A) A First Look at Microsoft Access

To start the application, click [Start] ➔ [All Programs] ➔ [Microsoft Office] ➔ [Microsoft Office Access 2003] (as below figure).

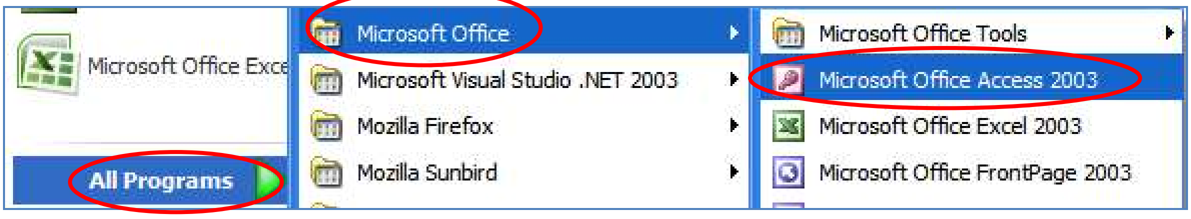

Microsoft Office Exce
All Programs
Microsoft Office
Microsoft Visual Studio .NET 2003
Mozilla Firefox
Mozilla Sunbird
Microsoft Office Tools
Microsoft Office Access 2003
Microsoft Office Excel 2003
Microsoft Office FrontPage 2003

Figure 1 - Start [Access] from [Start] Menu

You may see the following screen.

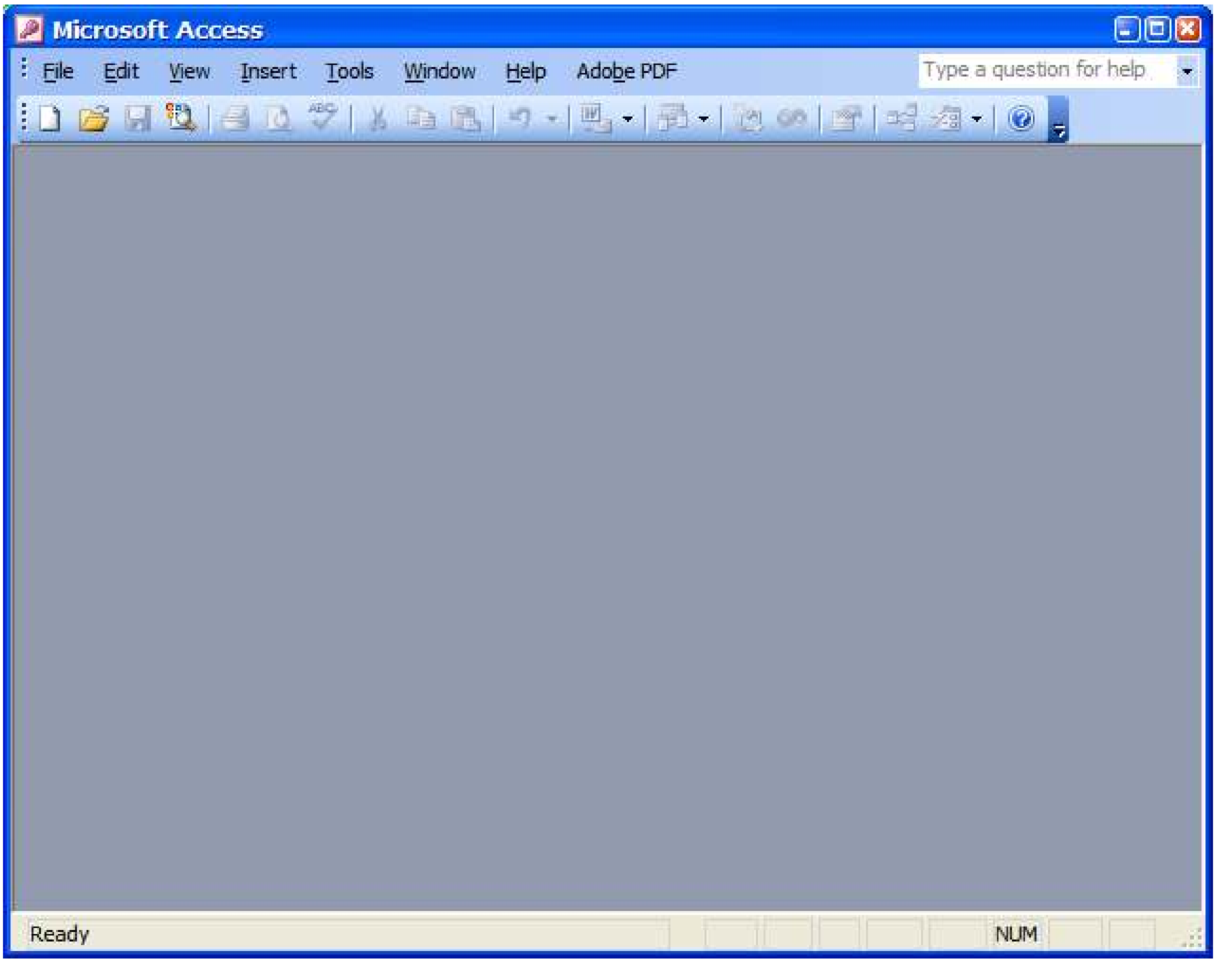


Figure 2 - The First Screen of Access

Open a Sample Database

From MS Access menu, click [File] ➔ [Open].

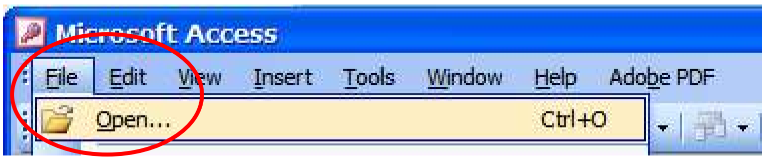


Figure 3 - MS Access Menu

Select the sample database file, Northwind.mdb.

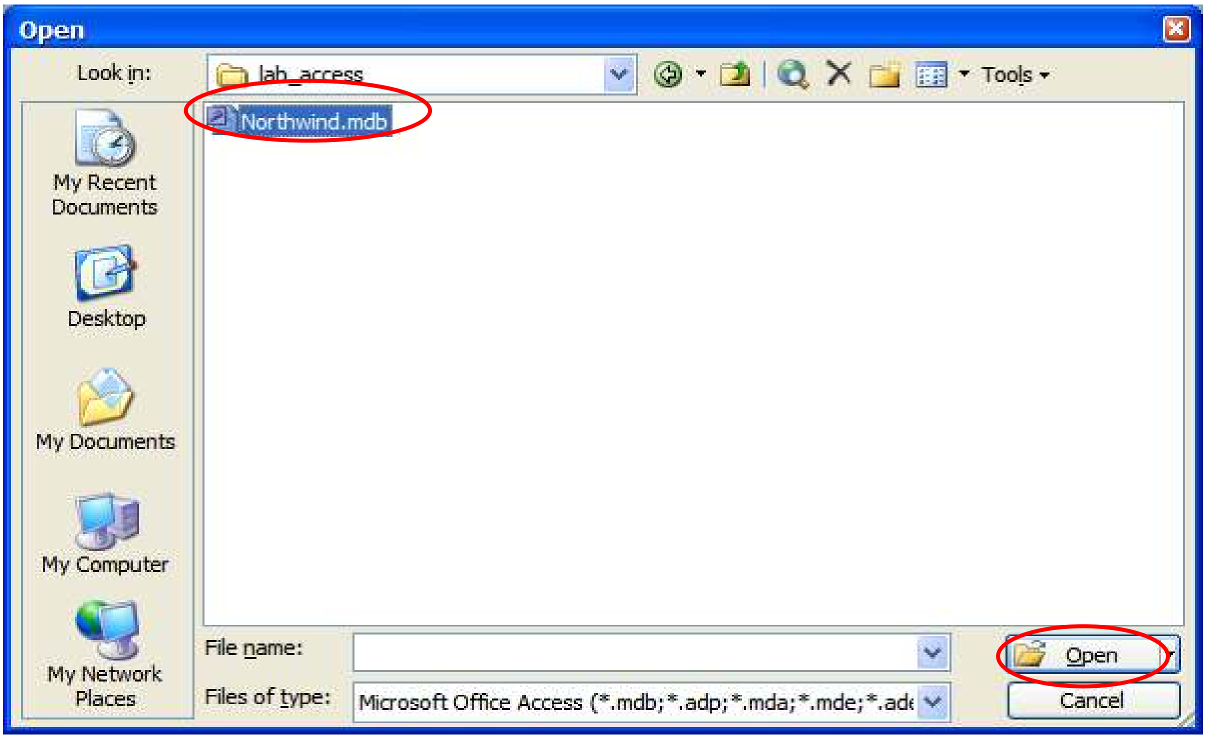


Figure 4 - Open Database File, Northwind.mdb

(If you cannot find the file in your machine, please go to the WebCT to download it.)

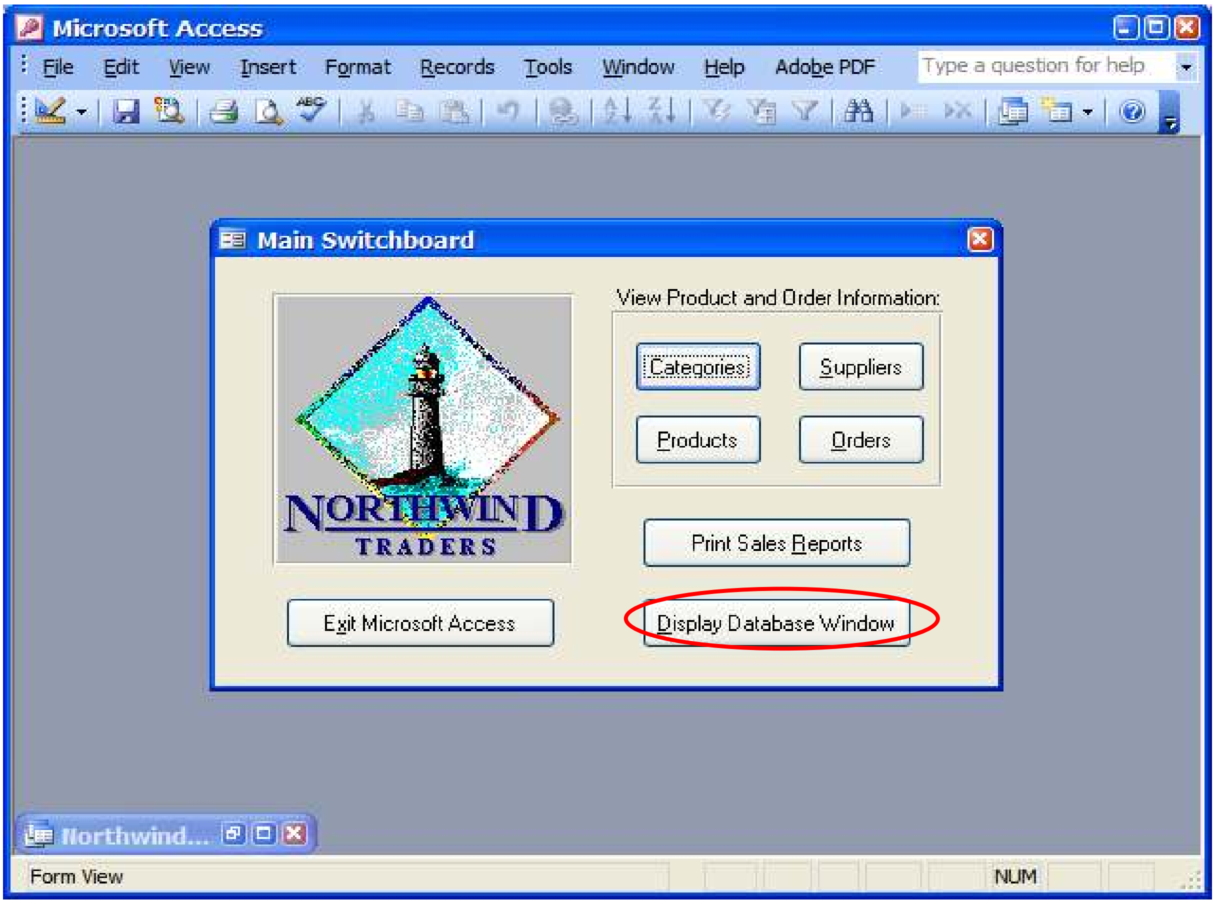
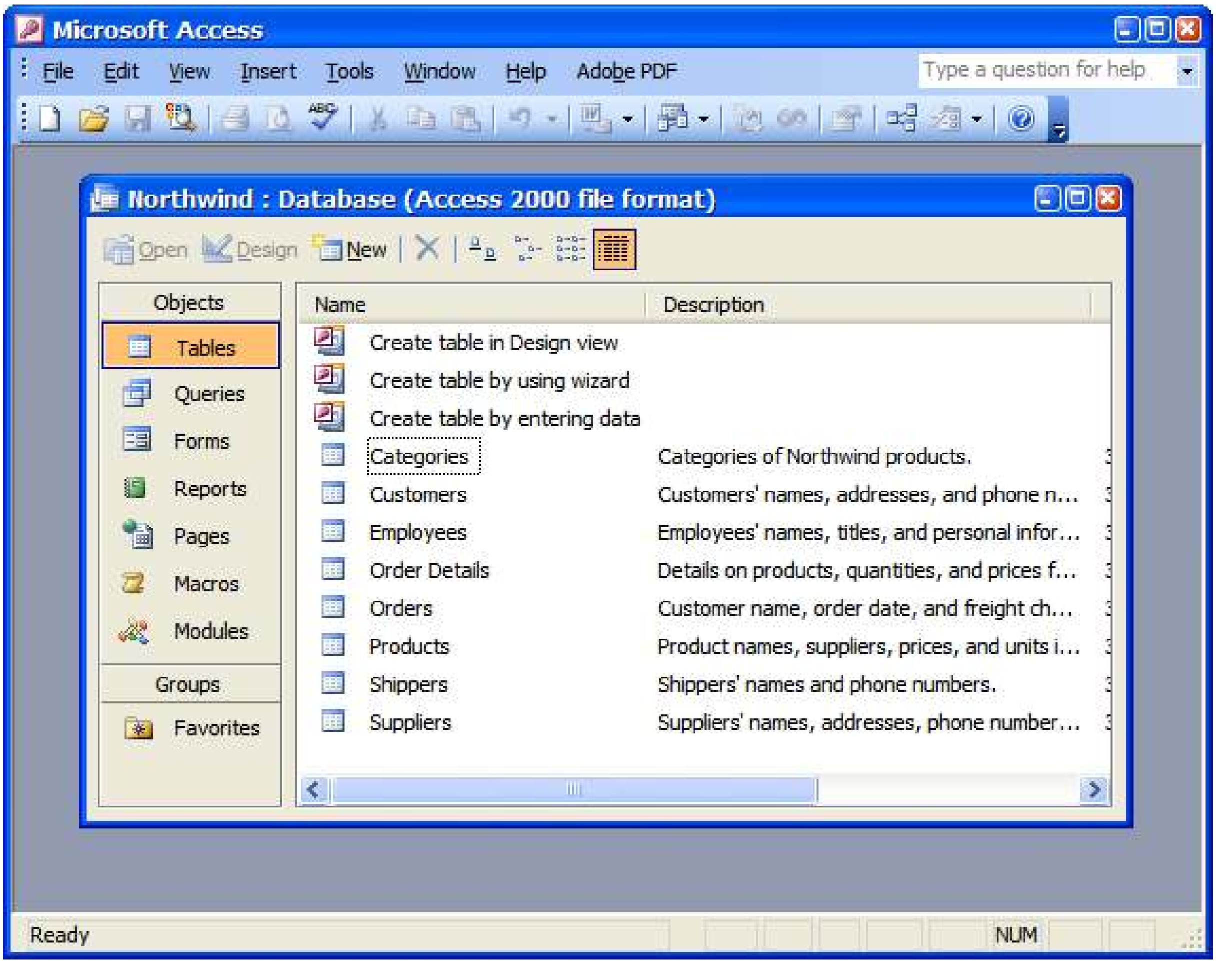


Figure 5 – Main Switchboard of Northwind

In the “Main Switchboard”, user can choose any function provided in this switchboard to use the application. For example, [Print Sales Reports] provides printing services to users to print reports as they need.

Now, let’s click [Display Database Window] button to see what exactly inside the database file. Your screen should be changed as the following one.



Name	Description
Create table in Design view	
Create table by using wizard	
Create table by entering data	
Categories	Categories of Northwind products.
Customers	Customers' names, addresses, and phone n…
Employees	Employees' names, titles, and personal infor…
Order Details	Details on products, quantities, and prices f…
Orders	Customer name, order date, and freight ch…
Products	Product names, suppliers, prices, and units i…
Shippers	Shippers' names and phone numbers.
Suppliers	Suppliers' names, addresses, phone number…

Figure 6 - Database Window for Northwind

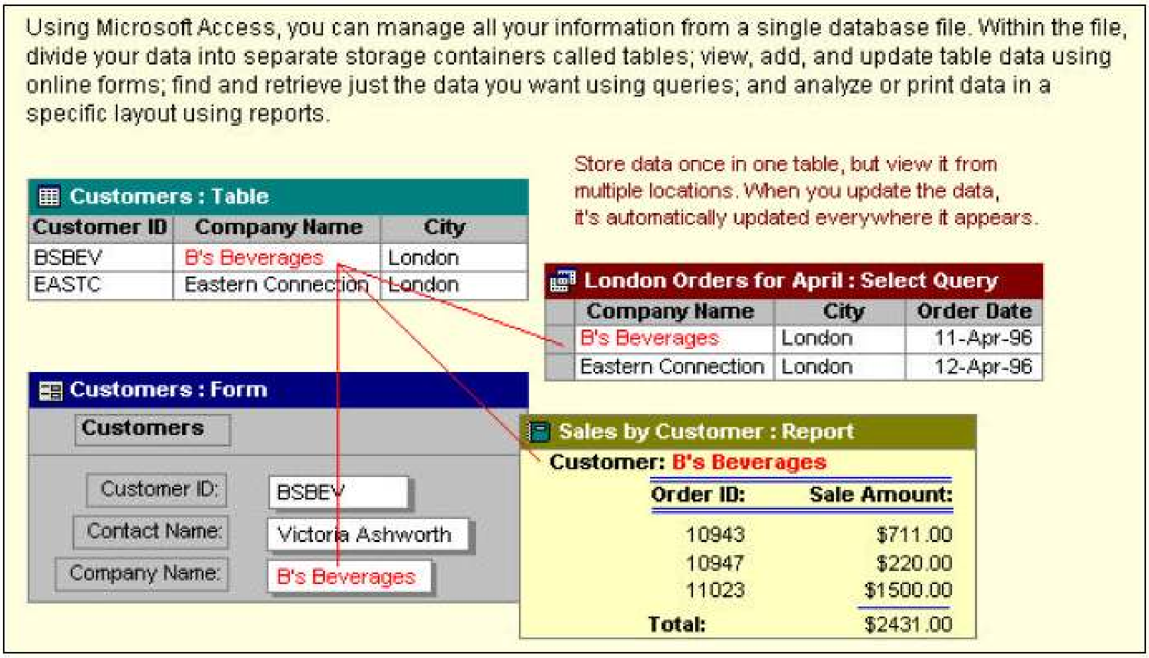
Here, user can access all components of MS Access. For example, tab [Tables] under [Objects] allows user to view a list of the available tables in this database file. Also, there are links for users to create new tables.

MS Access Common Components

- Tables
- Queries
- Forms
- Reports

Table

- A table allows the user to store a collection of data about a specific topic like Customers or Orders



Using Microsoft Access, you can manage all your information from a single database file. Within the file, divide your data into separate storage containers called tables; view, add, and update table data using online forms; find and retrieve just the data you want using queries; and analyze or print data in a specific layout using reports.

Store data once in one table, but view it from multiple locations. When you update the data, it's automatically updated everywhere it appears.

Customers : Table

Customer ID	Company Name	City
BSBEV	B's Beverages	London
EASTC	Eastern Connection	London

London Orders for April : Select Query

Company Name	City	Order Date
B's Beverages	London	11-Apr-96
Eastern Connection	London	12-Apr-96

Customers : Form

Customers

Customer ID:	BSBEV
Contact Name:	Victoria Ashworth
Company Name:	B's Beverages

Sales by Customer : Report

Customer: B's Beverages

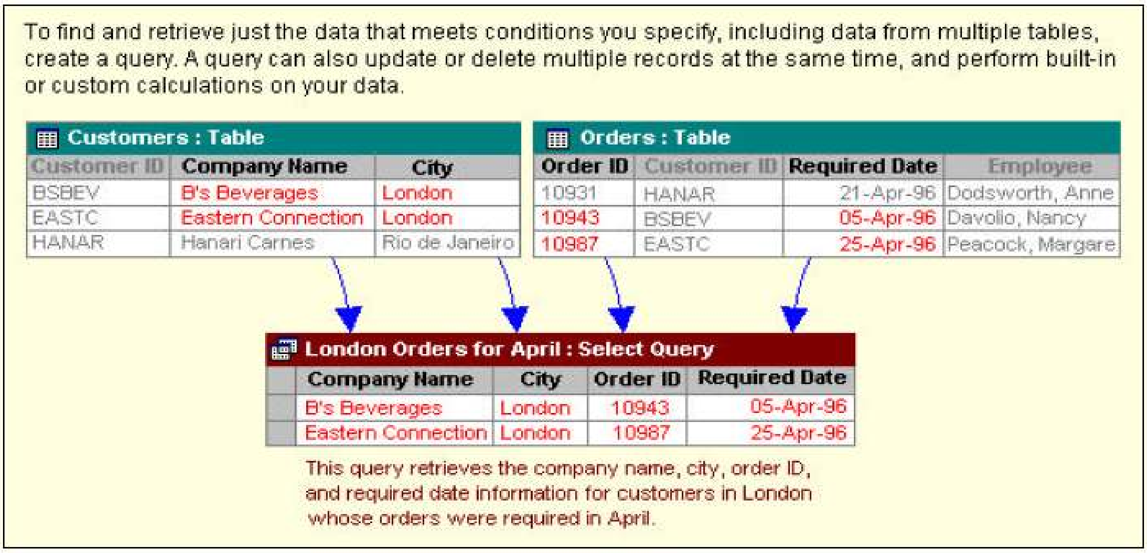
Order ID:	Sale Amount:
10943	$711.00
10947	$220.00
11023	$1500.00
Total:	$2431.00

Figure 7 - An Overview of Table

Query

- A query allows the user to view, change, and analyze data in different ways like combining data from two different tables (Customers and Orders) to create a user's own custom view (London Orders for April)

- Can also be used as the source of records for forms, reports, and data access pages.



To find and retrieve just the data that meets conditions you specify, including data from multiple tables, create a query. A query can also update or delete multiple records at the same time, and perform built-in or custom calculations on your data.

Customers : Table

Customer ID	Company Name	City
BSBEV	B's Beverages	London
EASTC	Eastern Connection	London
HANAR	Hanari Carnes	Rio de Janeiro

Orders : Table

Order ID	Customer ID	Required Date	Employee
10931	HANAR	21-Apr-96	Dodsworth, Anne
10943	BSBEV	05-Apr-96	Davolio, Nancy
10987	EASTC	25-Apr-96	Peacock, Margare

London Orders for April : Select Query

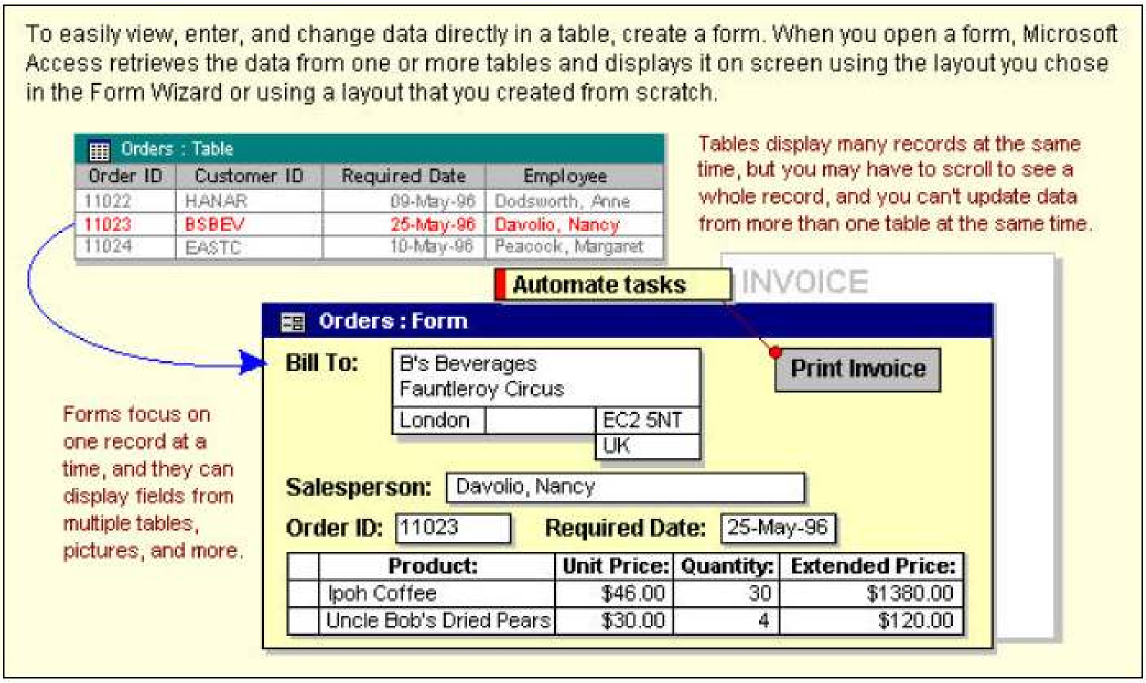
Company Name	City	Order ID	Required Date
B's Beverages	London	10943	05-Apr-96
Eastern Connection	London	10987	25-Apr-96

This query retrieves the company name, city, order ID, and required date information for customers in London whose orders were required in April.

Figure 8 - An Overview of Query

Form

- A form allows a user to enter/change/update data to table(s)



To easily view, enter, and change data directly in a table, create a form. When you open a form, Microsoft Access retrieves the data from one or more tables and displays it on screen using the layout you chose in the Form Wizard or using a layout that you created from scratch.

Orders : Table

Order ID	Customer ID	Required Date	Employee
11022	HANAR	09-May-96	Dodsworth, Anne
11023	BSBEV	25-May-96	Davolio, Nancy
11024	EASTC	10-May-96	Peacock, Margaret

Tables display many records at the same time, but you may have to scroll to see a whole record, and you can't update data from more than one table at the same time.

Orders : Form

Bill To: B's Beverages
Fauntleroy Circus
London EC2 5NT
UK

Salesperson: Davolio, Nancy

Order ID: 11023 Required Date: 25-May-96

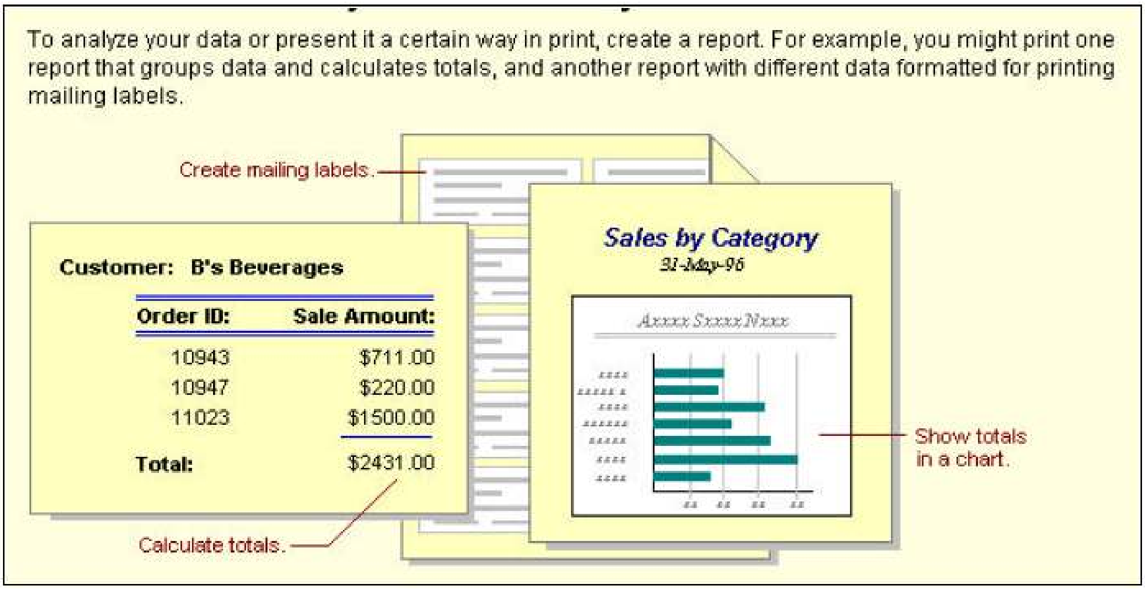
	Product:	Unit Price:	Quantity:	Extended Price:
	Ipoh Coffee	$46.00	30	$1380.00
	Uncle Bob's Dried Pears	$30.00	4	$120.00

Forms focus on one record at a time, and they can display fields from multiple tables, pictures, and more.

Figure 9 - An Overview of Form

Report

- A report is an effective way to output your data in a printed format in the way you want it



To analyze your data or present it a certain way in print, create a report. For example, you might print one report that groups data and calculates totals, and another report with different data formatted for printing mailing labels.

Customer: B's Beverages

Order ID:	Sale Amount:
10943	$711.00
10947	$220.00
11023	$1500.00
Total:	$2431.00

Figure 10 - An Overview of Report

B) Creating a New Database

1. Introduction

A table is a collection of data about a specific topic, such as products or suppliers. Using a separate table for each topic means you store that data only once, which makes your database more efficient and reduces data-entry errors. Tables organize data into columns (called fields or attributes) and rows (called records or tuples).

First, open MS Access. To build a new database, choose **File → New.** By selecting **New**, a panel will pop out on the right, which allows us to create a blank database, or to choose from other database template wizards. For this session, we will focus on creating a database from a blank one, so choose **New→ Blank Database**.

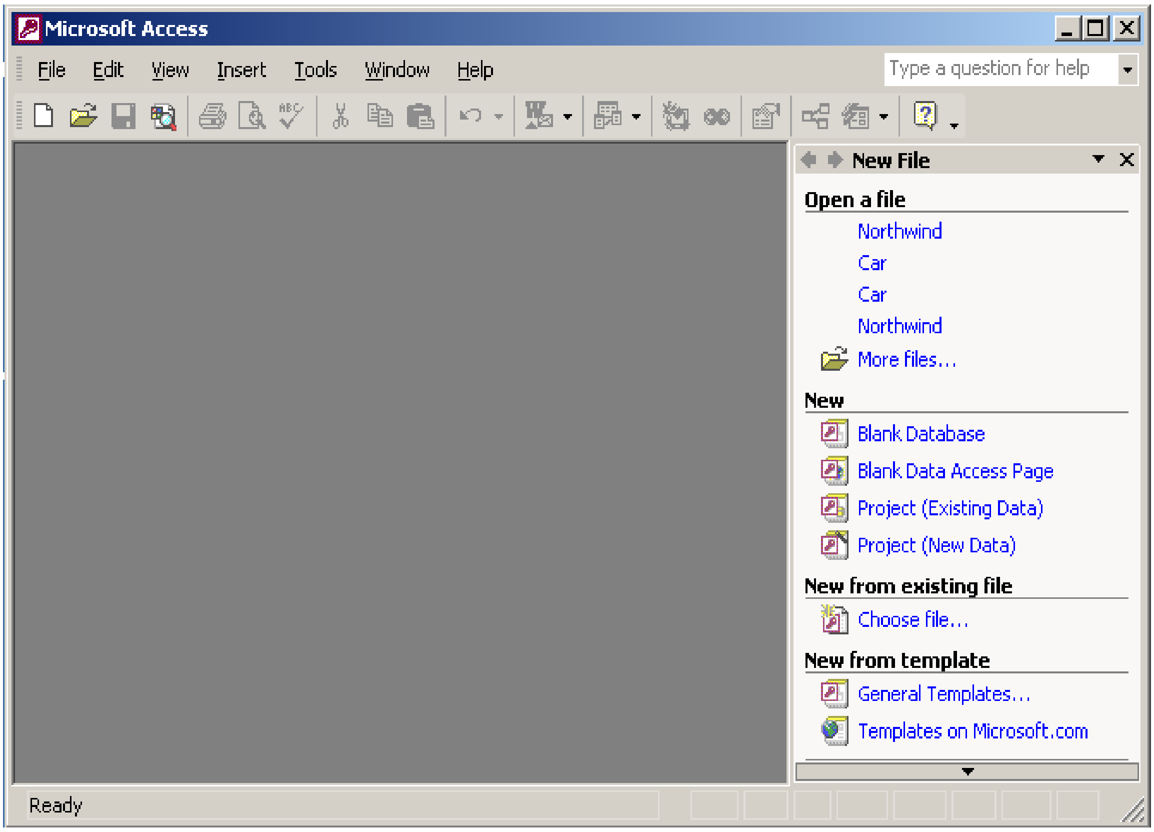


Figure 11 - Creating New Database

Once you created a blank database and type the database name, you will see a dialog box with seven objects on the left as shown in Figure 12, they are briefly described as follows,

- **Tables** - a collection of data about a specific topic, such as products or suppliers.
- **Queries** - a command for viewing or analyzing data in different ways or a result of the command.
- **Forms** - a friendly interface to add a new record
- **Reports** - an object that present data in a organized way according to your specification. Examples are telephone bills, sales summary etc.
- **Pages** - a web page that has connection to a database. It makes data available on the Internet or an intranet for interactive reporting, data entry, or data analysis.
- **Macros** - a set of one or more actions that each performs a particular operation, such as opening a form or printing a report. Macros can help you to automate common tasks. For example, you can run a macro that prints a report when a user clicks a command button.
- **Module** - a collection of Visual Basic for Applications declarations and procedures that are stored together as a unit.

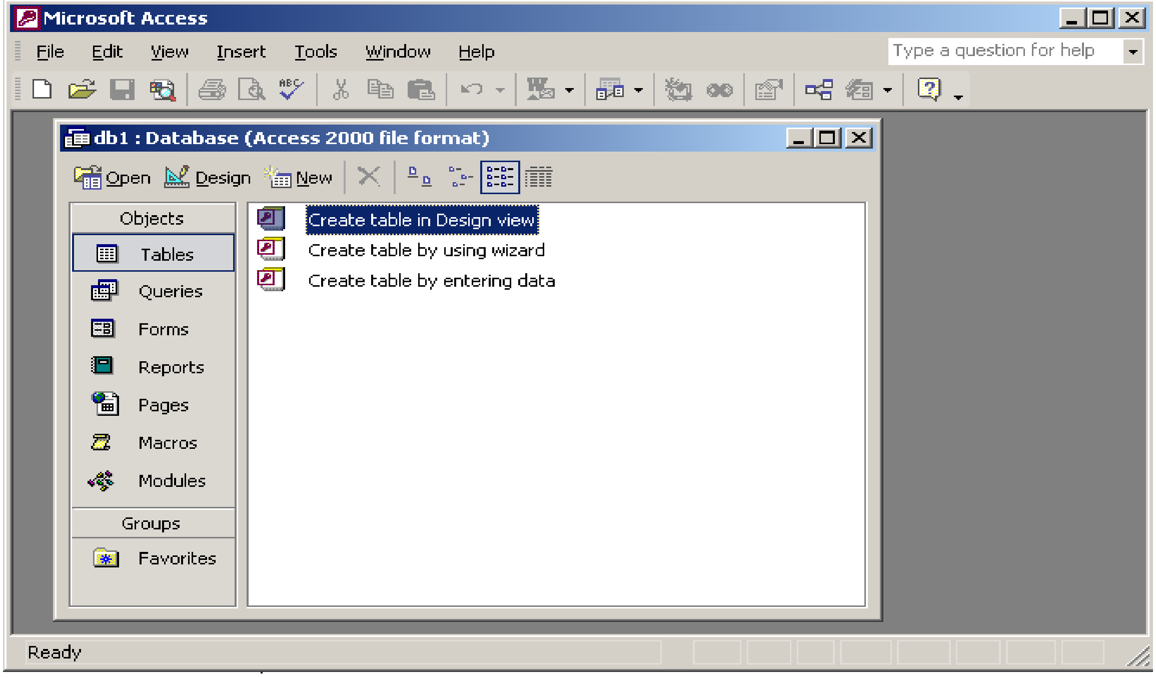

Microsoft Access
File Edit View Insert Tools Window Help
Type a question for help
db1 : Database (Access 2000 file format)
Open Design New
Objects
Tables
Queries
Forms
Reports
Pages
Macros
Modules
Groups
Favorites
Create table in Design view
Create table by using wizard
Create table by entering data
Ready

Figure 12 - New Database (db1.mdb)

2. Creating a Table:

There are three ways to create a table:

- Use Datasheet View, i.e. enter data directly
- Use Design View
- Use Table wizard

2.1 Create a Table in Datasheet View

To create a blank (empty) table in datasheet view, you can:

- Click **Tables→Create table by entering data** in Figure 12, or
- Click **New** in the database window, you will see a new dialog box as shown in Figure 13. Then click **Datasheet View** followed by clicking **OK**.

You are then given a Datasheet View with column headings Field1, Field2 and so on all across the top of the datasheet as shown in Figure 14. You can enter data directly into it. When you save the new datasheet, Microsoft Access will analyze your data and automatically assign the appropriate data type and format for each field. Because the names of each field are not descriptive, you may want to rename the fields.

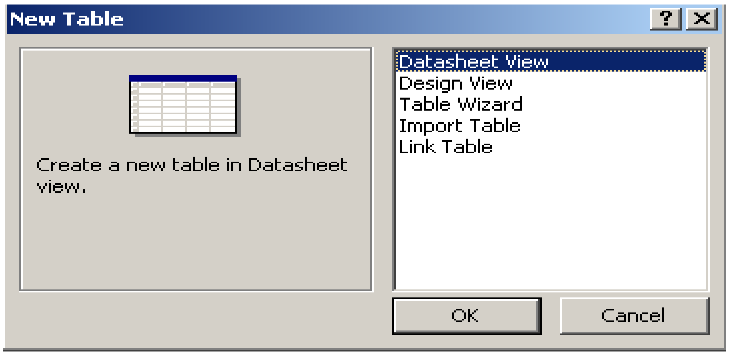
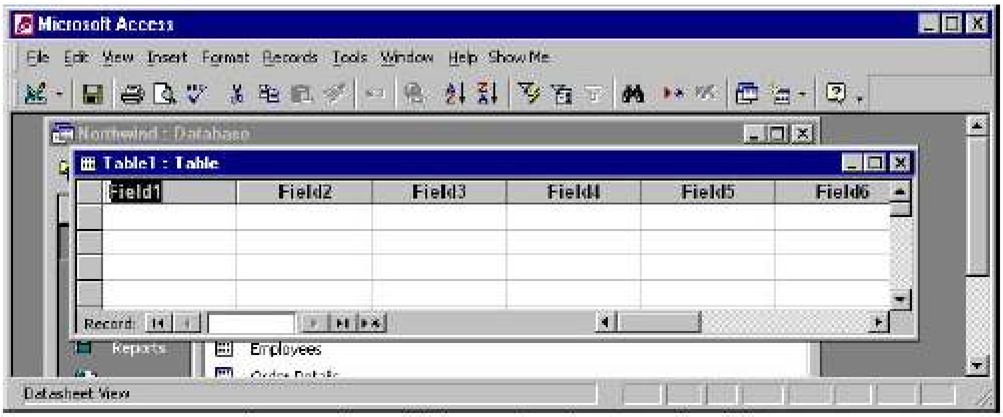


Figure 13 - New Table Dialog Box

Renaming Fields:

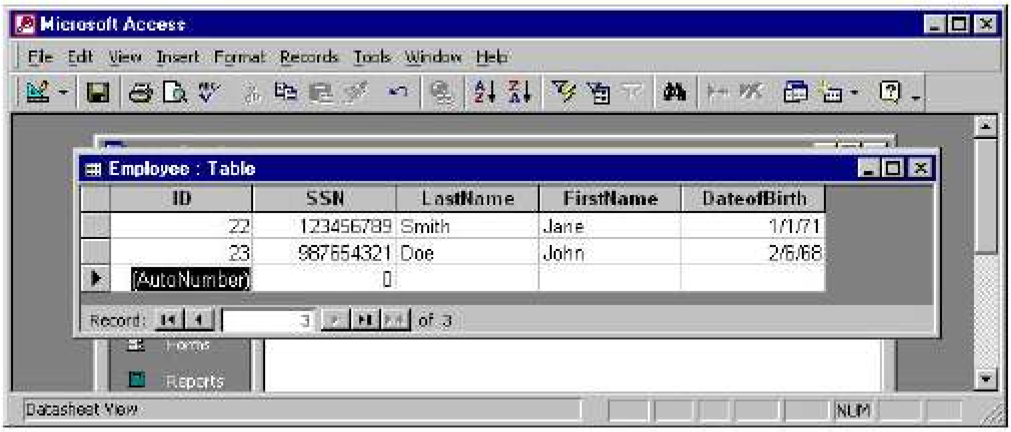
1. Place the cursor over the column heading you want to rename and double click. The column heading will appear highlighted and the cursor will be blinking (you are now in edit mode)
2. Type the name you want to use and then press the Enter key.
3. Repeat the first two steps for the second column, and so on.



Field1	Field2	Field3	Field4	Field5	Field6

Figure 14 - Create Table in Datasheet View (Rename Fields)

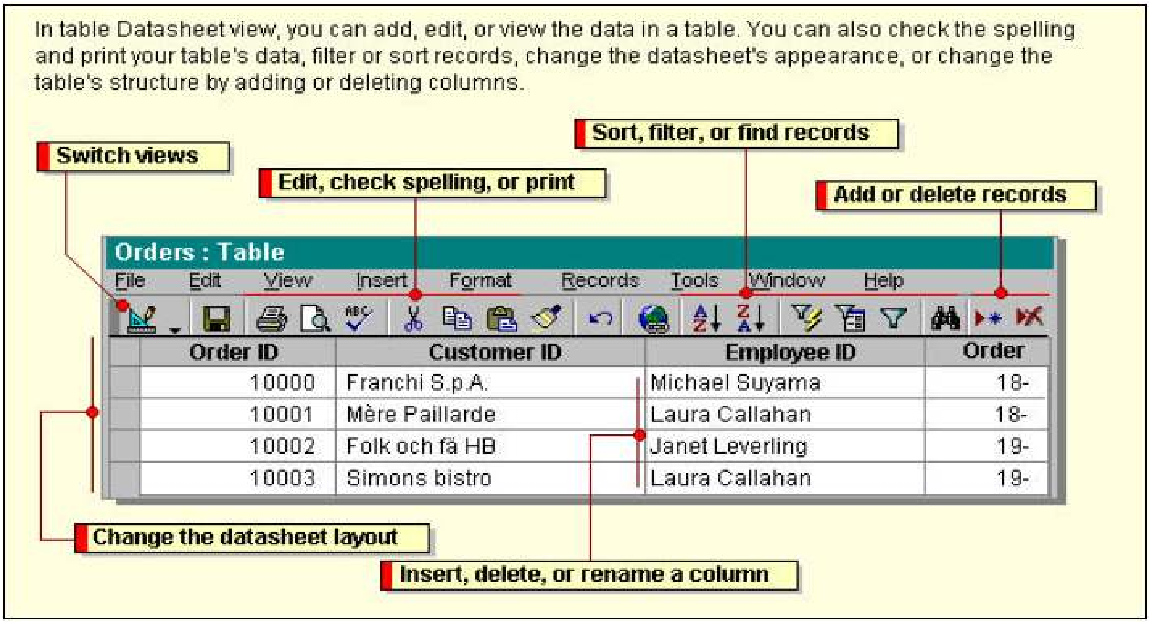
As the column corresponds to the field, the row corresponds to the record. Now we are ready to add the information. Say that, if we are doing a database of a company, the first table we may have is ***Employee***. And the fields of Employee may contain SSN, LastName, FirstName, and so on. Please refer to Figure 15 for the example Employee table.



ID	SSN	LastName	FirstName	DateofBirth
22	123456789	Smith	Jane	1/1/71
23	987654321	Doe	John	2/6/68
(AutoNumber)	0			

Figure 15 - Datasheet View of Employee Table

Summarizing Datasheet View



In table Datasheet view, you can add, edit, or view the data in a table. You can also check the spelling and print your table's data, filter or sort records, change the datasheet's appearance, or change the table's structure by adding or deleting columns.

Sort, filter, or find records
Switch views
Edit, check spelling, or print
Add or delete records
Orders : Table
File Edit View Insert Format Records Tools Window Help
Change the datasheet layout
Insert, delete, or rename a column

Order ID	Customer ID	Employee ID	Order
10000	Franchi S.p.A.	Michael Suyama	18-
10001	Mère Paillarde	Laura Callahan	18-
10002	Folk och fä HB	Janet Leverling	19-
10003	Simons bistro	Laura Callahan	19-

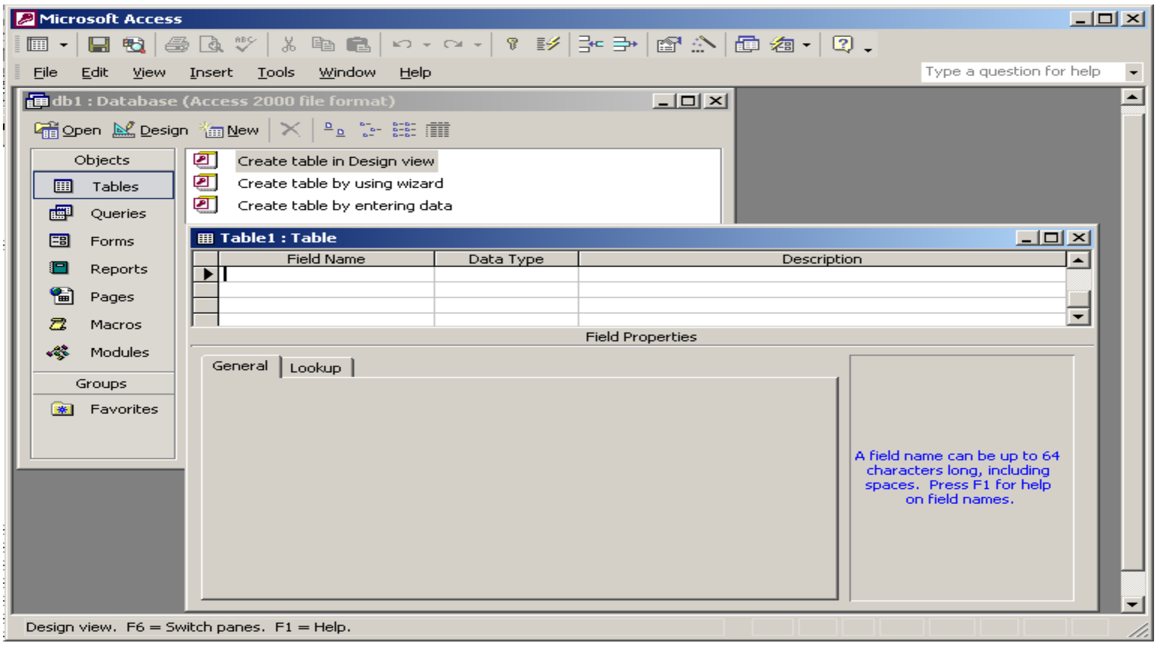
Figure 16 - An Overview of Datasheet

2.2 Create a Table in Design View

In Design View you can add fields, define how each field appears or handles data, and create a primary key. To create a blank (empty) table in design view, you can:

- Click **Tables→Create table in Design view** in Figure 12, or
- Click **Design View** in the dialog box as shown in Figure 13. Then click **OK.**

You are then given a Design View as shown in Figure 17.



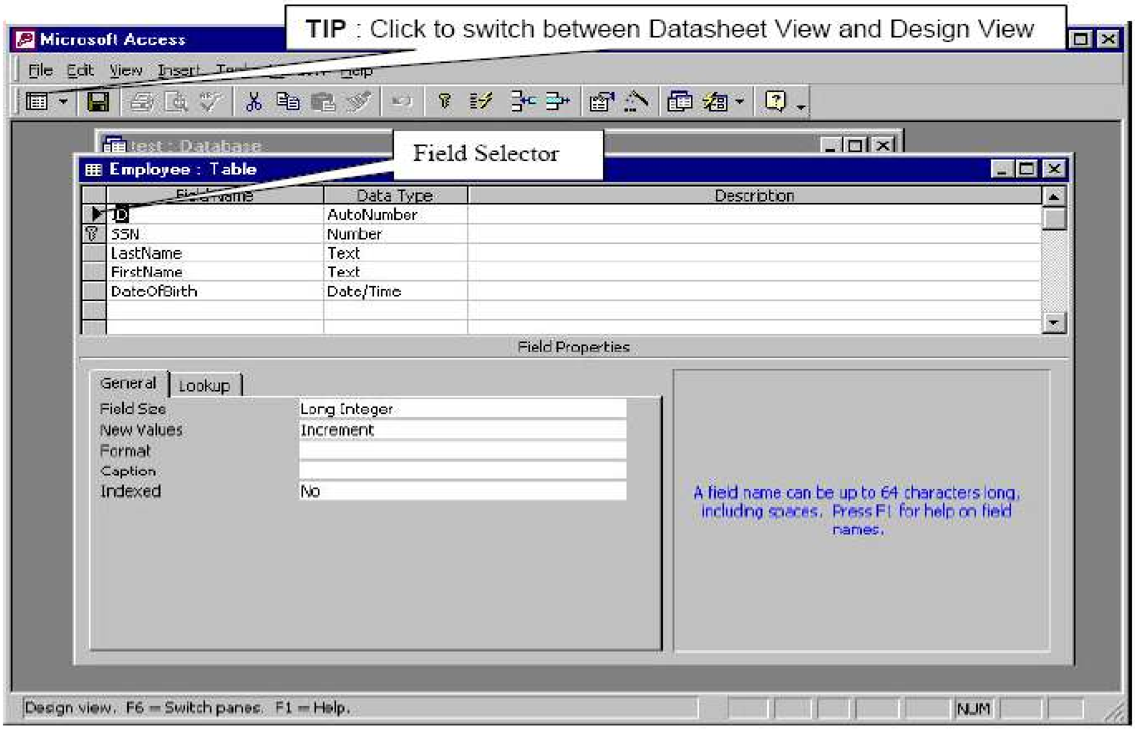
Field Name	Data Type	Description

A field name can be up to 64 characters long, including spaces. Press F1 for help on field names.

Design view. F6 = Switch panes. F1 = Help.

Figure 17 - Design View

In this view, we can specify detailed properties for each field. This includes the length and type of information used in the field. But if we were to *enter data* into the table, we must use **Datasheet View** or **Forms**. The design view for the example Employee table mentioned before will look like Figure 18.


TIP : Click to switch between Datasheet View and Design View

Field Selector

Field Name	Data Type	Description
ID	AutoNumber	
SSN	Number	
LastName	Text	
FirstName	Text	
DateOfBirth	Date/Time	

Field Size	Long Integer
New Values	Increment
Format	
Caption	
Indexed	No

A field name can be up to 64 characters long, including spaces. Press F1 for help on field names.

Design view. F6 = Switch panes. F1 = Help.

Figure 18 - Design View of Employee Table

There are three columns on the top portion of the window. The **Field Name** is the name of the fields. For example, SSN, FirstName, LastName are proper field names for the Employee table. The name for a field must follow MS Access **object-naming rules**[1]. The **Data Type** is like the domain of an attribute. It provides a list of data types that we can choose from, including Text, Memo, Number, Date, and so on. The **Description** column allows us to describe the field and it is optional**.** *It is always good practice to be descriptive in your comments.* This allows new users to easily understand the specifications and meaning of your fields. Table 2 summarizes all data types available in MS Access.

You can set up properties of fields in the **Field Properties** window at the bottom half pane. Table 1 describes all properties available for setup.

Before we save the table and quit, we need to specify the **primary key**. In our Employee table, SSN will be good for primary key. To define SSN as the primary key, click the **Field Selector** as shown in Figure 18 for the SSN field. Field Selector is the gray bar on the left side of the Table Design grid by each field. When we click here, the whole row appears highlighted. Then click menu **Edit→Primary Key** or click the Primary Key button (i.e. the key symbol, shown in Figure 18) on the toolbar in design view, a key symbol will appear on the Field Selector. Save the table as Employee. Now we have created one table.

Field Property	Description
Field Size	The maximum number of characters you can enter in the field. The largest maximum you can set is 255.
Format	The display layout for the field. Select a pre-defined format or enter a custom format.
Caption	A label for the field when used on a form. If you don't enter a caption, the field name is used as the label.
Default Value	A value that is automatically entered in the field for new records.
Validation Rule	An expression that limits the values that can be entered in the field.
Validation Text	The error message that appear when you enter a value prohibited by the validation rule.
Required	Specify whether the field is required data entry.
Allow Zero Length	Specify whether allow zero-length strings in the field.
Indexed	An index speeds up searches and sorting on the field, but may slow updates. Selecting "Yes – No Duplicates" prohibits duplicate values in the field.

Table 1 Field Properties in Design View

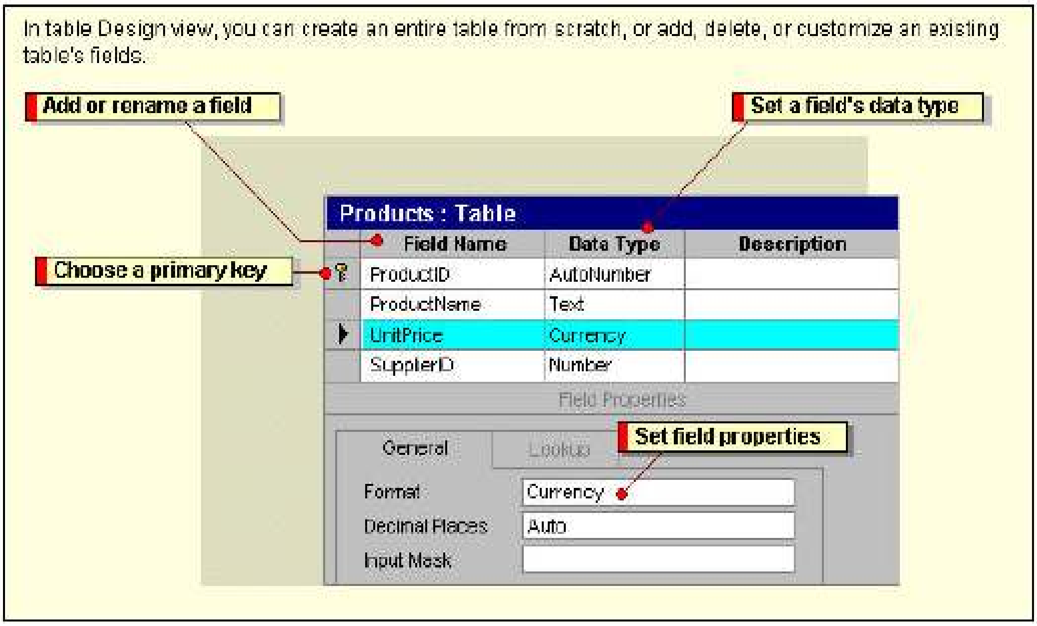
Setting	Type of Data	Size
Text	(Default) Text or combinations of text and numbers, as well as numbers that don't requires calculations, such as phone numbers	Up to 255 characters or the length set by FieldSize properly, whichever is less. MS Access does not reserve space for unused portions of a text field.
Memo	Lengthy text or combinations of text and numbers	Up to 65,535 characters.

[1] Object-naming rules are a set of specific rules for naming Microsoft Access objects. In Microsoft Access, names can be up to 64 characters long and can include any combination of letters, numbers, spaces, and special characters except a period (.), an exclamation point (!), an accent grave (`), and brackets ([ ]). Note that you also can't use leading spaces or control characters (ASCII values 0 to 31). For information on Visual Basic naming conventions, search the Help index for "naming conventions."
Tips
· Avoid including spaces in object names if you'll frequently refer to the objects in expressions or Visual Basic code.
· Avoid using extremely long names because they are difficult to remember and refer to.

Setting	Type of Data	Size
Number	Numeric data used in mathematical calculations	1,2,4 or 8 bytes (16 bytes if the FieldSize properly is set to Replication ID).
Date/Time	Date and time values for the years 100 through 9999	8 bytes
Currency	Currency values and numeric data used in mathematical calculations involving data with one to four decimal places. Accurate to 15 digits on the left side of the decimal separator and to 4 digits on the right side.	8 bytes
AutoNumber	A unique sequential (incremented by 1) number or random number assigned by MS Access whenever a new record is added to a table. AutoNumber fields can't be updated	4 bytes (16 bytes if the FieldSize property is set to Replication ID)
Yes/No	Yes and No values and fields that contain only one of two values (Yes/No, True/False or On/Off)	1 bit
OLE Object	An object (such as a MS Excel spreadsheet, a MS Word document, graphics, sounds, or other binary data) linked to or embedded in a MS Access table	Up to 1 GB (limited by available disk space)
Hyper Link	Text or combinations of text and numbers stores as text and used as a hyperlink address. The easiest way to insert a hyperlink address in a field or control is to click Hyperlink on the Insert menu in the datasheet view.	Each part of the three parts of a Hyperlink data type can contain up to 2048 characters
Lookup Wizard	Creates a field that allows you to choose a value from another table or from a list of values by using a list box or combo box. Clicking this option starts the Lookup Wizard, which creates a Lookup field. After you complete the wizard, MS Access sets the data type based on the values selected in the wizard.	The same size as the primary key field used to perform the lookup, typically 4 bytes.

Table 2 Data Types in MS Access (cont'd)

Summarizing Design View[2]



In table Design view, you can create an entire table from scratch, or add, delete, or customize an existing table's fields.

Field Name	Data Type	Description
ProductID	AutoNumber	
ProductName	Text	
UnitPrice	Currency	
SupplierID	Number	

Format: Currency
Decimal Places: Auto
Input Mask:

Figure 19 - An Overview of Design View

[2] you can set combination of more than two attributes as a primary key. To do so, first highlight attributes you wish to set as primary key, and click Primary Key button in design view.

2.3 Create a Table by Wizard

Wizard is always a useful tool for starters. You can choose the fields for your table from a variety of predefined tables such as business contacts, household inventory, or medical records. To create a blank (empty) table by wizard, you can:

- Click **Tables→Create table by using wizard** in Figure 12, or
- Click **Table Wizard** in the dialog box as shown in Figure 13. Then click **OK.**

Then follow the guide in the wizard step by step.

3. Working with Data

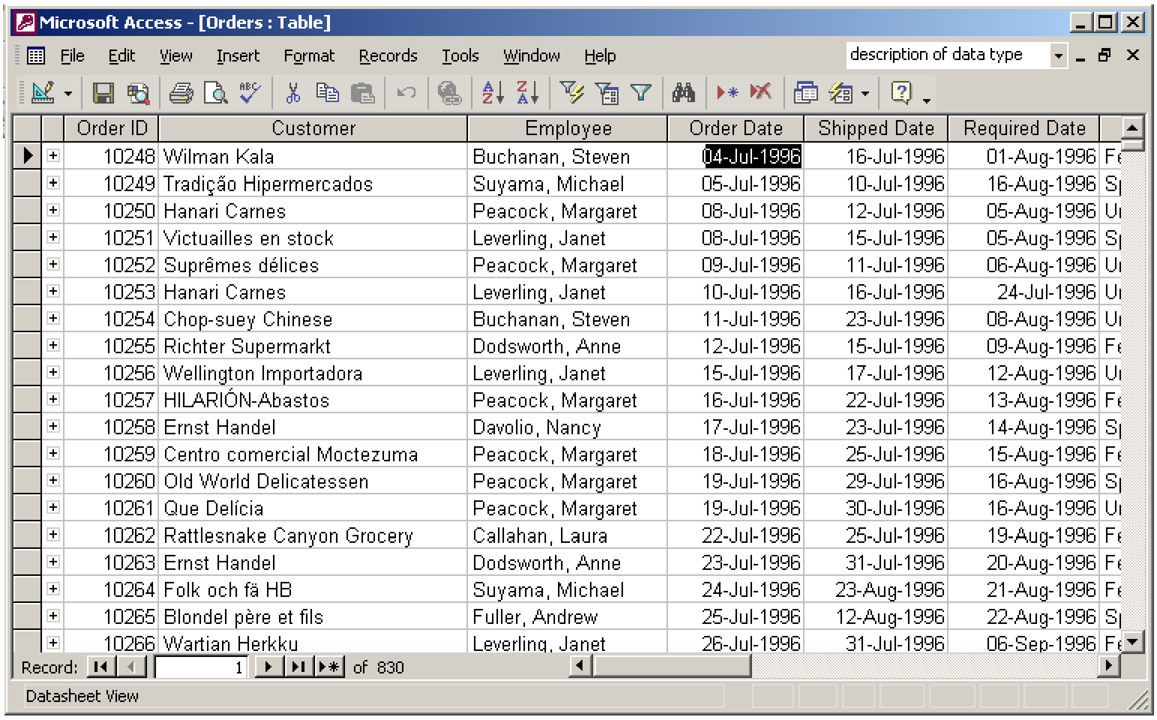
In this section, we will learn how to work with existing data. The sample database file used here is "Northwind.mdb". It is a sample database comes with Microsoft Access. You can find it in by clicking **Help→Sample Databases→Northwind Sample Database**. Then double-click Table "**Orders**" to open it.

3.1 Sorting

In the **Datasheet View**, we can sort the records in ascending or descending orders. To sort a single column, place the cursor anywhere in the column desired. Simply click either the Sort Ascending or Sort Descending toolbar buttons. We can also right-click and choose Sort Ascending or Sort Descending from the shortcut menu.

If we want to sort *multiple columns*, we need to do a little more work. The two columns we want to sort by must be adjacent to each other; the one that we want to sort by first must be to the left of the other. Let's work with "**Orders**" table in **Northwind Database**. Now we will try sorting by '**Order Date'** then by **'Shipped Date**', we must first move 'Shipped Date' column to the left of 'Order Date' column. Here are the steps,

1. Highlight the **'Shipped Date**' column by clicking the **'Shipped Date**' column heading.
2. Let go of the mouse button and then press it again, holding it this time.
3. Now drag the **'Shipped Date'** column over the **'Required Date'** column. When we get just to the right of the **'Order Date'**, let go of the mouse button. Then **'Order Date'** and **'Shipped Date'** should sit side by side now.
4. Click the mouse button on the **'Order Date'** header, highlighting the column. Holding the mouse button down, drag it over the **'Shipped Date'** column so that both the **'Order Date' and 'Shipped Date'** columns appear highlighted.
5. Click on **Records → Sort → Sort Ascending**. The sorted table is shown in Figure 20.



Order ID	Customer	Employee	Order Date	Shipped Date	Required Date	
10248	Wilman Kala	Buchanan, Steven	04-Jul-1996	16-Jul-1996	01-Aug-1996	Fe
10249	Tradição Hipermercados	Suyama, Michael	05-Jul-1996	10-Jul-1996	16-Aug-1996	S
10250	Hanari Carnes	Peacock, Margaret	08-Jul-1996	12-Jul-1996	05-Aug-1996	U
10251	Victuailles en stock	Leverling, Janet	08-Jul-1996	15-Jul-1996	05-Aug-1996	S
10252	Suprêmes délices	Peacock, Margaret	09-Jul-1996	11-Jul-1996	06-Aug-1996	U
10253	Hanari Carnes	Leverling, Janet	10-Jul-1996	16-Jul-1996	24-Jul-1996	U
10254	Chop-suey Chinese	Buchanan, Steven	11-Jul-1996	23-Jul-1996	08-Aug-1996	U
10255	Richter Supermarkt	Dodsworth, Anne	12-Jul-1996	15-Jul-1996	09-Aug-1996	Fe
10256	Wellington Importadora	Leverling, Janet	15-Jul-1996	17-Jul-1996	12-Aug-1996	U
10257	HILARIÓN-Abastos	Peacock, Margaret	16-Jul-1996	22-Jul-1996	13-Aug-1996	Fe
10258	Ernst Handel	Davolio, Nancy	17-Jul-1996	23-Jul-1996	14-Aug-1996	S
10259	Centro comercial Moctezuma	Peacock, Margaret	18-Jul-1996	25-Jul-1996	15-Aug-1996	Fe
10260	Old World Delicatessen	Peacock, Margaret	19-Jul-1996	29-Jul-1996	16-Aug-1996	S
10261	Que Delícia	Peacock, Margaret	19-Jul-1996	30-Jul-1996	16-Aug-1996	U
10262	Rattlesnake Canyon Grocery	Callahan, Laura	22-Jul-1996	25-Jul-1996	19-Aug-1996	Fe
10263	Ernst Handel	Dodsworth, Anne	23-Jul-1996	31-Jul-1996	20-Aug-1996	Fe
10264	Folk och fä HB	Suyama, Michael	24-Jul-1996	23-Aug-1996	21-Aug-1996	Fe
10265	Blondel père et fils	Fuller, Andrew	25-Jul-1996	12-Aug-1996	22-Aug-1996	S
10266	Wartian Herkku	Leverling, Janet	26-Jul-1996	31-Jul-1996	06-Sep-1996	Fe

Record: 1 of 830

Datasheet View

Figure 20 - Northwind Database: Sorted Result

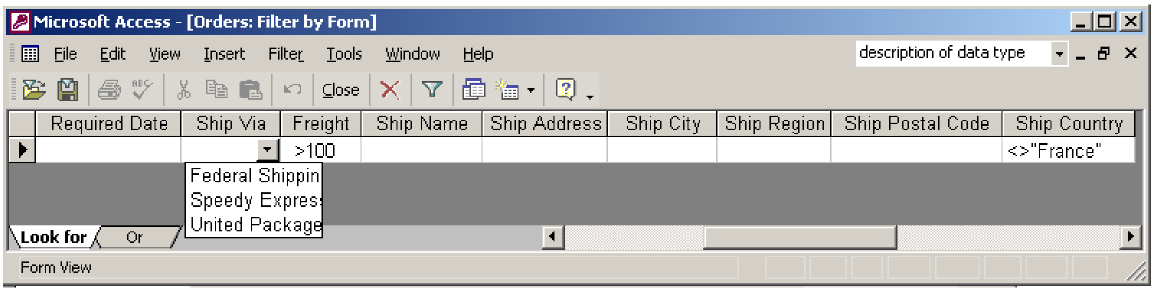
3.2 Filters

By using ***Filter by Selection***, you tell Access that you want to see only certain records, based on the value in the field in which the cursor currently resides. For example, say that we want to see those orders shipped in Germany. To do this,

1. In the **'Ship Country'** column, click a field that has **"Germany**" in this field.
2. Click the right button of mouse and select **"Filter by Selection**" button. Or, you may click **Records** button in the menu bar and select **Filter** button and select **Filter by Selection**. Only those records that have Germany for their Ship Country appear.
3. Click the right button again and select "**Remove Filter**" button to remove the filter.

With **Filter by Selection**, you were filtering records based on a field you selected in the datasheet, and then selected another field in the subset to narrow it further. When using **Filter by Form**, Access takes you to a different screen to specify the criteria you want to filter with. Using **Filter by Form**, although more complicated, allows you to be more specific and filter your data based on a combination of selected values from multiple fields. To do this,

1. Click on **Records → Filter → Filter by Form**
2. The datasheet will suddenly look as if you deleted all the records. Refer to Figure 21 for example. Now you can pick the fields you want to filter and display your information.
3. Click **Ship Via** field to see the drop-down list. You can use =, >, <, >=, and <= to specify your criteria.
4. Finally, click on **Filter → Apply Filter** to see the result.



Required Date	Ship Via	Freight	Ship Name	Ship Address	Ship City	Ship Region	Ship Postal Code	Ship Country
		>100						<>"France"

Federal Shippin
Speedy Expres
United Package

Figure 21 - Filter by Form

In the end, we will see how to use **AND** and **OR** criterion in a filter. The **AND** operator allows you to filter records based on two or more criteria. When you apply a filter using the AND operator, only those records that meet both (or all) criteria appear. To show how to use the AND operator, we will choose all orders shipped in USA **AND** freight is above $100. To do this,

1. Click the **Filter by Form** button to return to the **Filter by Form** screen. The screen should be blank.
2. Click **Ship Country** and select **USA**.
3. Click **Freight** and type **">100**" (without quotation mark).
4. Click the **Apply Filter** button. Now those orders shipped in USA and freight is above $100 will appear. The resulting table contains 40 records. Please check your answer.

To show all the orders which is either shipped in USA **OR** whose freight is over $100, you can

1. Click the **Record** menu.
2. Select **Filter** in the roll down menu and choose **Filter by Form**.
3. Press the right mouse button on any field and choose **Clear Grid** button.(this clears all previous filters' parameters)
4. Click **Ship Country** and select "**USA**". As soon as you enter the first criteria, Access enables an **OR** tab at the bottom of the **Filter by Form**.
5. Click the **Or** tab at the bottom of the **Filter by Form** screen.
6. Click freight and type **">100"** (without quotation mark).
7. Press the right mouse button in any field and a menu will pop up. Click the **Apply Filter** button. Now those orders that are either shipped in USA or whose freight is over $100 will appear. The resulting table contains 269 records.

C) Relationships in ER Diagram and Relationships in MS Access

1. What is a Relationship?

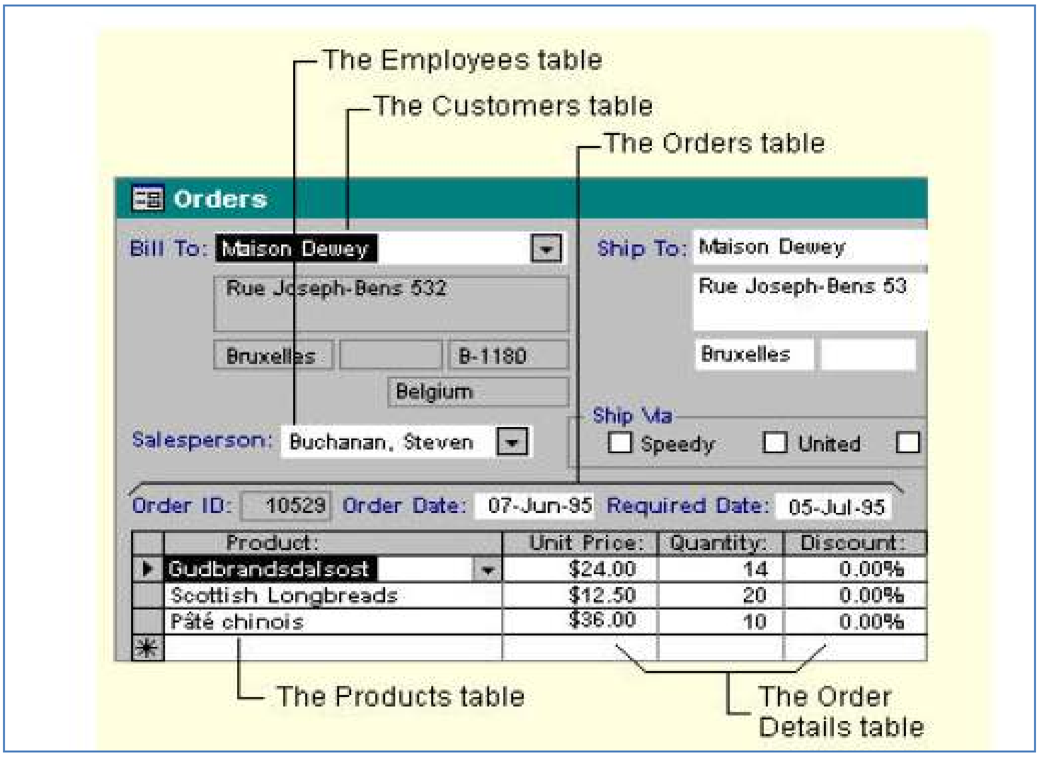
Definition in class: An association between 2 (or more) separate entities.
Definition in MS Access: An association between 2 common fields (column) in two tables.

There are three types of relationships:

- **One-to-One (1:1)**
- **One-to-Many (1:N)**
- **Many-to-Many (M:N)**.

2. Why Define Relationships?

After you've set up different tables for each subject in your Microsoft Access Database, you need a way of telling Microsoft Access how to bring that information back together again. The first step in this process is to define relationships between your tables. After you've done that, you can create queries, forms, and reports to display information from several tables at once. For example, the form in **Figure 22** includes information from five tables:



Orders

Bill To: Maison Dewey
Rue Joseph-Bens 532
Bruxelles B-1180
Belgium

Salesperson: Buchanan, Steven

Ship To: Maison Dewey
Rue Joseph-Bens 53
Bruxelles

Ship Via: □ Speedy □ United □

Order ID: 10529 Order Date: 07-Jun-95 Required Date: 05-Jul-95

Product:	Unit Price:	Quantity:	Discount:
Gudbrandsdalsost	$24.00	14	0.00%
Scottish Longbreads	$12.50	20	0.00%
Pâté chinois	$36.00	10	0.00%

Figure 22 - A Form Using Information from Five Tables

How do relationships work?

In the previous example in **Figure 22**, the fields in five tables must be coordinated so that they show information about the same order. This coordination is accomplished with **relationships** between tables. ***A relationship works by matching data in key fields — usually a field with the same name in both tables***. In most cases, these matching fields are the **primary key** (see footnote of page 5) from one table, which provides a unique identifier for each record, and a **foreign key** in the other table. For example, employees can be associated with orders they're responsible for by creating a relationship between the "**Employees**" table and the "**Orders**" table using the **EmployeeID** fields (which we will show later).

3. Relationships in ER Diagram vs MS Access

Relationships in ER Diagram ≠ Relationships in MS Access

ER Diagram ≠ MS Access Relationship View

Relationships in **MS Access** are <u>**links between attributes**</u>, but relationships in the **ER diagram** are <u>**links between entities**</u>.

3.1 Relationships in ER Diagram

Let's take a look at the relationship between the "**EMPLOYEE"** entity and the **"ORDER"** entity in **Figure 23**. 'Takes' is a one-to-many relationship. The 'Takes' relationship can be converted into an MS Access relationship as shown in **Figure 24**.

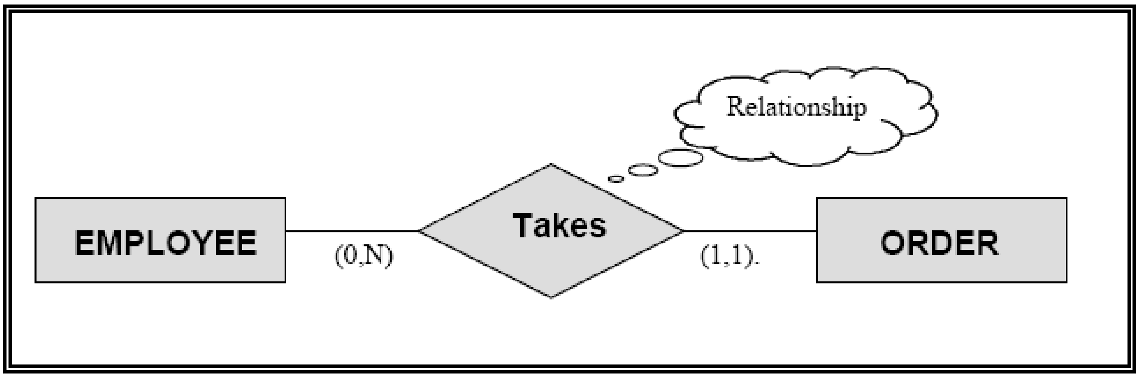


Figure 23 - Relationships in ER Diagram

3.2 Relationships in MS Access

Please refer to **Figure 24**, which corresponds to the relationship in ER diagram shown in **Figure 23**.

4. Creating Relationships Between Tables

Again, we will be using **Northwind Sample Database.** Open it as before from Help menu.

4.1 One-to-One relationship

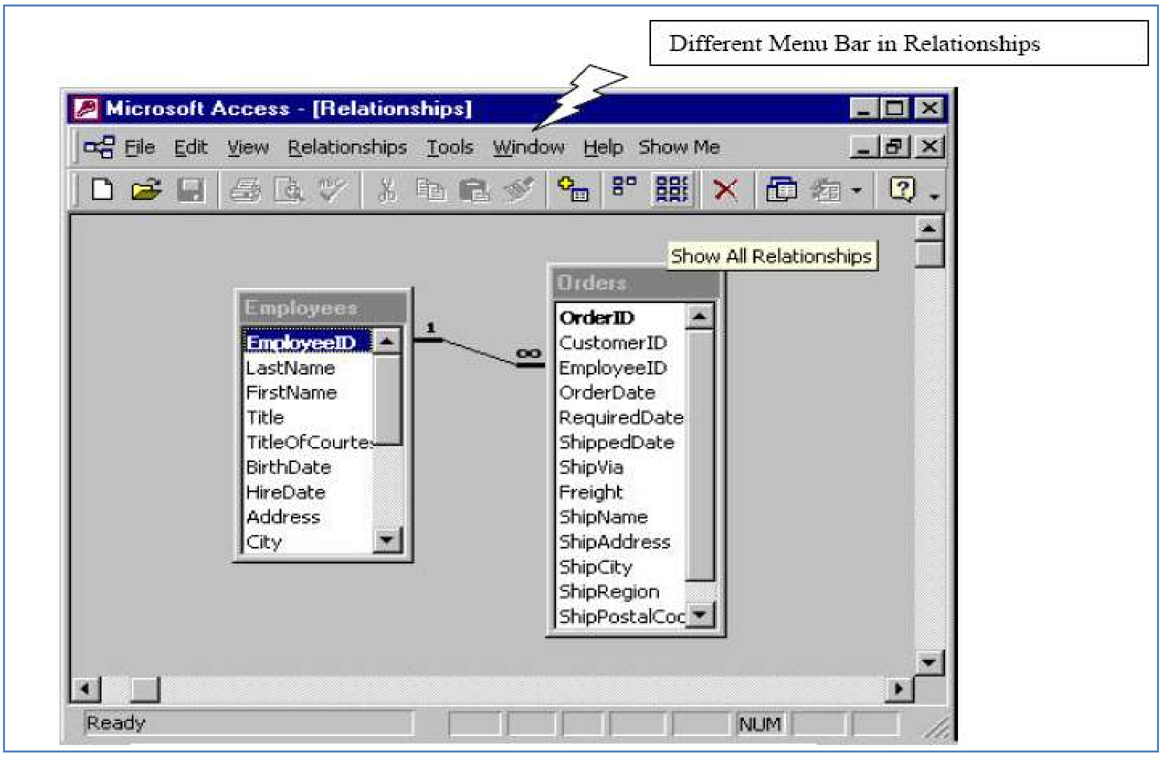


Figure 24 - Relationships in MS Access Relationship View

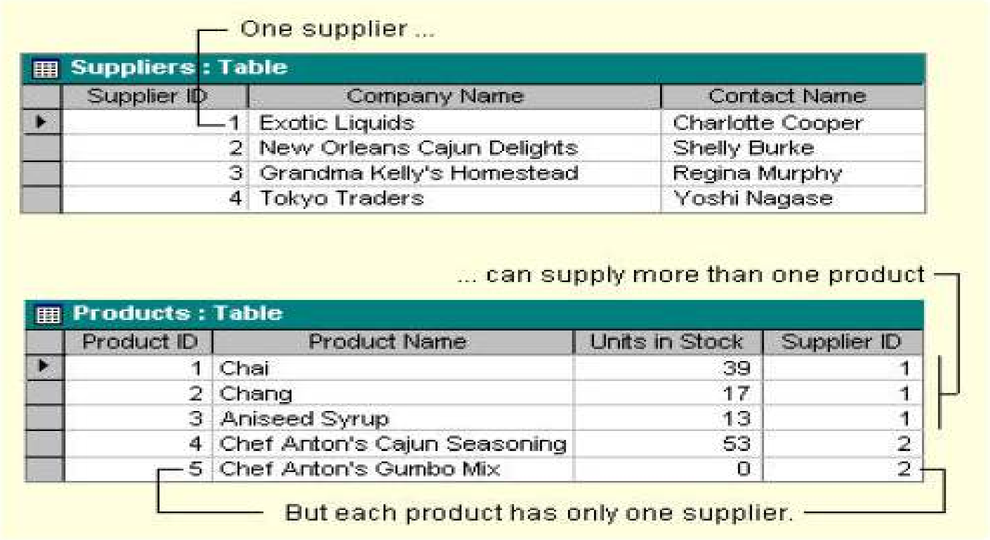
In a one-to-one relationship, each record in Table A can have **only** one matching record in Table B and each record in Table B can have only one matching record in Table A. This type of relationship is NOT common, because most information related in this way would be in one table. You might use a one-to-one relationship to divide a table with too many fields, to isolate part of a table for security reasons, or to store information that applies only to a subset of the main table. For example, you might want to create a table to track employees participating in a fundraising soccer game.

4.2 One-to-many Relationship

A one-to-many relationship is the most common type of relationship. In a **one-to-many** relationship, a record in Table A can have many matching records in Table B, but a record in Table B has only one matching record in Table A. Refer to **Figure 25** for Supplier table as A, and Products table as B.

Defining a One-to-many Relationships between Tables

1. Close any tables you have open. You can't create or modify relationships between any open tables.
2. If you haven't already done so, switch to the **Database Window**. You can press F11 to switch to the Database window from any other window.
3. Click on menu **Tools** → **Relationships** (**Note**: when you do this, the toolbar in the window will look different, refer to **Figure 24**). If the relationships are already defined for the database, a relationship view of the current database will show up and look like **Figure 26**.
4. If your database does not have any relationships defined, the **Show Table** dialog box will automatically be displayed (**Figure 27**). Add the tables that you want to relate. When the **Show Table** dialog box isn't displayed, in the **Relationships View** (which you originally accessed via the menu **Tool** →**Relationships**), click on menu **relationships** →**Show Table** or right-click and select **Show Table**.



One supplier ...

Suppliers : Table

Supplier ID	Company Name	Contact Name
1	Exotic Liquids	Charlotte Cooper
2	New Orleans Cajun Delights	Shelly Burke
3	Grandma Kelly's Homestead	Regina Murphy
4	Tokyo Traders	Yoshi Nagase

... can supply more than one product

Products : Table

Product ID	Product Name	Units in Stock	Supplier ID
1	Chai	39	1
2	Chang	17	1
3	Aniseed Syrup	13	1
4	Chef Anton's Cajun Seasoning	53	2
5	Chef Anton's Gumbo Mix	0	2

But each product has only one supplier.

Figure 25 - One-to-Many Relationship

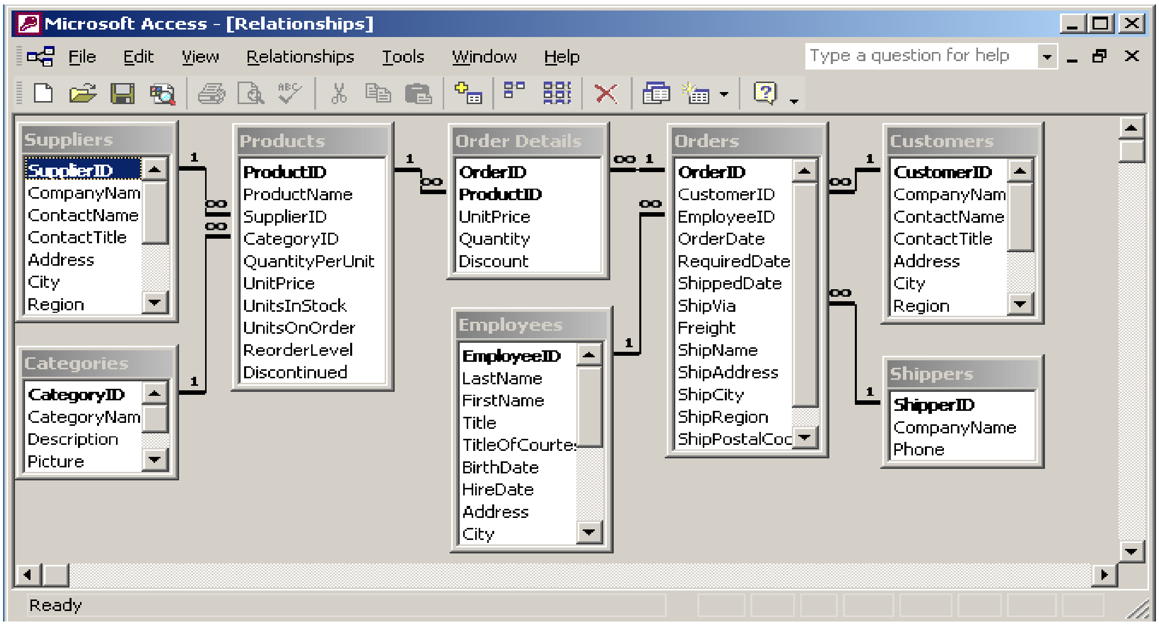


Figure 26 - Relationships View of Northwind Database

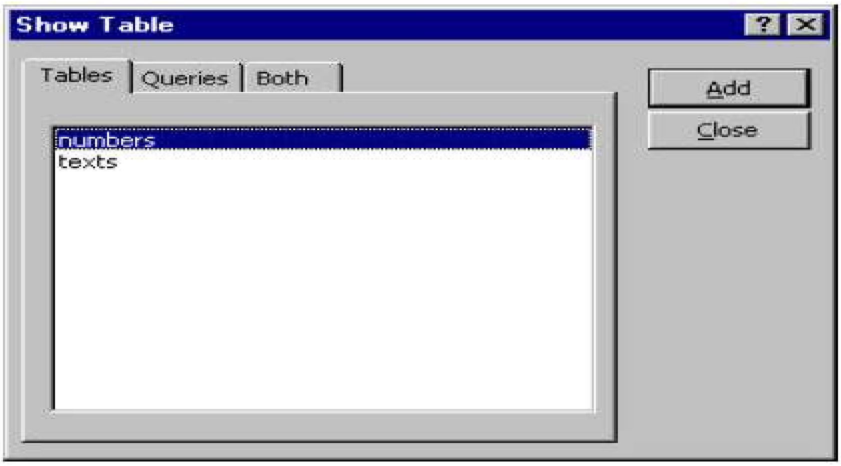


Figure 27 - Sample "Show Table" Dialog Box

5. Once in the relationship view you have all the tables you want to relate, then you need to define the relationship between any two tables by **dragging** the field that you want to relate from one table to the related field in the other table (refer to **Figure 28**). To drag **multiple fields**, press the CTRL key and click each field before dragging them. In most cases, you drag the **primary key**[3] field (which is displayed in bold text) from one table to a similar field (often with the same name) called the **foreign key**[4] in the other table. The related fields are NOT required to have the same names (Note it is good practice to do so since it reminds you where the relationship comes from), but they MUST have the same domain (or **data type**[5]) and contain the same kind of information. In addition, when the matching fields are **Number** fields, they must have the same FieldSize property setting. The two exceptions to matching data types:
   - you can match an **AutoNumber** field with a **Number** field whose **FieldSize** property is set to **Long Integer**
   - you can also match an **AutoNumber** field with a **Number** field if both fields have their **FieldSize** property set to **ReplicationID**.
6. Once you have created the relationships, the **Edit Relationships** dialog box is displayed as shown in **Figure 29**. Check the field names displayed in the two columns to ensure they are correct. You can change them if necessary. Set the relationship options if necessary. For information about a specific item in the **Relationships** dialog box, click on the question mark button (the cursor would now have a floating question mark next to it) and then click on the item.
7. Click the **Create** button to create the relationship.
8. Repeat steps 5 through 8 for each pair of tables you want to relate.

[3] Primary key: one or more fields whose value or values uniquely identify each record in a table. In a relationship, a primary key is used to refer to specific records in one table from another table.

[4] Foreign key: one or more table fields that refer to the primary key field or fields in another table. A foreign key indicates how the tables are related. The data in the foreign key and primary key fields must match. For example, the Products table in the Northwind sample database contains the foreign key SupplierID, which refers to the SupplierID primary key of the Suppliers table. Using this relationship, the Products table displays a supplier name from the Suppliers table for each product.

[5] Data type: the attribute of a variable or field that determines what kind of data it can hold. For example, the Text and Memo field data types allow the field to store either text or numbers, but the Number data type will allow only numbers to be stored in the field. Number data type fields store numerical data that will be used in mathematical calculations. Use the Currency data type to display or calculate currency values. Supported data types include field data types, Visual Basic data types, and query parameter data types.

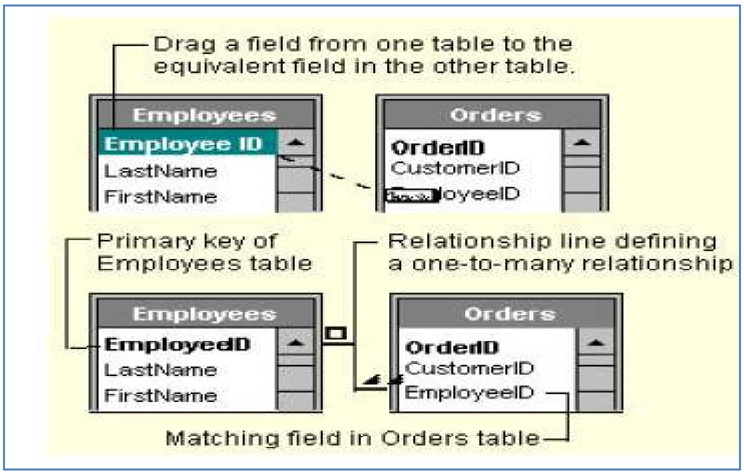
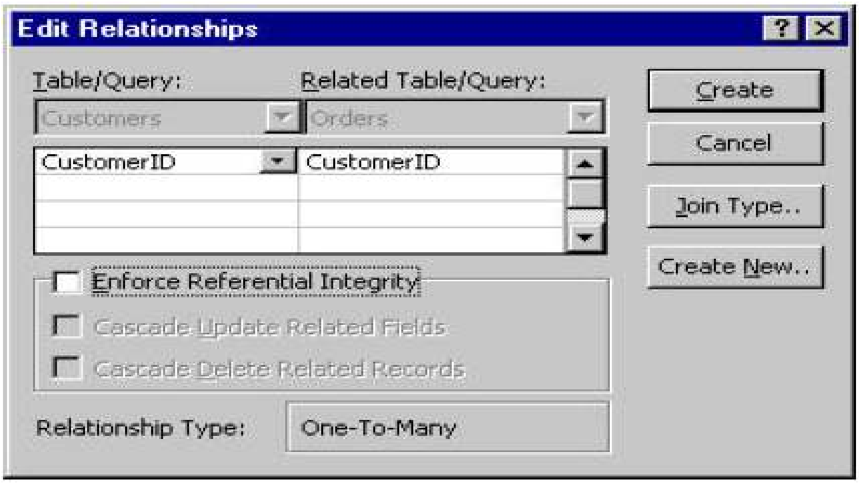

Drag a field from one table to the equivalent field in the other table.
Employees
Employee ID
LastName
FirstName
Orders
OrderID
CustomerID
EmployeeID
Primary key of Employees table
Relationship line defining a one-to-many relationship
Employees
EmployeeID
LastName
FirstName
Orders
OrderID
CustomerID
EmployeeID
Matching field in Orders table

Figure 28 - Creating a Relationship between Two Tables

Notes

- You can edit the relationship between the two tables later on, by just double-clicking on the **Relationship Line (**shown in both **Figure 26** and **Figure 28**) connecting the two tables in **Relationships View**. *Please keep in mind that when you delete table from the* ***Relationship Views****, it only changes the layout you see but not the relationship itself.*
- When you close the Relationships window, Microsoft Access asks if you want to save the layout. Whether you save the layout or not, the relationships you create are saved in the database.
- If you need to view all the relationships defined in the database, click **Show All Relationships** on the toolbar. To view only the relationships defined for a particular table, click the table, and then click **Show Direct Relationships** on the toolbar.
- If you need to make a change to the design of a table, you can right-click the table you want to change, and then click **Design Table**.
- You can create relationships using queries as well as tables. However, **referential integrity**[6] isn't enforced with queries.
- To create a relationship between a table and itself, add that table twice. This is useful in situations where you need to perform a lookup within the same table. For example, in the **Employees** table in the Northwind sample database, a relationship has been defined between the **EmployeeID** and **ReportsTo** fields, so that the **ReportsTo** field can display employee data from a matching **EmployeeID**.

[6] Referential integrity: Rules that you follow to preserve the defined relationships between tables when you enter or delete records. If you enforce referential integrity, Microsoft Access prevents you from adding records to a related table when there is no associated record in the primary table, changing values in the primary table that would result in orphan records in a related table, and deleting records from the primary table when there are matching related records in a related table.



Table/Query: Customers

Related Table/Query: Orders

Table/Query	Related Table/Query
CustomerID	CustomerID

☐ Enforce Referential Integrity

☐ Cascade Update Related Fields

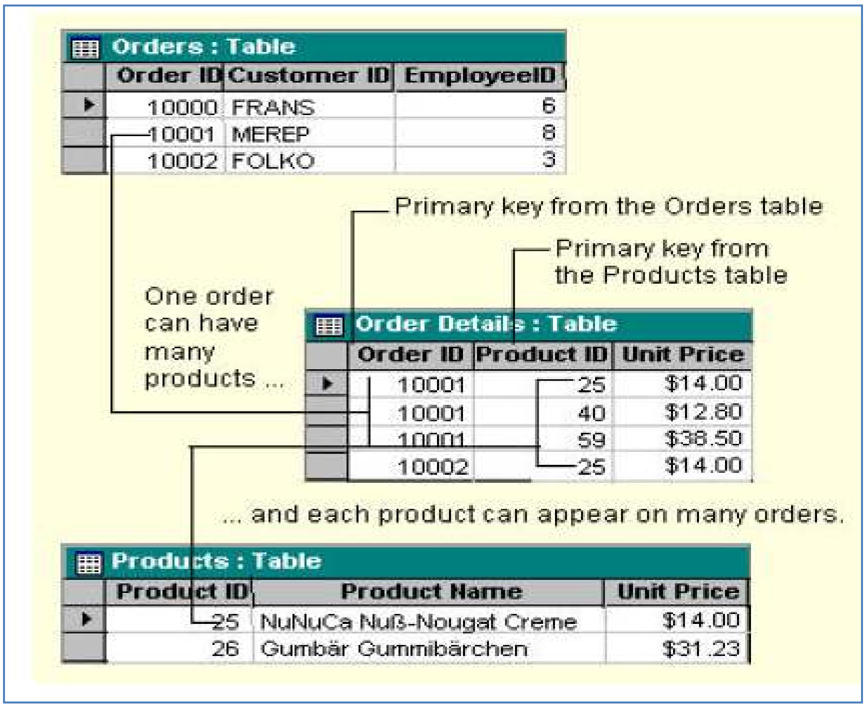
☐ Cascade Delete Related Records

Relationship Type: One-To-Many

Figure 29 - Edit Relationships Dialog Box

4.3 Many-to-many Relationship

In a **many-to-many** relationship, a record in Table A can have many matching records in Table B, and a record in Table B can have many matching records in Table A. This type of relationship is **only possible** by defining a third table, called a junction table, whose primary key consists of two fields: the **primary keys from both Tables A and B**. A many-to-many relationship is really two one-to-many relationships with a third table. For example, the **Orders** table and the **Products** table in **Figure 30** have a **many-to-many** relationship that's defined by creating two **one-to-many** relationships with the **Order Details** table.



Orders : Table

Order ID	Customer ID	EmployeeID
10000	FRANS	6
10001	MEREP	8
10002	FOLKO	3

Primary key from the Orders table

Primary key from the Products table

One order can have many products ...

Order Details : Table

Order ID	Product ID	Unit Price
10001	25	$14.00
10001	40	$12.80
10001	59	$38.50
10002	25	$14.00

... and each product can appear on many orders.

Products : Table

Product ID	Product Name	Unit Price
25	NuNuCa Nuß-Nougat Creme	$14.00
26	Gumbär Gummibärchen	$31.23

Figure 30 - Many-to-Many Relationship

Defining a Many-to-many Relationship between Tables

Figure 31 shows a relationship view for Northwind database containing a many-to-many relationship between Products and Orders. Please refer to it while you understand the following steps.

1. Create the two tables that will have a **many-to-many** relationship.
2. Create a third table, called a **junction table**, and add fields with the same definitions as the primary key fields from each of the other two tables to this table. In the junction table, the **primary**

key fields function as **foreign keys**. You can add other fields to the junction table, just as you can to any other table.

3. In the **junction table**, set the **primary key** to include the **primary key** fields from the other two tables. For example, in an **Order Details** junction table, the primary key would be made up of the **OrderID** and **ProductID** fields. (Note: You can set multiple fields as the **primary key** by highlighting multiple rows (which correspond to fields) which you want to be part of your **primary key** in **Design View,** and then click on **Edit** → **Primary Key**. Alternatively you can also use the **primary key** button in the tool bar)
4. Define a **one-to-many** relationship between each of the two **primary tables** and **the junction table**.
5. To add data to the tables, create a **form**[7] that works with more than one table.

Note:

In the Northwind sample database, a **many-to-many** relationship exists between the **Orders** and **Products** tables. One order in the **Orders** table can include multiple products from the **Products** table. In addition, a single product can appear in many orders. In the sample database, the **Order Details** table is a **junction table** between the **Orders table** and the **Products table**.

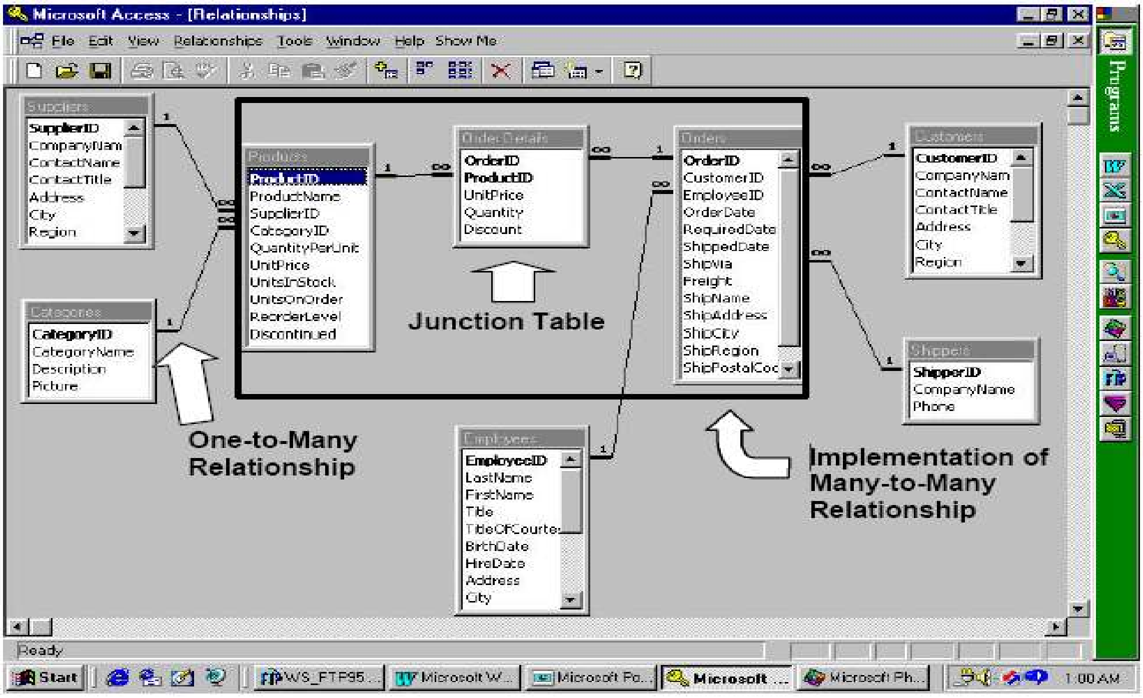


Figure 31 - Junction Table in Many-to-Many Relationship in Northwind

5. Creating a field that looks up or lists values in tables

5.1 Lookup Wizard

When you set up the fields for the table, you can create a field that displays either of two kinds of lists to *make data entry simpler* by means of **Lookup Wizard**:

- **Lookup list** that displays values looked up from an existing table or query
- **Value list** that displays a fixed set of values that you enter when you create the field

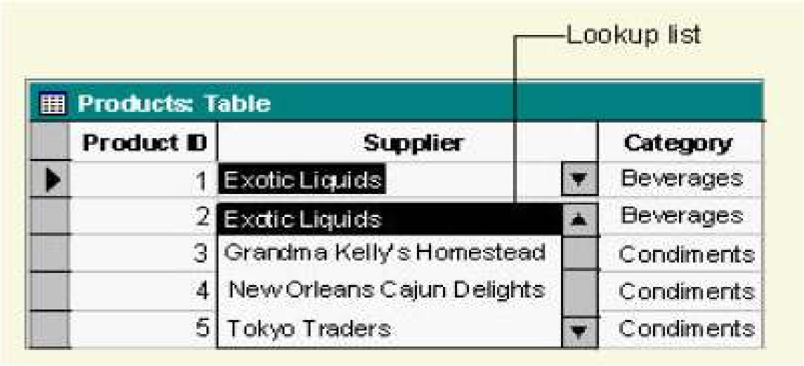
We will introduce how to use the lookup wizard in design view to generate lookup list and value in the following two sections.

[7] Form: a Microsoft Access database object on which you place controls for taking actions or for entering, displaying, and entering data in fields.

Creating a field that looks up data from another table in Design view

Lookup List

The most common **Lookup list** displays values looked up from a related table. For example, the **SupplierID** field in the **Products** table of the **Northwind** sample database displays the **Lookup list** as shown in **Figure 32**.



Products: Table

Product ID	Supplier	Category
1	Exotic Liquids	Beverages
2	Exotic Liquids	Beverages
3	Grandma Kelly's Homestead	Condiments
4	New Orleans Cajun Delights	Condiments
5	Tokyo Traders	Condiments

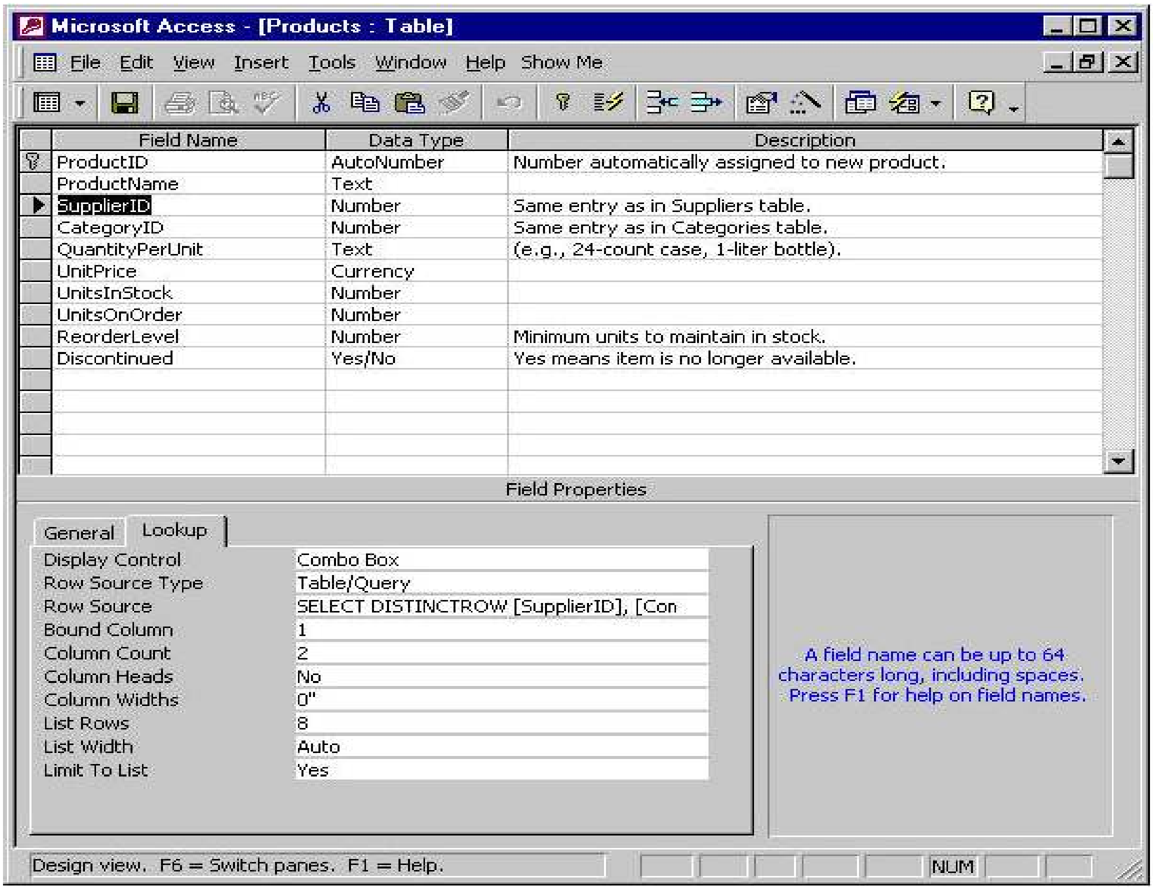
Figure 32 - Lookup List

You can add a **new** Lookup field in either design view or datasheet view of tables. However, if the field you want to use as the foreign key for a Lookup field already exists, you must open that field's table in **Design view** to define the Lookup field. For example, assume you already have a **Suppliers** table filled with data, now you want to create a **Products** table containing a **SupplierID** field whose contents should come from the **Suppliers** table. You can make the data entry simpler for this by changing it to a Lookup field, so that a drop-down list containing all supplier IDs from **Suppliers** table will be available when you start to enter data into Products table. In order to do this, you must open the **Products** table in **Design view** to change **SupplierID** to a Lookup field. Here are the steps to follow:

1. Open the table in **Design view**.
2. Do one of the following:
   - If the **SupplierID** field is not defined yet, click in the row below where you want to add the field, and then click **Insert** → **Rows** on the toolbar, or to add a new field at the end of the table, click in the first blank row. Type **SupplierID** in the Field Name column, following Microsoft Access object-naming rules.
   - If the **SupplierID** is already defined, click the corresponding row.
3. In the '**Data Type'** column, click the down arrow and select **'Lookup Wizard'** from the list.
4. Click the option that indicates you want the Lookup field to look up the values in a table or query.
5. Click **Next** and follow the directions in the remaining Lookup Wizard dialog boxes.

When you click the **Finish** button, Microsoft Access creates the Lookup field[8] and sets certain field properties based on the choices you made in the wizard. For information on the properties that the **Lookup Wizard** sets, go back to the field that was set by the **Lookup Wizard**, and click on the **Lookup** tab in the **Field Properties** window (**Figure 33**).

[8] Lookup list field and form: once you've created a Lookup list field, if you add the field to a form, Microsoft Access copies its definition into the form. You won't have to create the combo or list box and its Lookup or value list definition for the form. However, if you change the definition of a Lookup or value list field in the table after adding it to a form, those changes will NOT be reflected in that form. To correct this, delete the field from the form and then add it again.


Microsoft Access - [Products : Table]
File Edit View Insert Tools Window Help Show Me
Field Properties
General
Lookup
NUM

Field Name	Data Type	Description
ProductID	AutoNumber	Number automatically assigned to new product.
ProductName	Text	
SupplierID	Number	Same entry as in Suppliers table.
CategoryID	Number	Same entry as in Categories table.
QuantityPerUnit	Text	(e.g., 24-count case, 1-liter bottle).
UnitPrice	Currency	
UnitsInStock	Number	
UnitsOnOrder	Number	
ReorderLevel	Number	Minimum units to maintain in stock.
Discontinued	Yes/No	Yes means item is no longer available.

Display Control	Combo Box
Row Source Type	Table/Query
Row Source	SELECT DISTINCTROW [SupplierID], [Con
Bound Column	1
Column Count	2
Column Heads	No
Column Widths	0"
List Rows	8
List Width	Auto
Limit To List	Yes

A field name can be up to 64 characters long, including spaces. Press F1 for help on field names.

Design view. F6 = Switch panes. F1 = Help.

Figure 33 - Properties Listed in Lookup Tab in Field Properties Window

Note:

- It is also possible to add a Lookup field to a table that displays values from the same table that contains the Lookup field. For example, in the **Employees** table of the Northwind sample database the **ReportsTo** field is a Lookup field that displays data from the **FirstName** and **LastName** fields by looking up the corresponding **EmployeeID** in the same table.

Now let's go back to **Figure 32**. It is created by looking up the **SupplierID** values in the **Suppliers** table and by displaying the corresponding **Supplier** names. Picking a value from a **Lookup list** sets the **foreign key** value in the current record (**SupplierID** in the **Products** table) to the **primary key** value of the corresponding record in the original table (**SupplierID** in the **Suppliers** table). This creates an association to the related table to *display* (but NOT store) the **Supplier** names in the record. The foreign key (**SupplierID**) is stored but is not displayed. For this reason, any updates made to the data in the **Suppliers** table will be reflected in both the list and records in the **Products** table. You must define a Lookup field in the table that will contain the **foreign key** and display the Lookup list. In this example, the **Lookup list** field would be defined in the **Products** table.

Create a value list field in Design view

Value List

A **Value list** looks the same as a **Lookup list**, but consists of a fixed set of values you type in when you create it. A value list should only be used for values that will not change very often and don't need to be stored in a table. For example, a list for a **Salutation** field containing Mr., Mrs., or Ms. would be a good candidate for a value list. Choosing a value from a value list will store that value in the record. It doesn't create an association to a related table. For this reason, if you change any of the original values in the value list later, they will not be reflected in records added before this change was made.

1. Open the table in **Design view**.
2. To insert the field within the table, click in the row below where you want to add the field, and then click **Insert** → **Rows** on the toolbar.
3. To add the field to the end of the table, click in the first blank row.
4. In the **Field Name** column, type the name for the field, following Microsoft Access object-naming rules.
5. In the **Data Type** column, click the arrow and select **Lookup Wizard**.
6. In the first **Lookup Wizard** dialog box, click the option that indicates you will type in the values that you want.
7. Click **Next** and follow the directions in the remaining Lookup Wizard dialog boxes.

Note:

- When you use the **Lookup Wizard** to create a fixed value list[9], Microsoft Access sets certain field properties based on the choices you made in the wizard.

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[9] Value list field and form: once you've created the field, if you add it to a form, Microsoft Access copies its definition into the form. You won't have to create the value list definition for the form. However, if you change the definition of the value list field in the table after adding it to a form, those changes will not be reflected in that form. To correct this, delete the field from the form and then add it again.