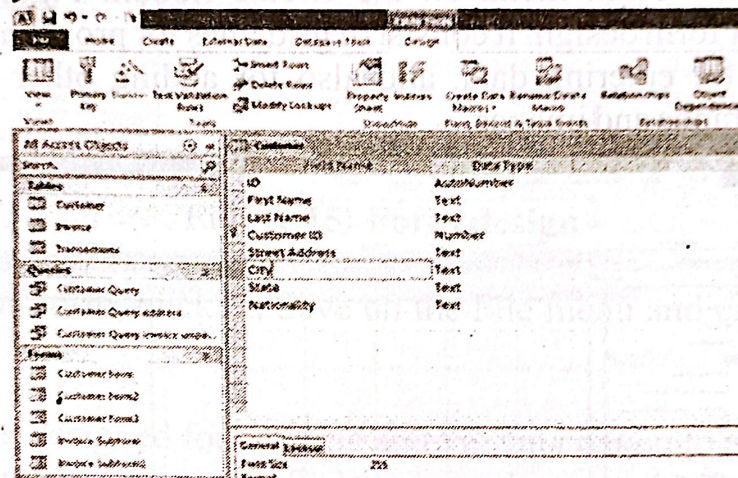


Figure 12: Setting the Primary key of a Table

Foreign Key

A foreign key is simply one or more fields in a given Table that are primary key in another Table. Foreign key helps in uniquely identifying a related record from the other Table in which the field (Foreign key) is a primary key. For instance the Customer ID field in the Invoice Table in Figure 13 is a foreign key in the Table because Customer ID is a Primary key in Customer Table in Figure 12.

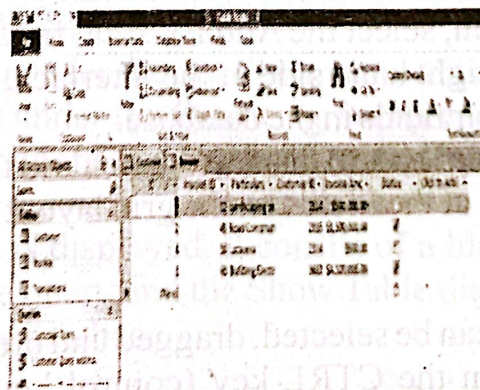


Figure 13: Foreign Key

The difference between the primary and foreign keys is that primary key uniquely identifies records in the Table but foreign key may not necessarily identify records uniquely in a Table. Foreign key simply establish a relationship between its Table and the other Table where it is a primary key.

3.3.3 Designing Forms

Forms are the interfaces through which data can be entered into database Tables. This section presents the basic steps for designing a simple form for entering data into a Table. As an example, a form will be designed for entering data into the Customer Table of the BusinessDB.

Step 1: Select Form Design menu on the Create ribbon. Figure 14 depicts the interface for form design. It consist of grid lines for proper alignment of fields and boxes for entering data, and also for adding other contents such as headings, graphs and images.

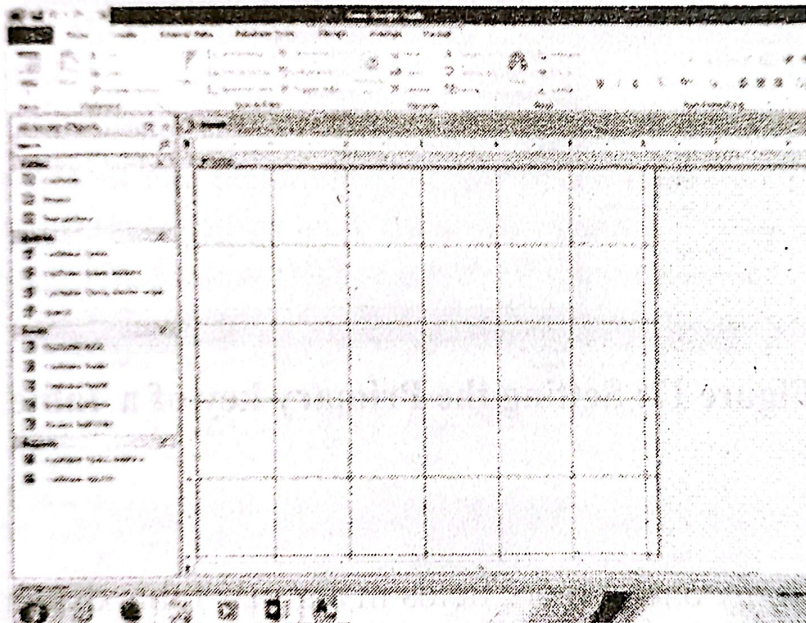


Figure 14: Form design interface

To add the fields and the text boxes for entering data, take the following steps:

Step 2: On the Design ribbon, select the Add Existing fields menu. A Field List pane is displayed by the right hand side of the interface. The pane contains the list of the Tables and their fields in the database.

Step 3: Expand the Customer Table to display the fields in the Table.

Step 4: Drag and Drop each of the Fields on the grid layout of the form in the position desired.

Alternatively, all the fields can be selected, dragged and dropped them at once. Select all the fields by holding on the CTRL key (control key) on the keyboard while

clicking on the fields.

The form can be edited as desired by changing the theme, color, font; adding logo, title date and time, etc. Figure 4.15 depicts a complete form for entering data into the Customer Table.

The screenshot shows the Microsoft Access interface with the 'Customer form' in Design View. The form is titled 'Customer form' and contains the following fields:

Field Name	Value
First Name	John
Last Name	Doe
Customer ID	1
Street Address	100 Main St
City	Chicago
State	Ill
Nationality	USA

Figure 15: Form design

Step 5: To save the form, click on Save on the File menu and enter a name for the form.

A form can also be designed for entering and viewing data into and from more than one tables. This kind of Forms are called compound or complex forms.

3.3.4 Creating Query

As earlier discussed, a query pulls required data from one or more Tables in a database. This section gives the steps for creating a simple query in MS Access. A query that pulls data from the Customer and Invoice Tables of the **BusinessDB** will be used as an example.

Step 1: Select the Create ribbon.

Step 2: Click Query design under the queries group – this is one of the two approach to creating a query under the Queries group (i.e. query can be created using the query wizard or query design).

The interface in Figure 16 is displayed. It consist of a blank query pane, a pane for setting the properties of the query and the Show Table dialogue box that displays all the Tables and queries in the database.

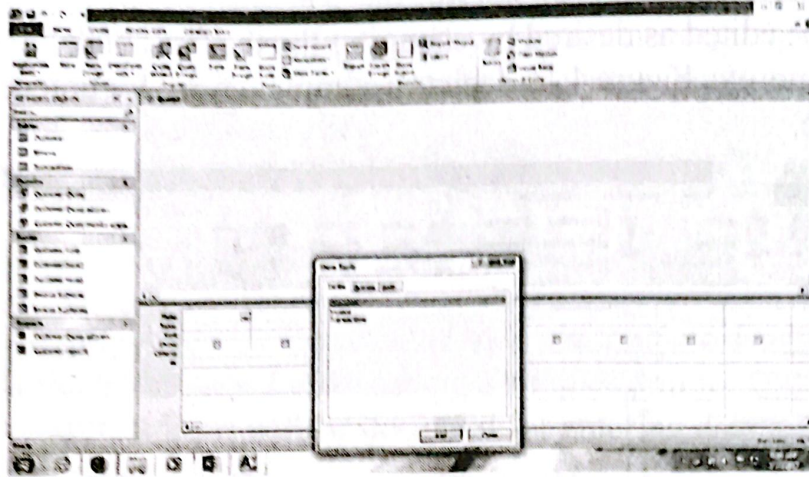


Figure 16: Query design interface

Step 3: from the Show Table dialogue box, add the Table(s) from which data is to be pulled for the query by selecting the Table name and clicking on the Add button. Since the query example is to pull data from the Customer and Invoice Tables, add them to the query. When done, close the Show Table dialogue box. Figure 17 depicts the resultant interface after adding the two Tables.

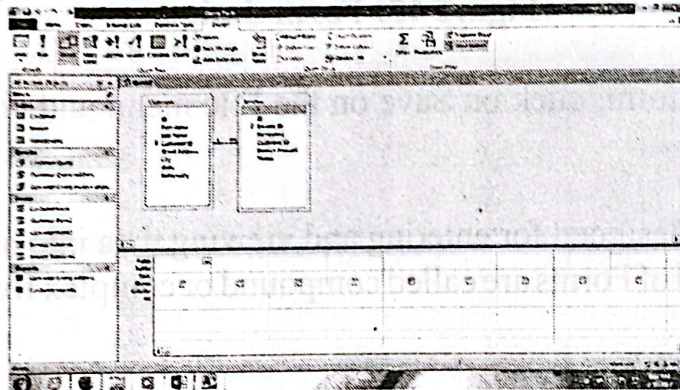


Figure 17: Adding Tables to Query

The next steps are to design the query by adding the required fields from the Tables using the pane at the bottom of the query interface.

- Step 4: Select the fields by clicking on the arrow in the field row. The Table row is automatically populated by the Table which the selected field belongs to.
- Step 5: (Optional) Select the sort row to sort the result of the query either in ascending or descending order of the field.
- Step 6: Check or uncheck the show row if the field is to be explicitly shown in the result of the query.
- Step 7: (Optional) Set the criteria row to select certain records from the Table that meets the criterion. For instance to pull all records that have ID greater than certain value (10), the criterion "> 10" will be entered.
- Step 8: Repeat steps 4 - 7 for all the required fields for the query.
- Step 9: To save the query, click on Save on the File menu and enter a name for the query.

Figure 18 depicts the complete design of a simple query pulling data from the Customer and Invoice Tables.

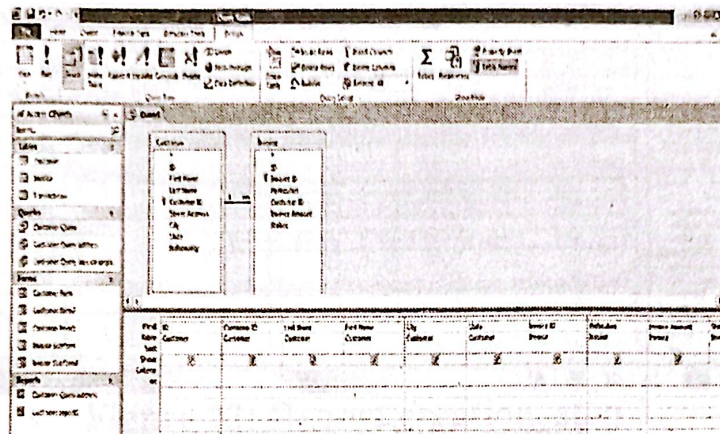


Figure 18: Simple query for retrieving data from Customer and Invoice Tables

Having created the query, it can be executed to generate the required results. This is done by clicking on Run on the Design ribbon menu. It will generate the output depicted in Figure 19. The result consists of only the 10 fields selected during the design of the query in the order of the fields were selected. The query returns 4 records in the database.

CustomerID	CustName	City	State	InvoiceID	InvoiceDate	InvoiceAmount	Status		
1	ABCD	Chennai	TN	1	10/10/2010	10000.00	Open		
2	EFGH	Madurai	TN	2	10/10/2010	20000.00	Open		
3	IJKL	Coimbatore	TN	3	10/10/2010	30000.00	Open		
4	MNOP	Salem	TN	4	10/10/2010	40000.00	Open		

Figure 19: Simple query result

3.3.5 Creating Report

Relatively, the creation of report is similar to the creation of query. The interface are almost the same except that the report interface has designated header and footer sections as shown in Figure 4.20. The page header is often used for displaying the fields that will be in the report; that is, the Table fields that will be pulled from the database to make the report. The detailed section is where the records that are part of the report will be displayed. A report header can be added by clicking on the Title menu in the Header and Footer group of the Design ribbon.

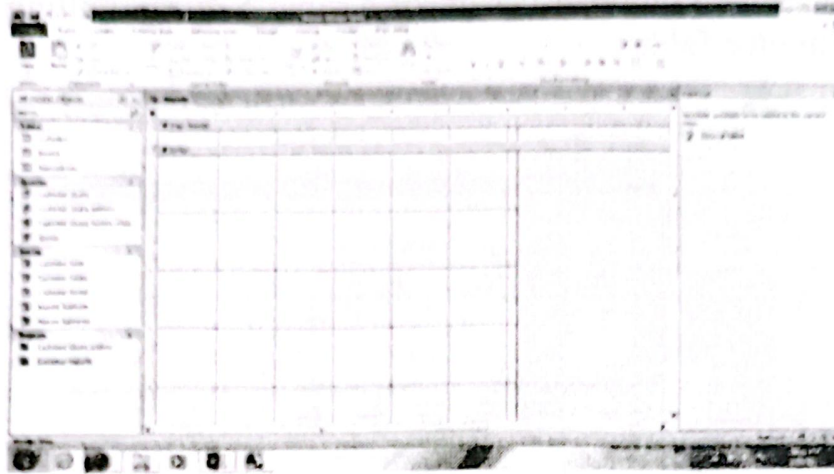


Figure 20: Creating report

The following steps can be followed to design a simple report from a MS Access database. As an example, a report that gives the customers the transactions they do will be designed.

- Step 1: Select the Report design menu on the Reports group of the Create ribbon. Figure 4.20 will be displayed.
- Step 2: Each of the required fields for the report can be dragged and dropped into the report grid area just as it was done in the creation of query. All the fields can also be selected at once by holding down the CTRL key while clicking on the fields. Figure 21 depicts the report for the example been demonstrated after performing this step.

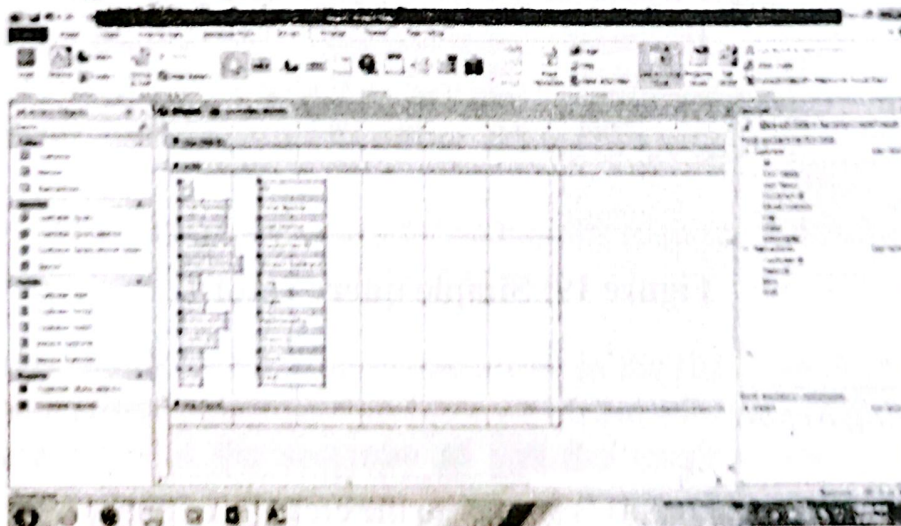


Figure 21: Report creation, step 2

- Step 3: To organize the report in a tabular form so that there will be a header of the fields and the detail containing the record, highlight all the fields added to the report as depicted in Figure 21, right-click on one of the fields and select Layout and then Tabular from the context menu. This will re-arrange the labels and boxes of the fields, putting the labels on the Page Header section and the boxes on the Detail section as depicted in Figure 22.

This step can also be accomplished by clicking on the Tabular menu in the Table group of the Arrange ribbon as shown in Figure 23.

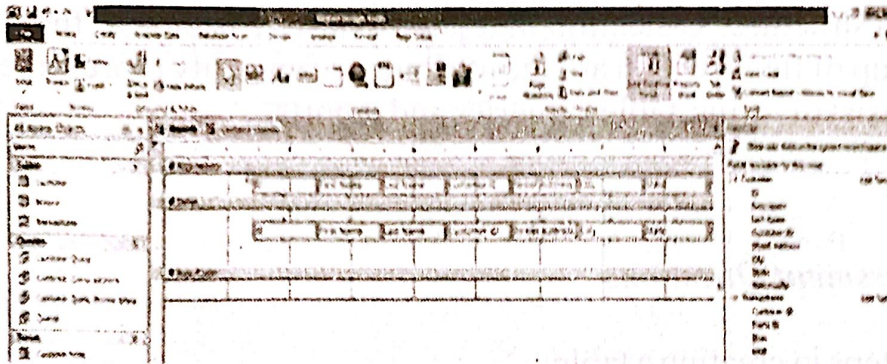


Figure 22: Report creation, step 3

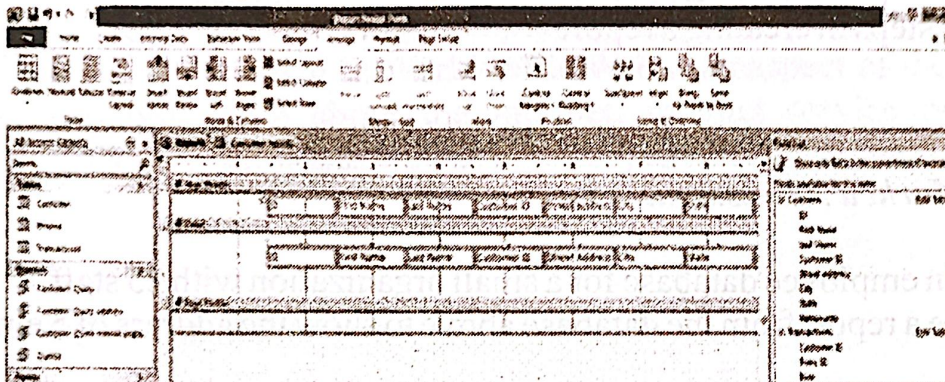


Figure 23: arranging the fields in Tabular form

Note that the Page Footer section has been dragged up to close the empty space in the Detail section.

An example of a report generated from the **BusinessDB** database is depicted in Figure 24.

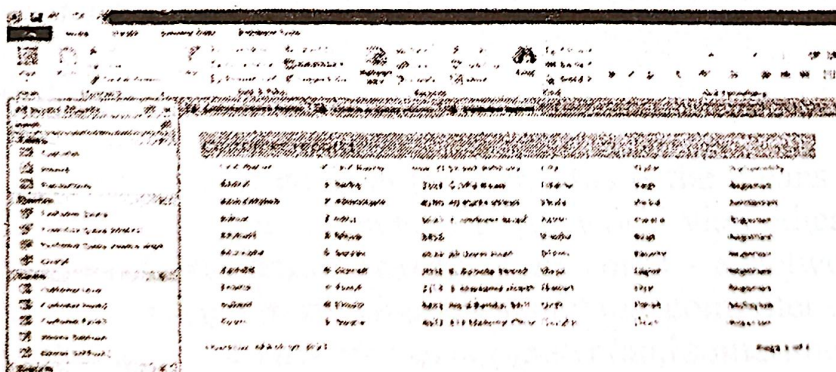


Figure 24: Database Report output

A report header has been added to the report. It can be printed by selecting Print from the File menu.

4.0. Summary

A database is a structured collection of related data. In a database, there exist records that are made up of fields which are the attributes of an entity represented as a record. Databases consist of forms, tables, queries and reports.

5.0. Self-Assessment Questions

- i. List the steps in creating a table
- ii. List the steps in creating a form
- iii. List the steps in creating a report

6.0. Tutor Marked Assessment

- i. Create an employee database for a small organization with 25 staff.
- ii. Generate a report from the database above to show the address of 5 employees.

7.0. Further Reading

<https://searchsqlserver.techtarget.com/definition/database-management-system>
<https://www.techopedia.com/definition/24361/database-management-systems-dbms>