

## Concepts of data and Databases

**Objectives :** At the end of this lesson you shall be able to

- explain database structure and control
- describe Ms access database utilities.

Microsoft Access is a Database Management System (DBMS) from Microsoft that combines the relational Microsoft Jet Database Engine with a graphical user interface and software-development tools. It is a member of the Microsoft Office suite of applications, included in the professional and higher editions.

- Microsoft Access is just one part of Microsoft's overall data management product strategy.
- It stores data in its own format based on the Access Jet Database Engine.
- Like relational databases, Microsoft Access also allows you to link related information easily. For example, customer and order data. However, Access 2013 also complements other database products because it has several powerful connectivity features.
- It can also import or link directly to data stored in other applications and databases.
- As its name implies, Access can work directly with data from other sources, including many popular PC database programs, with many SQL (Structured Query Language) databases on the desktop, on servers, on minicomputers, or on mainframes, and with data stored on Internet or intranet web servers.
- Access can also understand and use a wide variety of other data formats, including many other database file structures.
- You can export data to and import data from word processing files, spreadsheets, or database files directly.
- Access can work with most popular databases that support the Open Database Connectivity (ODBC) standard, including SQL Server, Oracle, and DB2.
- Software developers can use Microsoft Access to develop application software.

Microsoft Access stores information which is called a database. To use MS Access, you will need to follow these four steps:

- **Database Creation:** Create your Microsoft Access database and specify what kind of data you will be storing.
- **Data Input:** After your database is created, the data of every business day can be entered into the Access database.
- **Query:** This is a fancy term to basically describe the process of retrieving information from the database.

- **Report (optional):** Information from the database is organized in a nice presentation that can be printed in an Access Report.

### Architecture

- Access calls anything that can have a name an object. Within an Access desktop database, the main objects are tables, queries, forms, reports, macros, data macros, and modules.
- If you have worked with other database systems on desktop computers, you might have seen the term database used to refer to only those files in which you store data.
- But, in Access, a desktop database (.accdb) also includes all the major objects related to the stored data, including objects you define to automate the use of your data.

### RDBMS

In the computing system (web and business applications), there are enormous data that comes out every day from the web. A large section of these data is handled by Relational database management systems (RDBMS). The idea of relational model came with E.F.Codd's 1970 paper "A relational model of data for large shared data banks" which made data modeling and application programming much easier. Beyond the intended benefits, the relational model is well-suited to client-server programming and today it is predominant technology for storing structured data in web and business applications.

### MS Access - RDBMS

Microsoft Access has the look and feel of other Microsoft Office products as far as its layout and navigational aspects are concerned, but MS Access is a database and, more specifically, a relational database.

- Before MS Access 2007, the file extension was \*.mdb, but in MS Access 2007 the extension has been changed to \*.accdb extension.
- Early versions of Access cannot read accdb extensions but MS Access 2007 and later versions can read and change earlier versions of Access.
- An Access desktop database (.accdb or .mdb) is a fully functional RDBMS.
- It provides all the data definition, data manipulation, and data control features that you need to manage large volumes of data.

- You can use an Access desktop database (.accdb or .mdb) either as a standalone RDBMS on a single workstation or in a shared client/server mode across a network.
- A desktop database can also act as the data source for data displayed on webpages on your company intranet.
- When you build an application with an Access desktop database, Access is the

## RDBMS.

### Data Definition

Let us now understand what Data Definition is:

- In document or a spreadsheet, you generally have complete freedom to define the contents of the document or each cell in the spreadsheet.
- In a document, you can include paragraphs of text, a table, a chart, or multiple columns of data displayed with multiple fonts.
- In spreadsheet, you can have text data at the top to define a column header for printing or display, and you might have various numeric formats within the same column, depending on the function of the row.
- An RDBMS allows you to define the kind of data you have and how the data should be stored.
- You can also usually define rules that the RDBMS can use to ensure the integrity of your data.
- For example, a validation rule might ensure that the user can't accidentally store alphabetic characters in a field that should contain a number.

### Data Manipulation

Working with data in RDBMS is very different from working with data in a word processing or spreadsheet program.

- In a word processing document, you can include tabular data and perform a limited set of functions on the data in the document.
- You can also search for text strings in the original document and, with ActiveX controls, include tables, charts, or pictures from other applications.
- In a spreadsheet, some cells contain functions that determine the result you want, and in other cells, you enter the data that provides the source information for the functions.
- An RDBMS provides you many ways to work with your data. For example,
- You can search a single table for information or request a complex search across several related tables.
- You can update a single field or many records with a single command.

- You can write programs that use RDBMS commands to fetch data that you want to display and allow the user to update the data.

Access uses the powerful SQL database language to process data in your tables. Using SQL, you can define the set of information that you need to solve a particular problem, including data from perhaps many tables.

### Data Control

Spreadsheets and word processing documents are great for solving single-user problems, but they are difficult to use when more than one person needs to share the data.

- When you need to share your information with others, RDBMS gives you the flexibility to allow multiple users to read or update your data.
- An RDBMS that is designed to allow data sharing also provides features to ensure that no two people can change the same data at the same time.
- The best systems also allow you to group changes (which is also known as transaction) so that either all the changes or none of the changes appear in your data.
- You might also want to be sure that no one else can view any part of the order until you have entered all of it.
- Because you can share your Access data with other users, you might need to set some restrictions on what various users are allowed to see or update.

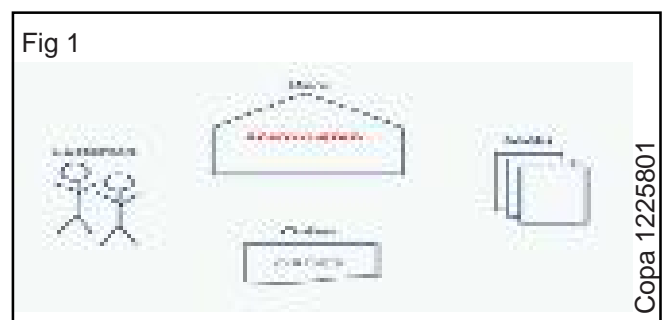
### Designing a Database

The first step in creating a database is to think about why you need it-what is its purpose? Once you know the answer, you can begin designing your own database. Ask yourself questions like What kinds of information will it store? How will I have to break down this information so it can be stored in my database? How will I use the data once it's in there?

#### The bookstore scenario

The best way to learn about designing a database is to jump right in to the process. Let's pretend we work for the bookstore, and we need to build a database for the store to use. Let's think about what we might need the database to do for us.

The following diagram shows that we have **customers** and sell **books** via **orders**, both in the store and online.



The store needs a way to keep track of these things.

## Determine the purpose of the database

The first step of designing a database is to determine the purpose of the database. What do we need it to do?

At Ready-2-Read, our customers will place orders for books. At the very least, we will want our database to track the books we sell, the customers we sell them to, and the date of each of the orders.

The database will also be able to tell us where our customers live when we need to send them books or coupons. Additionally, we can use it to track our sales or to make a bestseller list to post in the store.

## Plan database tables

Once we've established its purpose, we can begin about how to break up the information into the tables the database will need to store data. Recall that a table is a collection of records, and each record is broken up into the smallest pieces of needed information, called fields.

Because we're planning a database to track our customers, the books we have, and the orders our customers place, we will need a table for each one of these.

- Customers
- Orders
- Books

## Plan table fields

Once you know what tables you need, the next step is deciding what fields belong in each table. Remember that fields are the smallest chunk of information in any record.

Let's look at our Ready-2-Read bookstore example again. There will be several fields in our Customers table. We'll obviously want each customer's first name and last name. We'll also need an address if we need to send a customer his order. Email will be necessary if we need to contact the customer if there is an issue with the order.

Customers	Books	Orders
First Name	Title	Customer
Last Name	Author First	Book
Street	Author Last	Date
City	Price	
State	Category	
Pin/Zip Code		
Email		

We will also need several fields in the Books table. Title and Author make sense for books. We'll need a Price for each book. Category will help us know what type of books sell the best so we can order more books that fit into this category.

The Orders table will have fewer fields. We'll need this table to track the Customer who is placing the order, the

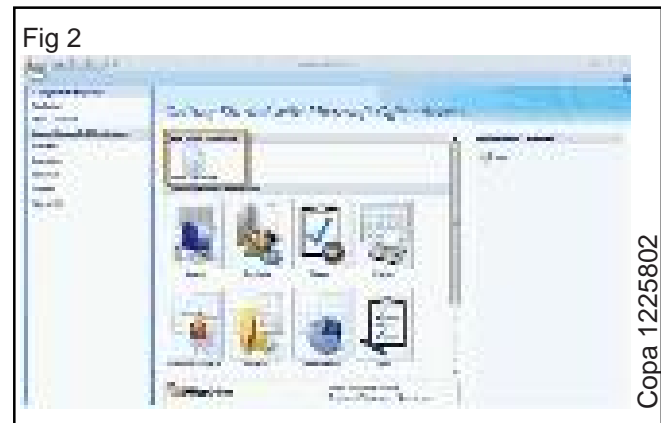
Book the customer is ordering, and the Date the order is placed.

## Creating a new database with Access

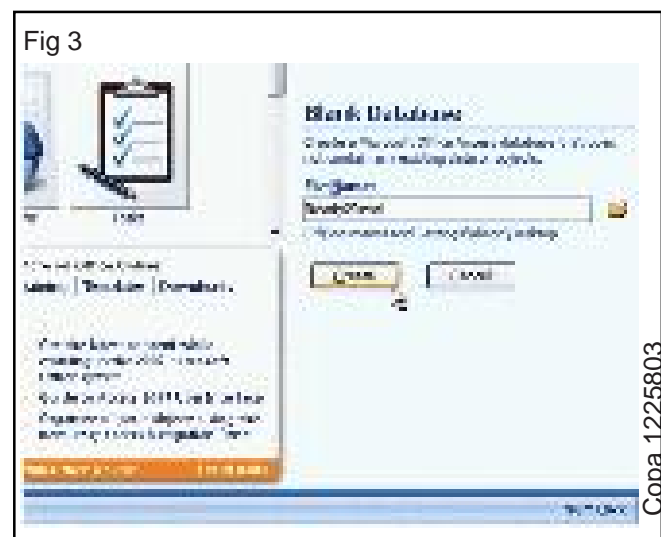
When you launch Access 2007/2010, you will see the Getting Started window.

In the left pane, the template categories-including the featured local templates-are listed, as well as the categories on Office Online. Templates are prebuilt databases focused on a specific task that you can download and use immediately.

You will also see the New Blank Database option, which allows you to build your own database from scratch.



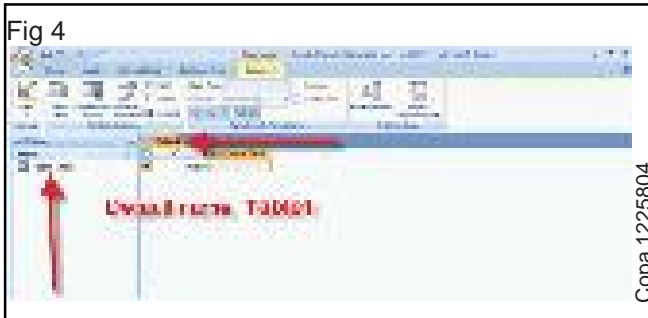
When you choose the New Blank Database option at the top of the window, you will be prompted to rename the database from the default name, which is Database1.accdb. Rename the database whatever you want. In the example below, we named the database Ready2Read because it's the name of the store in our scenario.



Click Create to finish naming the database.

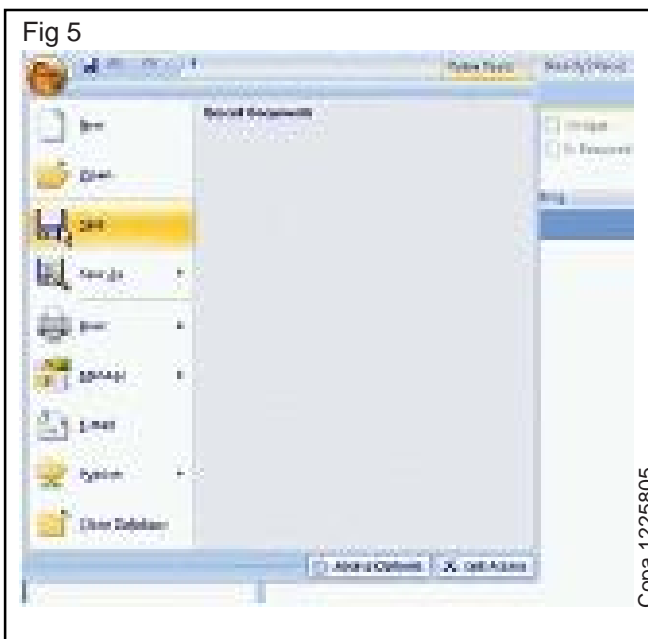
## Setting up tables

The new database opens with one table showing as a default. It also defaults to naming this table Table1 in both the navigation pane and the Table tab itself. You will want to name your tables based on your database design plan.

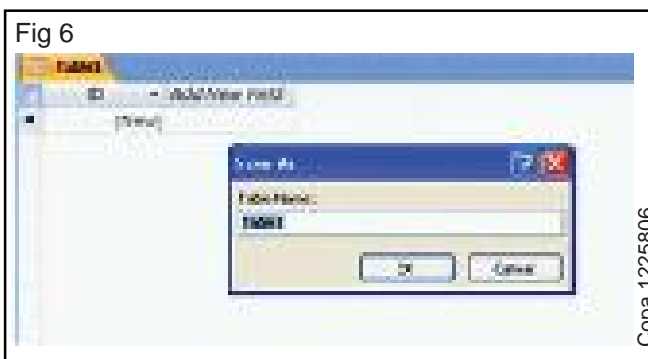


### Naming a table

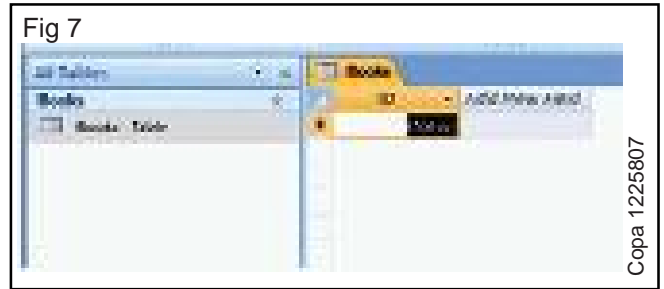
To give the table a unique name, you must first click on the Microsoft Office button in the upper-left corner of the application.



Next, select Save from the menu. The Save As dialog box will appear to let you save the table whatever name you want.



The new table names appear in both the navigation pane and the Table tab itself, as you can see in the picture below.



**TIP:** Give your tables logical, easy-to-understand names.

### To rename a table:

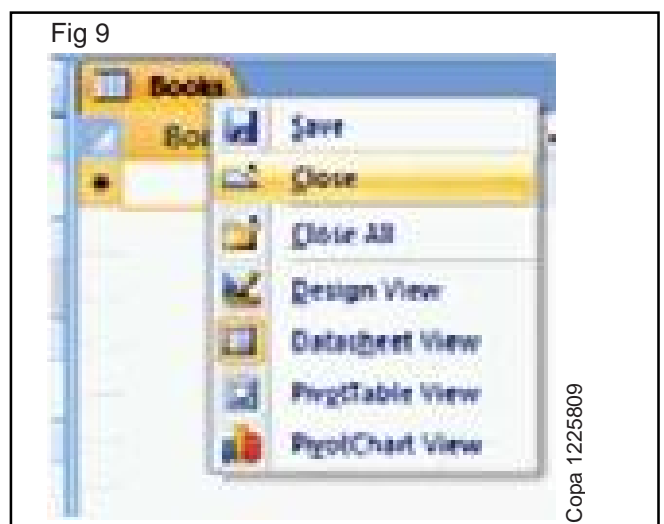
With the table closed, right-click the Table you want to rename in the navigation pane. Select the Rename option that appears in the menu.



The table name will be highlighted and a cursor will appear, which means you can now type the new name right there. Left-click anywhere outside of the table name to make the change.

### To close a table:

There are several ways to close an active table. You can right-click the Table tab and choose Close from the menu.



A more common method is to click the X that appears in the top-right corner of the active database object window.



**To open a table:**

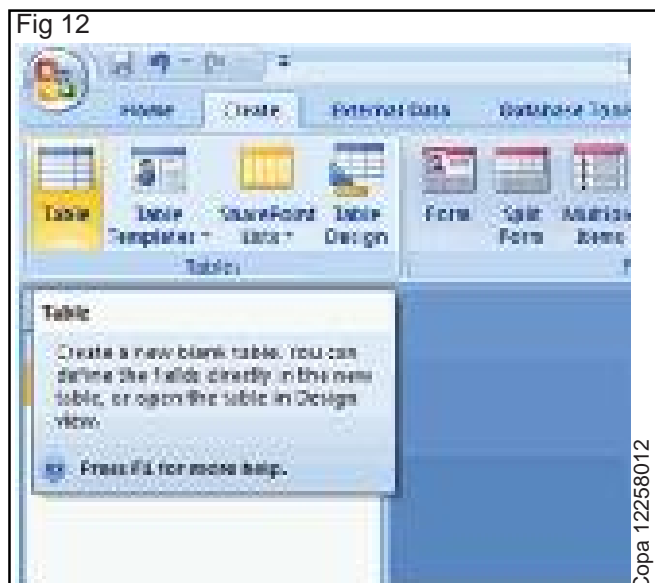
To open a table, right-click the Table name of the table you want to open in the navigation pane, then choose Open from the menu.



A more common method is to double-click the table name in the navigation pane. The selected table will open in the active database object window.

**Adding more tables to the database**

By default, Access 2007 starts out with one table. To add more tables to the database, click the Create tab on the Ribbon.



Next, select Table from the Tables command group. A new table will open in the active database object window. You must name your table using the Save command from Microsoft Office menu.

**Adding fields to a table**

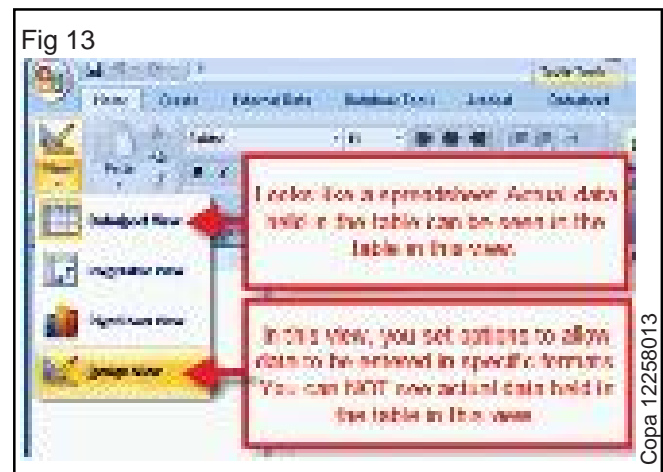
Access 2007 allows you to add fields to tables when you are:

- Working in Datasheet view, which looks like a spreadsheet
- Working in Design view, where you are able to set more controls for your fields

Either way, you need to know how to switch between the two views.

**To switch views:**

Select the Views command group from either the Home tab (seen below) or the Datasheet tab on the Ribbon. Select the view option you want from the menu.

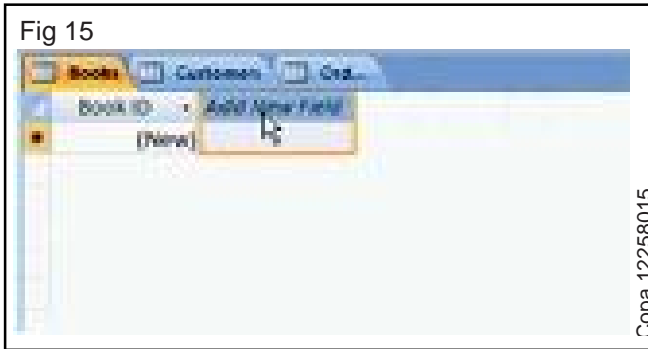


**Adding fields in Datasheet view**

By default, Access 2007 creates one field in each new table: the ID field. This field auto-numbers to give each record in the table a unique number identifier. Recall that records are the rows in a table. You may want to rename the ID field with a unique name because the ID field appears automatically in every table you create. While this is not necessary, it may help avoid confusion when setting up table relationships.



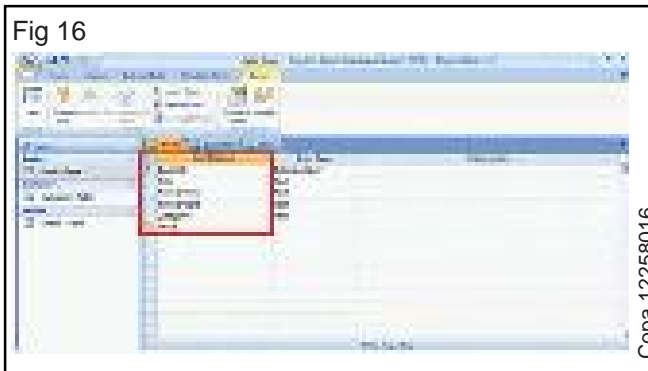
To add more fields to a table in Datasheet view, double-click the Add New Field header.



The Add New Field text will disappear from the header. Name the field by typing the name directly into the header. Press the Tab key on your keyboard to move to the next field.

### Adding fields in Design view

In Design view, the field names are along the lefthand column instead of across the top like in Datasheet view, as seen below.



To add a new field to a table in Design view, click in the cell where you want the new field and type the field name. When you switch back to Datasheet view, your new field appears as its own column, as seen below.



### Datatypes

Every field in a table has properties and these properties define the field's characteristics and behavior. The most important property for a field is its data type. A field's data type determines what kind of data it can store. MS Access supports different types of data, each with a specific purpose.

- The data type determines the kind of the values that users can store in any given field.
- Each field can store data consisting of only a single data type.

Here are some of the most common data types you will find used in a typical Microsoft Access database.

Type of Data	Description	Size
Short Text	Text or combinations of text and numbers, including numbers that do not require characters. calculating (e.g. phone numbers).	Up to 255
Long Text	Lengthy text or combinations of text and numbers. characters.	Up to 63, 999
Number	Numeric data used in mathematical (16 bytes if set to calculations. Replication ID).	1, 2, 4, or 8 bytes
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.	8 bytes.
AutoNumber	A unique sequential (incremented by 1) number or random number assigned by set to Replication Microsoft Access whenever a new record is ID). added to a table.	4 bytes (16 bytes if
Yes/No	Yes and No values and fields that contain only one of two values (Yes/No, True/False, or	1 bit.

Here are some of the other more specialized data types, you can choose from in Access.

Data Types	Description	Size
<b>Attachment</b>	Files, such as digital photos. Multiple files can be attached per record. This data type is not available in earlier versions of Access.	Up to about 2 GB.
<b>OLE objects</b>	OLE objects can store pictures, audio, video, or other BLOBs (Binary Large Objects)	Up to about 2 GB.
<b>Hyperlink</b>	Text or combinations of text and numbers stored a	Up to 8,192 (each part of a Hyperlink data type can contain up to 2048 characters).
<b>Lookup Wizard</b>	<p>The Lookup Wizard entry in the Data Type column in the Design view is not actually a data type. When you choose this entry, a wizard starts to help you define either a simple or complex lookup field.</p> <p>A simple lookup field uses the contents of another table or a value list to validate the contents of a single value per row. A complex lookup field allows you to store multiple values of the same data type in each row.</p>	Dependent on the data type of the lookup field.
<b>Calculated</b>	You can create an expression that uses data from one or more fields. You can designate different result data types from the expression.	You can create an expression that uses data from one or more fields. You can designate different result data types from the expression.



## MS Access - Adding Data

### Adding records to tables

When you enter records into your table, you are populating the database. In Access 2007, you can do this a few different ways.

#### To add records in the new record row:

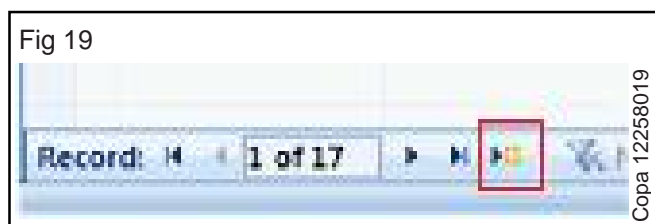
- Click the record row with the asterisk that appears at the bottom of the table.



- Type the data into the appropriate fields.
- Hit Enter or the Tab key to move to the next field.

#### To add records with the New Record navigation button:

- Click the New Record button in the navigation bar. The navigation bar is located in the bottom-left corner of the open object pane.



- Type data into the appropriate fields.
- Hit Enter or the Tab key to move to the next field.

#### To add records with the New Record command:

- Click the New Record command in the Records group in the Ribbon.



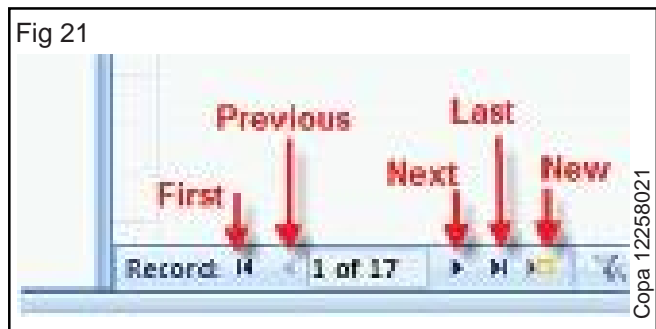
- Type the data into the appropriate fields.
- Hit the Enter or the Tab key to move to the next field.

### Editing records in tables

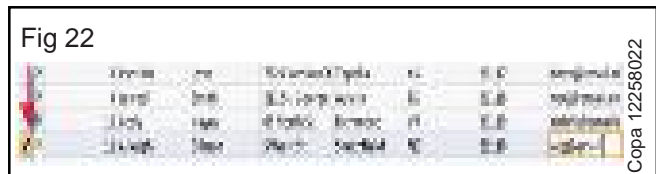
Sometimes it is necessary to edit records in the database. Like with every other task in Access 2007, this can be done several different ways.

#### To edit a record directly:

- Scroll through the records, or use the navigation buttons on the navigation bar to find the record to edit.



- Click the cell containing the information that must be edited. A pencil icon appears to indicate edit mode.



- Type the new information into the field.
- Click outside of the record row to apply the change.

#### To edit a record using Find and Replace:

- Click the Find command in the Find group on the Ribbon.



- The Find and Replace dialog box opens.



- Tell Access what to find by typing it into the Find What: area.
- Type the replace term in the Replace With: area.
- Tell Access where to look with the Look In: drop-down list. The first choice in the drop-down list is the field you were last in within the table.
- Tell Access what to Match: Any part of the field, the whole field, or just the start of the field.
- Tell Access how to Search: Up finds records above the cursor, Down finds records below the cursor, and All searches all records.
- Click one of the action options:
  - Find Next will find the next instance of the word in the table.

- Replace will put the new word into the table, overwriting what is currently there.
- Cancel stops the editing process.

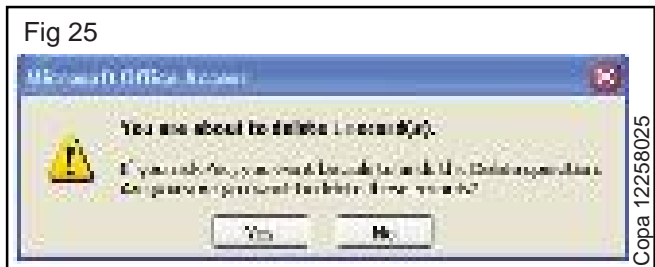
**CAUTION:** DO NOT use Replace All because it will overwrite every instance of the Find term in the table, which can have a serious impact on your data.

**To copy and paste a Record:**

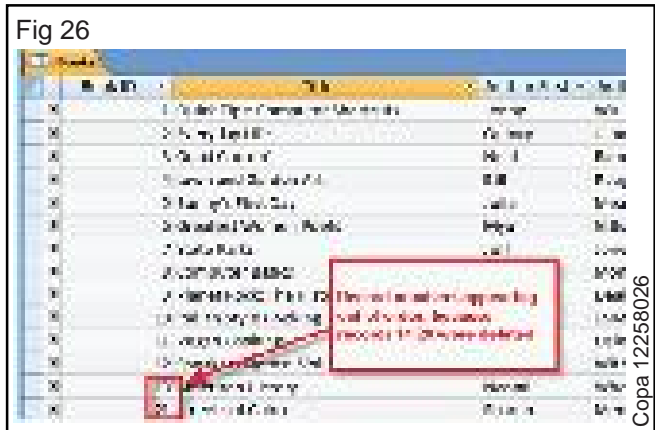
- Select the record you want to copy. Right-click, then select Copy.
- Select the new record row. Right-click and select Paste. The record information appears with a new record ID number.

**To delete a record:**

- Select the record you want to delete, then right-click and select Delete Record.
- A dialog box appears, telling you the action cannot be undone and asking if you are sure you want to delete the record.



There may be other records that rely on the record you are trying to delete. DO NOT delete a record without knowing how it will impact the rest of your database.



When you delete a record, the record number is permanently deleted from the database table. If you delete the last record from a table and then add a new record, your new record numbers will appear to be out of sequence.

**Data validation**

Data validation is an important database concept. It is the process by which Access tests the data that is being entered into the database to make sure it is in an acceptable-or valid-format.

Let's say one of your database users has entered an order date of January 4, 2008, in the month/date/year format as 01/04/2008. Another user has entered an order placed on that same date in the day/month/year format as 04/01/2008. If the database is tracking all sales for the month of January 2008, it may not show both orders as placed in January, even though both were placed on the same date.

Access 2007 allows you to set **field properties** and **data validation** rules to force the person entering data to follow a specific format.

**Data types and validation rules**

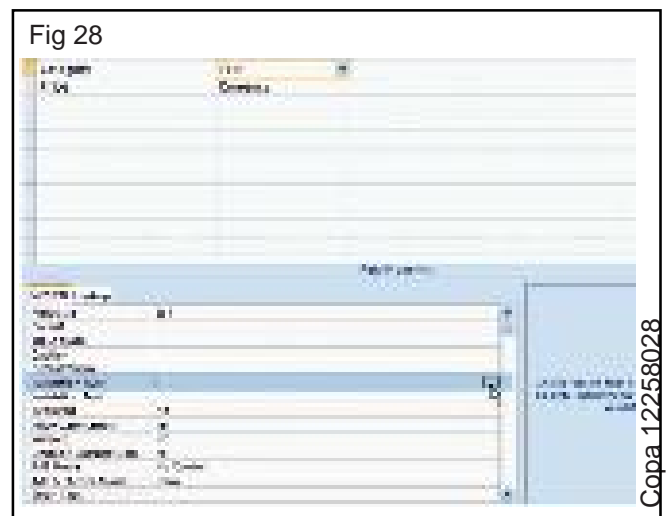
Data validation begins when data types are set during the process of building tables and fields. For example, if a field data type had been set to Currency and a text value is entered in that table field during data entry, Access will not accept an invalid format and will display a validation error, like the one below.

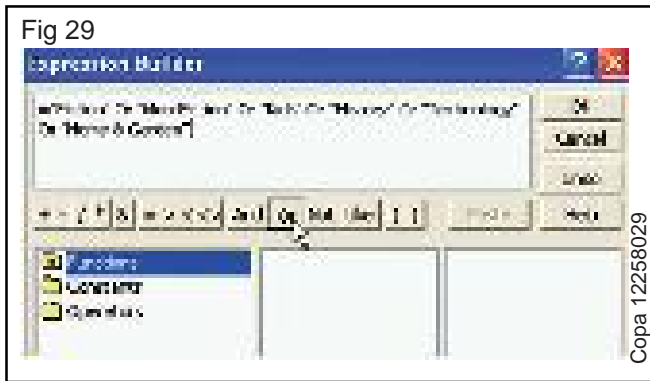


Data validation is accomplished by setting data validation rules and other field properties for various fields.

**To set data validation rules:**

- In Design view, highlight the field that requires a validation rule.
- In the Field Properties section at the bottom half of the window, set your validation rule using the Expression Builder. The Expression Builder offers common syntax to set up a data validation rule.





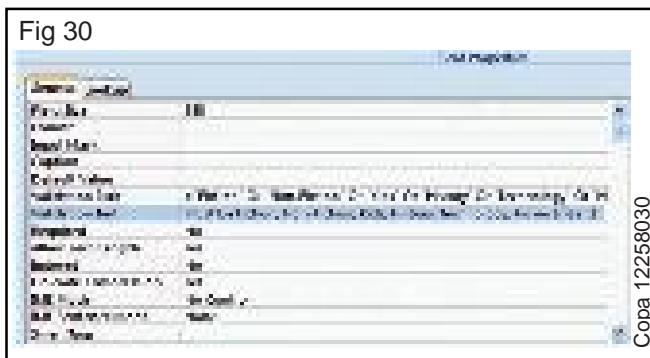
Copa 12258029

Validation rules work most easily with numerical fields. Rules for text fields require you to enclose each acceptable value inside its own quotation marks, separating them with Or, as seen above.

**Validation text**

Validation text is a specialized error message you can set to have Access tell the user entering data the specific way you want that person to enter it.

To set the validation text, enter the error message exactly as you want it to appear to users in the row directly beneath the Validation Rule row in the Field Properties section of Design view. For the validation rule we set for Category, you'd set the validation text like this:



Copa 12258030

The image below shows the resulting error message users would see when the Category validation rule has been broken.



Copa 12258031

**Using field properties to ensure data integrity**

Another way to ensure data integrity is by setting field properties such as Field Size, Format, and Required.

- Field Size can be set to hold a specific number of characters, up to as many as 255 for text fields. If you were using a text field to hold the two-letter state postal abbreviation, the field size could be set to 2 to ensure no one enters a full state name into this field.
- The Format field property can be set to display text or numbers in a standardized way. For example, text can be set to show as all uppercase, and numbers can be set to show scientific numbers, percentages, or decimals.
- Set the Required property to Yes if you want users entering data to be required to enter something in the field. Choose No if users are allowed to leave the field blank.

These are just some ways Access helps you ensure data being entered into your database is valid.