Database Design 1 Reference

1. Background to Databases

1.1 What is a Database?

"A database is a collection of related information"

An efficient database holds data independently of the programs, which process the data. A Database Management System (DBMS) manipulates the data and avoids the need for each program to manage its own data.

Ideally, all the data possessed by an organisation is considered as a whole and is structured in such a manner so that data is entered **once and stored in one place**. Database interfaces then make this data available to all programs. In essence, a database is any collection of data which has been organised so that it is retrievable.

Typically databases are highly structured although, in general terms, hypertext systems and text retrieval may be considered as free format databases. In this course only fixed format record type databases will be considered. Students should be aware that there are systems such as PICK which are databases but do not have fixed format records.

Data should not be duplicated. It must be stored in one place so that it is easy to access and update. In the real world, data is also stored on backup media to guard against accidental erasure.

Modern client-server systems may distribute the data over a number of file servers but, to the user, all the data appears to be located in one place.

1.2 Database Facts

Why do we need databases?

- To store large volumes of information efficiently.
- To retrieve information quickly.
- To enable computerised processing of information.
- To maintain data easily.
- To maintain data consistency by eliminating redundancy.
- To achieve device independence.
- To obtain consistent documentation.

Types of Databases

There are two main types of database:

- the simple flat file model such as a card index
- relational database - a database comprising a number of linked tables.

1.3 Extra Information - Databases

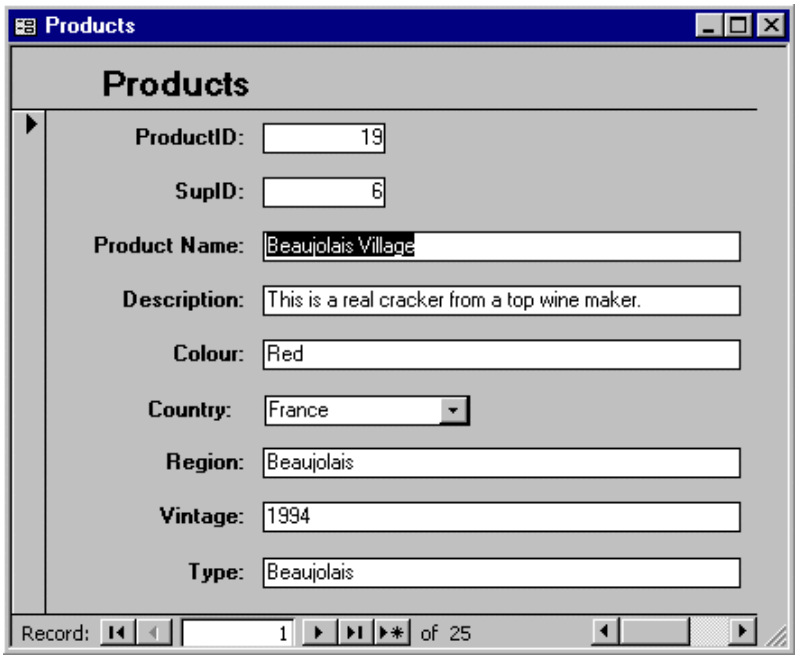
- Text retrieval systems apply database techniques of indexing and should probably be considered as a third type of database.
- Virtually all the modern PC based databases such as Paradox, Dbase IV, Access (the database tool set use in this course) are relational.
- SQL databases (such as Oracle, SQL Server, Informix etc) are all relational. SQL is the language used to program queries and reports from the database information.
- Xbase language products (such as Dbase IV, Recital etc) all use a common language that is very different from the SQL language.
    - The Pick language is also used in a small but significant market segment and appears in such products as Pick, Universe and others.
    - Client / Server - this refers to the implementation of the database system and not its functionality. However Client / Server implementation will normally be highly complex systems which will be relational and currently mainly SQL based.

1.4 Database Terminology

field the smallest complete unit of data in the database.

record a collection of fields with data in them.

form defines the layout of some or all the fields that make up a record as presented on screen. Note there can be a number of forms displaying record information from one database. Forms are used both for the entry and display of data. Users with lower security access to a given database may be presented with forms having a limited number of fields displayed.



file or table collection of records defined with the same structure - may appear as a DOS file in Database engines such as Dbase IV and Paradox. Note that in Access, the individual tables and forms are not visible from the Windows level.

database a collection of tables which may be related via reference codes or merely related as they hold data concerning different aspects of the business. In Access, a database consists of one Windows file only which has a very complex internal structure.

DBMS software which makes it easier to use a database.

query a query is used to interrogate, sort, search and select records from a database.

entity An entity is something that your computer system will store information about (such as a person, product or place). Facts about an entity are normally stored in a table.

normalisation The process of splitting complex tables into small stable units of data that are related by common fields. This cuts down on data repetition and ensures data integrity and security.

2. Database Design Process

2.1 The Importance of Database Design

In relational databases (RDBMS), such as those created using Microsoft Access, you store information about different subjects in separate tables. To bring the information together in a meaningful way, you then tell Microsoft Access how the different subjects relate to each other.

A successful database relies totally on its design and, although designing and planning a database can be time-consuming and difficult, in the long-term the initial hard work pays off.

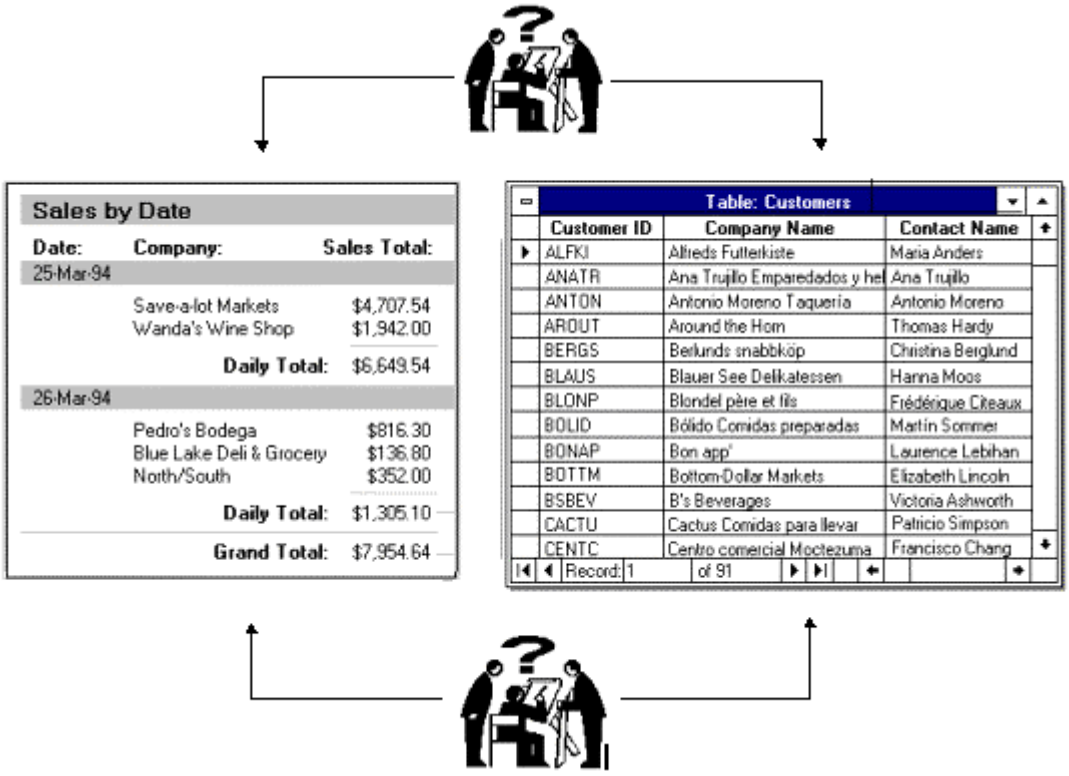
Each database application should be built by following a clear and comprehensive design specification. Although this may change slightly as the database develops, any changes should be minor. The final specification blueprint should be uncomplicated and easy-to-follow so that others involved in using or developing the database can pick up on any element from start to finish.

Collaborative team work is an essential part of the database design process - from the operator inputting the data to the manager querying the information and producing database reports.

In a nutshell, the key to good design lies in the planning and information-gathering stage, basically the design process can be broken down into 6 steps:

1. Determine the ***purpose*** of the database so you can decide what facts need to be stored.
2. Sketch out any **reports** you'd like to produce and gather any **forms** that might currently be used to record data.
3. Determine the ***tables***. Divide the information into separate subjects, such as staff or projects. Each subject will be a table in the database.
4. Determine the ***fields***. Decide what information is needed for tables in your database.
5. Determine the ***relationships***. Look at each table and work out how the data in it is related to the other tables. Create new tables where necessary to clarify relationships.
6. Refine the ***design***. Create the tables and add sample data to test your design

2.2 The Database Design Process



3. Access Overview

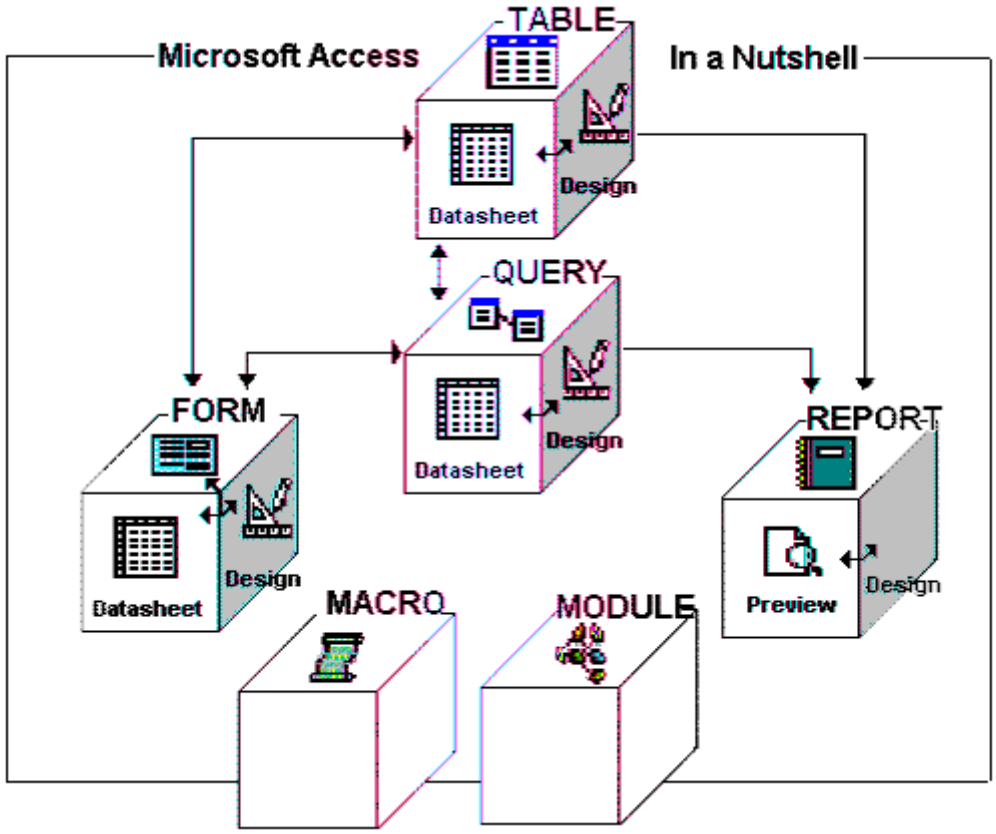
3.1 Microsoft Access Database Objects

Microsoft Access can contain **6** types of database objects:

1. **Tables** - To store data.
2. **Queries -** To gather data you request from table/s and then view, edit or print the results.
3. **Forms** - To display the data from tables or queries so you can view, edit or enter data.
4. **Reports** - Summarise and present data from tables and queries so you can print it or analyse it.
5. **Macros -** Automate your database by performing actions you specify without the need of programming.
6. **Modules** - To store Visual Basic code you can write to customise, enhance and extend your database.

The illustration that follows offers a visual overview of Microsoft Access and the diagram gives a 3-dimensional view of the database. For example, a **Table** or **Query** can be manipulated as a **Datasheet** or worked with in **Design** mode - the more you work with Access, the clearer this concept will become.

3.2 Microsoft Access Overview



4. Creating Databases

4.1 Microsoft Access Naming Conventions

The **Database** (.mdb) file: Use a name that is unique, short and descriptive. Microsoft Access will automatically add a .mdb extention.

Names of fields, controls, and objects:

- Can be up to 64 characters long.
- Can include any combination of letters, numbers, spaces, and special characters except a period (.), an exclamation point (!), an accent grave (`), and brackets ([ ]).
- Can't begin with leading spaces.
- Can't include control characters (ASCII values 0 through 31).

Although ***you can include spaces*** in field, control, and object names, most examples in the Microsoft Access documentation show field and control names without spaces because spaces in names can produce naming conflicts in some circumstances.

When you name a field, control, or object, it's a good idea to make sure the name doesn't duplicate the name of a property or other element used by Microsoft Access; otherwise, your database can produce unexpected behaviour in some circumstances.

When naming Microsoft Access objects, try to give them meaningful names and include a prefix code letter for that object. For example:

tblSuppliers - the Suppliers Table

qrysuppliersMainForm - a query used as a base for the Suppliers Main Form

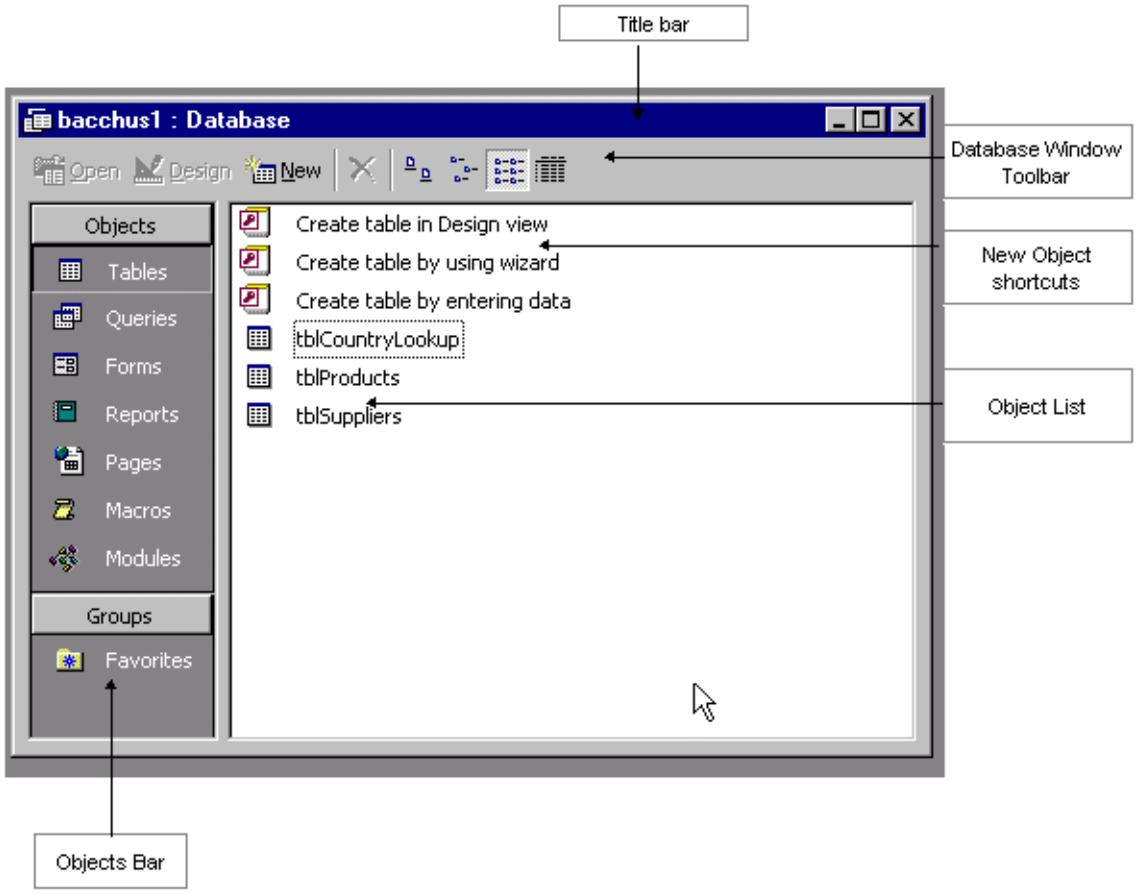
frmSuppliersAndProducts - a form displaying Suppliers and product details

rptSalesOrdersByWineType - a report displaying wine details grouped under wine type.

4.2 Database Window

Every time you create or open a database you will see the Database Window. Think of this window as your command centre as it is from here that you will create, modify and open the objects (tables, forms, etc.) in your database.

Database Window:



The parts of the database window are labelled in the figure above.

1. **Title Bar** Shows the name of the open database.
2. **Objects bar** You use the Objects bar on the left-hand side of the window to choose the type of object you want to display. For example, click Forms to display a list of the forms in the open database.
3. **Object List** Select the object (table, query, etc) you want from the displayed list. The figure above shows the Tables list for the Bacchus database.
   The New Object shortcuts above the list provide a quick way to create a new object of the selected type.
4. **Database Window Toolbar**Use the buttons on the toolbar to open the selected object in a particular view, to create a new object of the current type or delete a selected object. For example, click the **Design** button to open an object in Design view.
   The four buttons at the right hand end of the toolbar can be used to change the appearance of the object list.

5. Record Structures Revision

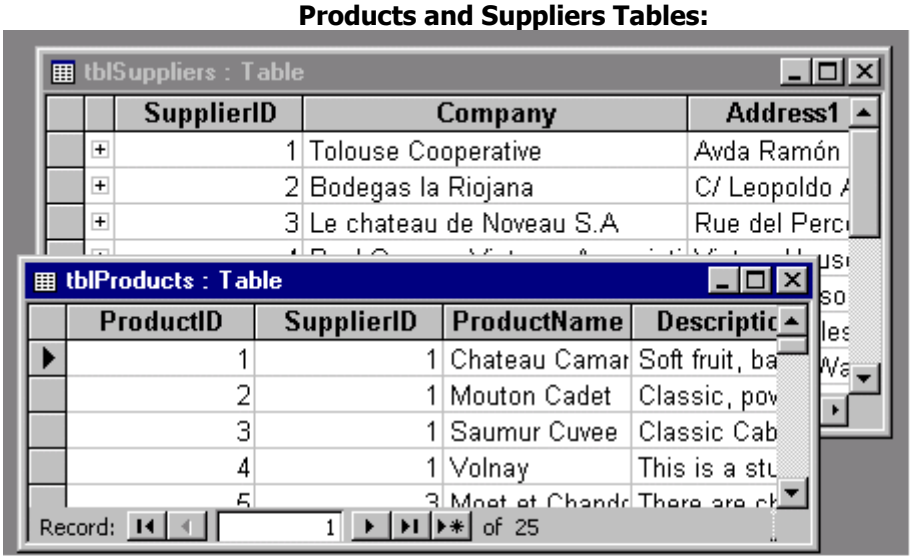
5.1 Tables

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. This makes your database more efficient and it also reduces the risk of data entry errors.

Tables organise data into columns (called fields) and rows (called records).

Tables consist of a large number of records. Each record describes the attributes of one instance of the entity. A Customer table, for example, contains one record for each customer.

Products and Suppliers Tables:



In the Suppliers table you enter a supplier ID, company name, and so on for each supplier. In the Products table you include the Supplier ID field, so that when you enter a new product , you can identify its supplier by entering that supplier's unique ID number. By matching the SupplierID in the Products and Suppliers tables, Access can bring the data from the two tables together for viewing, editing or printing.

5.2 Records and Fields

Records contain a number of fields which hold the values of the attributes of the entity represented in each record. The record for Toulouse Co-operative, for example, contains fields for the supplier ID, name, phone number, address, etc.

SupplierID	Company	Phone Number	Address1
1	Tolouse Cooperative	0101 314 567 6507	Avda Ramón

Fields are the smallest unit of the database and these fields are selected by the database designer to have the relevant DATA type and length. Fields that hold addresses or names will be character or string fields. Other common data types used are numeric, date/time, and memo.

Each field in a table contains the same type of information for every product. Using the Bacchus Product table as an example, the Description holds textual description, the Product ID a unique number, etc.

ProductName
Chateau Camarsac
Mouton Cadet

5.3 Extra Information - Field Types

alphanumeric strings specified by length of string, used for names, address, etc.

numeric fields - integer (Short numbers). Used for quantities of items order where absolute accuracy is required and the range of the numbers stored will be small i.e. 0 to 32000.

real number formats, length must include sign (if negative and decimal point). Therefore a field size of 8 with two decimals for pence can only contain a positive value up to one penny less than £100,000 or a negative value of 1 penny greater that £1000.

BCD (binary coded decimal) fields. These are used where large values must be stored with absolute accuracy - normal in financial transactions.

Currency field - only available in some databases. This maintains accuracy without the computational overhead of the BCD data type defined above.

logical fields - true / false or yes/no. Cannot be indexed in a number of databases.

dates - a special data field is needed so that if a number of days is added to given data field, the result will be meaningful. For example 31 days from 1 January is 1 February whereas 31 days from 1 February is not 1 March. The actual day will depend on whether the year is a leap year.

Memo fields - are used when a field will contain usage and restrictions. Formatted and non formatted memo fields. Formatted fields normally available in Windows based databases as they contain formatting information such as font, size, colour etc.

BLOB - binary large objects. These objects are sometimes further categorised as noted below:

- ***BINARY*** - (special BLOB) use for sound.
- ***GRAPHIC*** - (special BLOB) used for images. See the last field in Categories in the Northwind Traders database in Access sample databases.
- ***OLE*** - (special BLOB) Object linked embedded object - Only applies for Windows based databases.

6. Tables

6.1 Database Components

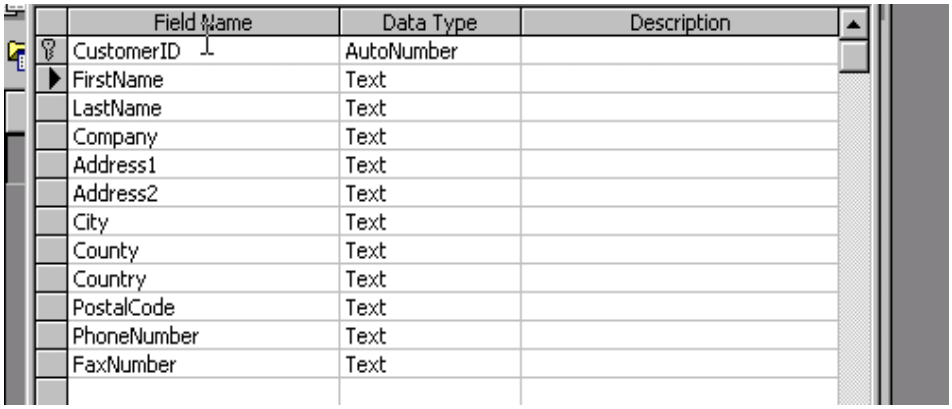
A database comprises:

1. Tables holding the information
2. Screens on which information is entered or displayed
3. Reports that may be printed or displayed showing information produced from the database.

6.2 Table Design

The tables are the prime responsibility of the database designer and should be designed to accommodate all the required information and the necessary links. These links are needed so that the various tables can be related together in order to provide the information in the format required by the organisation.

The following diagram is a simple Customer table designed in Access.



Field Name	Data Type	Description
CustomerID	AutoNumber	
FirstName	Text	
LastName	Text	
Company	Text	
Address1	Text	
Address2	Text	
City	Text	
County	Text	
Country	Text	
PostalCode	Text	
PhoneNumber	Text	
FaxNumber	Text	

Each text field in a table can be given a maximum length. These lengths must be specified carefully so that the space used by each record is **minimised** whilst catering for the maximum size of information to be stored. If fields are too big, not only is disk space wasted but the system is made slower because more information must be processed even though it is only blank spaces.

6.3 Working with Access Tables

A ***table*** is the fundamental structure of a relational database system. It consists of a collection of records about a particular category of information. For example, a table could be a list of staff, customers or a record of resources.

Fields are the building blocks of tables. Each field contains information about one aspect of the category, such as a last name, a part number, or a job title.

You will use the **Table object** to create and view tables of data. You can open a **Table** in either of two views:

1. In **Design view,** you can create and modify the structure of a table.
2. In **Datasheet view,** you can view, add, and edit data in a table.

While you work with Access objects (tables, queries, etc.) you can switch views at any time by clicking the relevant view icons on the object's toolbar:

 **Switching between Access Windows**

You can use the WINDOW menu to switch between open object windows or to move to the database window.

Use the Database Window toolbar button  **or press F11 to switch to the database window.**

6.4 Tables - Design View

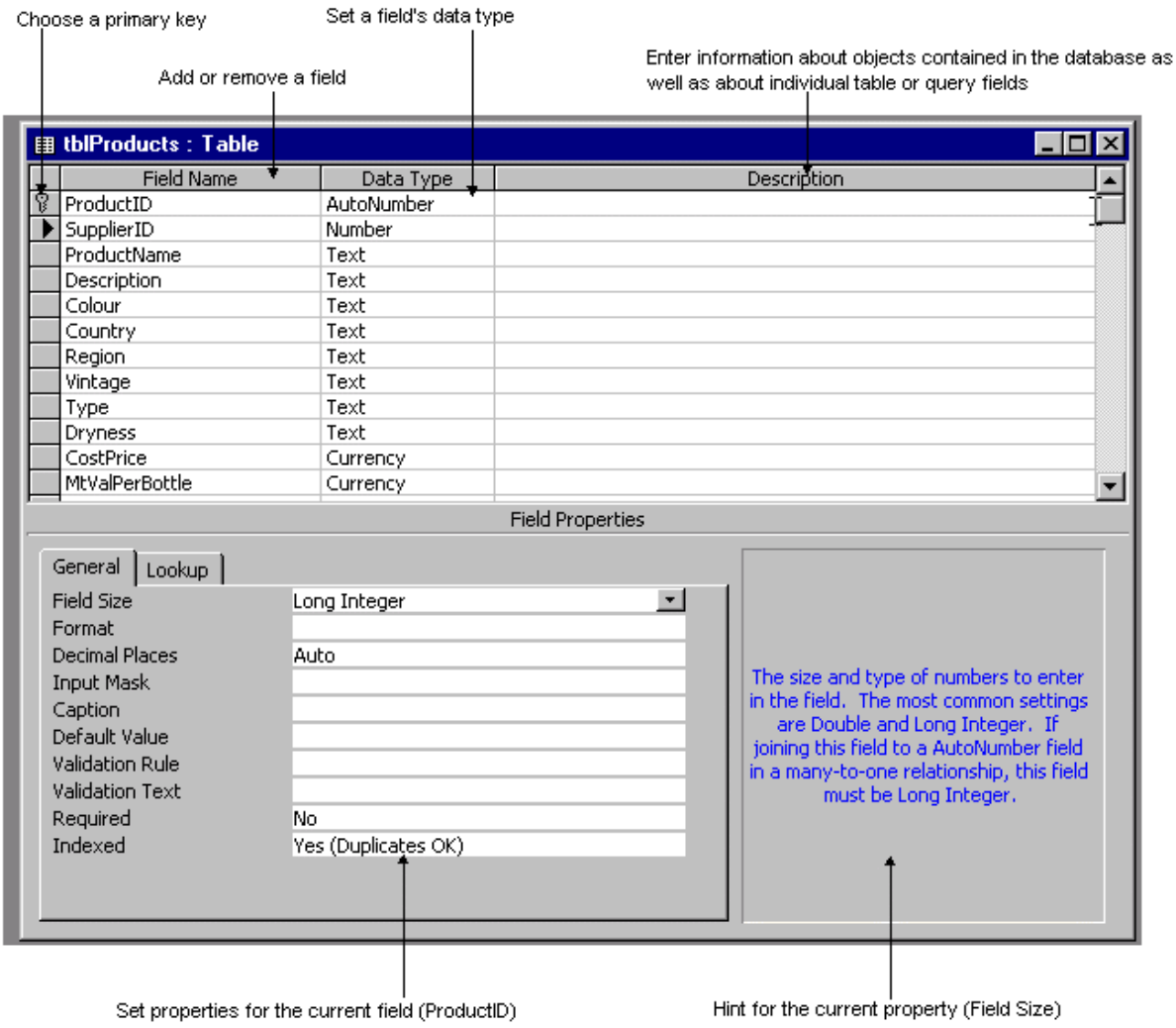
When you are working with a table and switch to **Design View** your screen will resemble the screen below. You can switch to **Design View** by clicking the **Design View** toolbar button  .

In the **grid in the upper part** of the window, you type the field name, select the field data type, and type a description of each field. (The description is optional.)

Under **Field Properties**, you can set properties for individual fields. The available options depend on the data type you define for the field.

At the **lower right**, Microsoft Access displays a description of the current column or field property.

(If you want more information about a particular property you can press the F1 key to display the Help topic associated with the current property.)



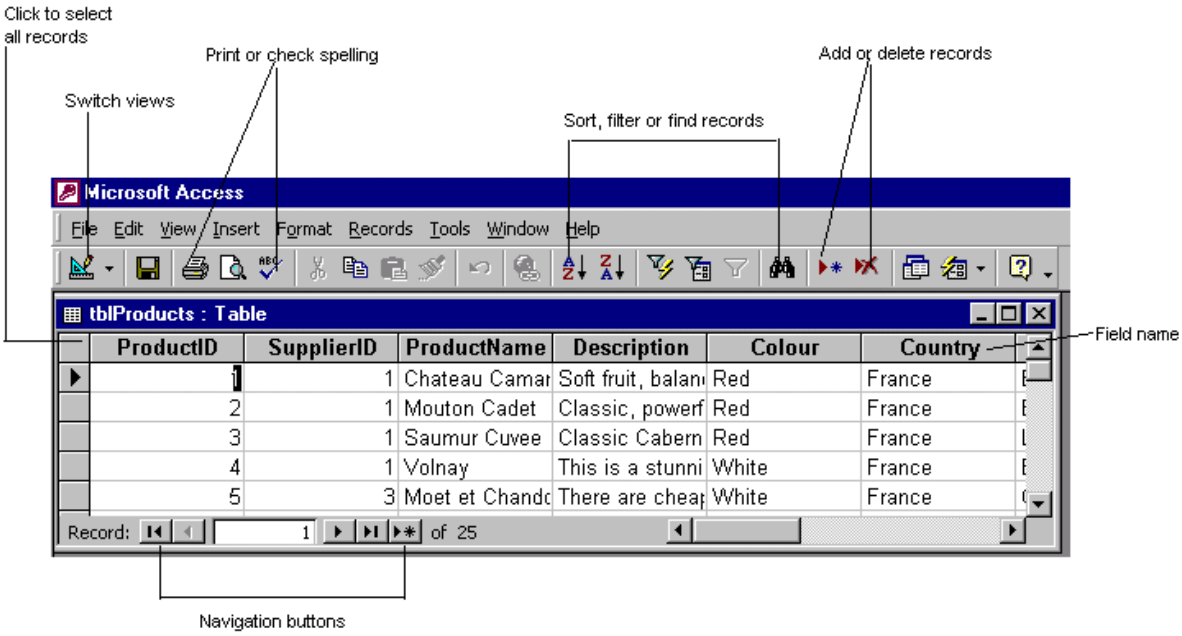
6.5 Tables - Datasheet View

A datasheet displays data in a **row-and-column** format similar to a spreadsheet. You can display a datasheet in a Table, Query, or Form window.

To display a datasheet you click the **Datasheet View** button  .

You can use a datasheet to add and edit data, although a form usually provides more flexibility for these operations. Field names appear as column headings in the datasheet.

To display records out of view you can use the vertical scroll bar, the Page Up and Page Down keys, or the navigation buttons. To display fields out of view, use the horizontal scroll bar.



6.6 Access Field Data Types

Every field must have a defined data type. The data type determines the kind and range of values that can be entered in a field and the amount of storage space available in the field. For example, you will probably define most fields in a table of names and addresses as **Text** fields. Even a phone number field that contains only digits should be defined as a **Text** field.

Data type	Use for...	Data type	Use for...
Text	Text and numbers, such as names and addresses, phone numbers and postal codes. A Text field can contain up to 255 characters.	**Currency**	Currency values. Don't use the Number data type for currency values because numbers to the right of the decimal may be rounded off during calculations. The Currency data type maintains a fixed number of digits to the right of the decimal.
Memo	Lengthy text and numbers, such as comments or explanations. A Memo field can contain up to 32,000 characters.	**Autonumber**	Sequential numbers automatically inserted by Microsoft Access. Numbering begins with one. Makes a good *primary key* field.

Number	Numerical data on which you intend to perform mathematical calculations, except calculations involving money. Set the FieldSize property to define the specific Number data type.	**Yes/No**	Yes/No, True/False, On/Off, or fields that will contain only one of two values.
Date/Time	Dates and times. A variety of display formats are available, or you can create your own.	**OLE Object**	Objects created in other programs using the OLE protocol that can be linked to or embedded in a Microsoft Access database through a control in a form or report.

6.7 Indexes

An ***index*** helps Microsoft Access find and sort records faster. Microsoft Access uses indexes in a table as you use an index in a book: to find data, it looks up the location of the data in the index. You can create indexes based on a single field or on multiple fields.

Multiple-field indexes enable you to distinguish between records in which the first field may have the same value.

You'll probably want to index fields you search frequently, fields you sort, or fields that you join to fields in other tables in queries. However, indexes can slow down some action queries such as append queries, when the indexes for many fields need to be updated while performing these operations.

6.8 Primary Key

The ***Primary Key***  is a field or combination of fields that uniquely identifies each record in a table. As the main index for the table, it is used to associate data between tables.

If a table doesn't include an obvious primary key field, you can have Access create a field (using the Autonumber data type) that assigns a unique number to each record.

6.9 Fields

- You can't ***index*** fields with the data types Memo, Yes/No, and OLE Object.
- The ***Autonumber*** data type is compatible with the Number data type with the FieldSize property set to **Long Integer**.
- ***Sorting***. With Microsoft Access, you can perform simple or complex sorts. *Simple* sorts allow you to sort all records in ascending or descending order. Complex sorts allow you to sort specified records in ascending order by some fields and in descending order by others.

6.10 Field Properties

Each field has a set of **properties** you use to specify how you want data stored, handled, and displayed. You set the properties in the bottom part of the **Table's Design** view. The properties you can set for each field are determined by the data type you select for the field.

You can display the Help topic related to a particular property by clicking the property and then pressing the F1 key.

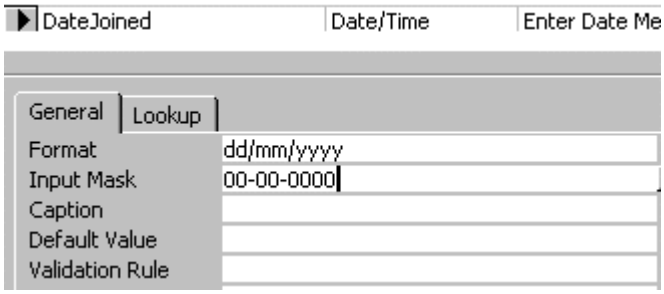
Property	Description
FieldSize	Maximum length of a text field or type of Number
Format	How data is displayed; use predefined formats or customise your own
DecimalPlaces	Number of places to the right of the decimal
InputMask	Formatting characters for data entry; use predefined masks or customise your own
Caption	Default field label in a form or report
DefaultValue	Value entered in a field when records are created
ValidationRule	Expression that defines data entry rules
ValidationText	Text that appears when invalid data is entered in the field
Required	Setting that defines whether data must be entered
AllowZeroLength	Setting that defines whether zero-length strings are permitted
Indexed	Single-field indexes to speed searches and sorting

6.11 Field Formatting

You can specify how data is displayed in a form or datasheet by defining formats for individual fields. You can select from predefined formats, such as Medium Date (displayed as 27-Jun-99) or create your own custom formats, such as **June 99**. By specifying formats, you can display data consistently throughout the database, regardless of how the data is entered.

Predefined formats are available for fields of the following data types: **Number, Currency, Autonumber, Date/Time**, and **Yes/No**. You can create custom formats for any field data type other than **OLE** Object.

Field format example:



6.12Adding Records

You can add a record to any table (including an attached table) using a form or datasheet. Microsoft Access automatically saves a new record when you move to another record or close the form or datasheet.

Records are added by doing one of the following:

- Select RECORDS / Data Entry
- Select EDIT Go To/New
- Press CTRL+PLUS SIGN
- Press the New Record button 

The data is then **typed in** the record.

To **move to a field** you can click with the **mouse** or pressing the **TAB**, **ENTER** or **ARROW** keys moves you on to the next field (pressing these keys after the last field will move you on to the next record).

 **Adding Records**

- If you used **RECORD Data Entry,** you can display **ALL** records again by selecting **RECORDS Remove Filter/Sort** command**.**
- To **add a few** existing records to a table you can use **EDIT Copy** or **EDIT Paste**.
- To **add many** existing records to a table you can create an **append query** or use **EDIT Paste Append.**

6.13 Saving Records

Microsoft Access automatically **saves** data in a record when the focus leaves it. For example, Microsoft Access saves a record when you move the focus to a different record; close the active form, datasheet, or database; or exit Microsoft Access. However, if you want to save the current record's data while the record has the focus, you can save record changes as you work using one of the methods shown below:

- Move to the next record or **change the focus**
- Choose **Save** from the **FILE** menu
- Press **SHIFT+ENTER**
- **Close** the form or datasheet

6.14 Selecting Fields and Records

As a rule, you always select the **fields** (columns) and **records** (rows) you want to work with first, and then you choose the operation you want to perform.

For example, to delete a record, select the record, and then choose **Delete** from the **EDIT** menu, or click the Delete button on the Toolbar (or press the **DEL** key).

To select:	Do this:
A single record	Click the record selector (marked with the green cross): 

Several records	Drag down the record selectors: 
All records	Choose Select EDIT All Records or click in the top left of this window (shown by the green cross): 
A single field	Click the field label: 

6.15 Editing Field Data

You can update records in an underlying table by editing the data in fields on a form or in a datasheet. Microsoft Access protects data from unwanted changes in:

- Counter, locked, and disabled fields
- Calculated controls
- Fields in locked records
- Fields in certain types of queries
- Fields in the underlying table that aren't included in the query or form you're editing.

To edit text and numeric data in a field you just click the field you want to edit, or move to it using the **TAB** or **ARROW** keys and edit the field contents.

6.16 Finding and Filtering Data

You can move to specific records in a table or dynaset by searching for specific text. To conduct a search you choose the **EDIT Find** command or press the ***Find Tool***  .

You can search for any text string, including a phrase, a word, or part of a word and you can use wildcards to make the search more general. (**NB:** Wildcard characters are used to replace characters in a string).

For the fastest searches you should search for the first characters within a single ***indexed*** field. If you are searching a non-indexed field repeatedly, index the field.

Because the ***Find*** dialog box remains on the screen during searches, you can find as many records as you want without having to choose the **Find** command repeatedly. If necessary, drag the box out of the way to see your records.

You should use a ***filter*** rather than the **Find** command if you want to isolate or sort specific records within the table. As with a query, a filter creates a **subset** of your records.

There are four methods you can use to filter records***: Filter By Selection, Filter For Input***, ***Filter By Form***, and ***Advanced Filter/Sort.***

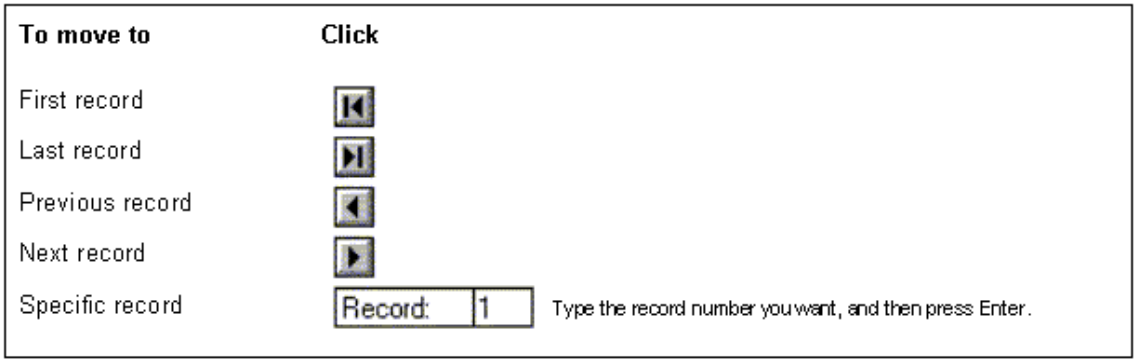
The use of ***wildcards*** is covered later in the section covered **Queries**.

Filters are covered in greater detail in the section covering **Forms**

6.17 Browsing Records

You can use the **RECORDS / Go To** command, the **UP** and **DOWN** arrow keys, **PAGE UP** and **PAGE DOWN**, or the **VERTICAL SCROLL BAR** to move between records in a datasheet or form. However, the most efficient way to move between records in large databases is with the ***navigation buttons*** in the lower-left corner of the window:

Navigation Buttons



6.18 Deleting Records and Data

You can delete a record from a table using a form or a datasheet. Records are deleted by first selecting the record(s) and then pressing **DEL** key (or **EDIT Delete**) to delete the selection. Microsoft Access always prompts you to confirm the deletion.

To delete records that meet specific criteria you can create a **delete query** or create a **filter** that includes only those records and then delete them.

When you delete records, you may want to delete **related data** in other tables, otherwise, your database will contain obsolete data that could be misleading.

 **Using EDIT CUT**

Removes the selected item and places it on the Clipboard so you can paste or insert it elsewhere. You can cut:

- A database object
- An action
- An OLE object
- Field or record data
- A control in Design view
- Text, including expressions/property of a form or report settings.

7. Importing External Data

From the **Database Window** you can use the **FILE Get External Data** command to transfer data from a text file, spreadsheet, or database table into a Microsoft Access table; or you can copy objects from another Microsoft Access database into the open database.

This Microsoft Access feature will prove invaluable to you if you have existing data in various formats which you want to use with Microsoft Access.

In order to show you how this feature works, we have chosen to use **Excel spreadsheets**. If you need to carry out such a process in the future and your data source is not Excel, you can refer to the **HELP** screens or user manual for guidance.

7.1 Importing External Data

If you import a table from another application or database, you may need to supply the **password** set in the other application.

If you're importing a **text file** or **spreadsheet**, and errors occur, Microsoft Access gives you the option to cancel. If you continue, it imports as many records as it can and creates a table called **Paste Errors** containing a description of each error that occurs.

After you import a table, it's a good idea to set **field properties** in the **table's Design view**. You'll also want to set a **primary** key for the table.

8. Relationships

" A database is a collection of related information "

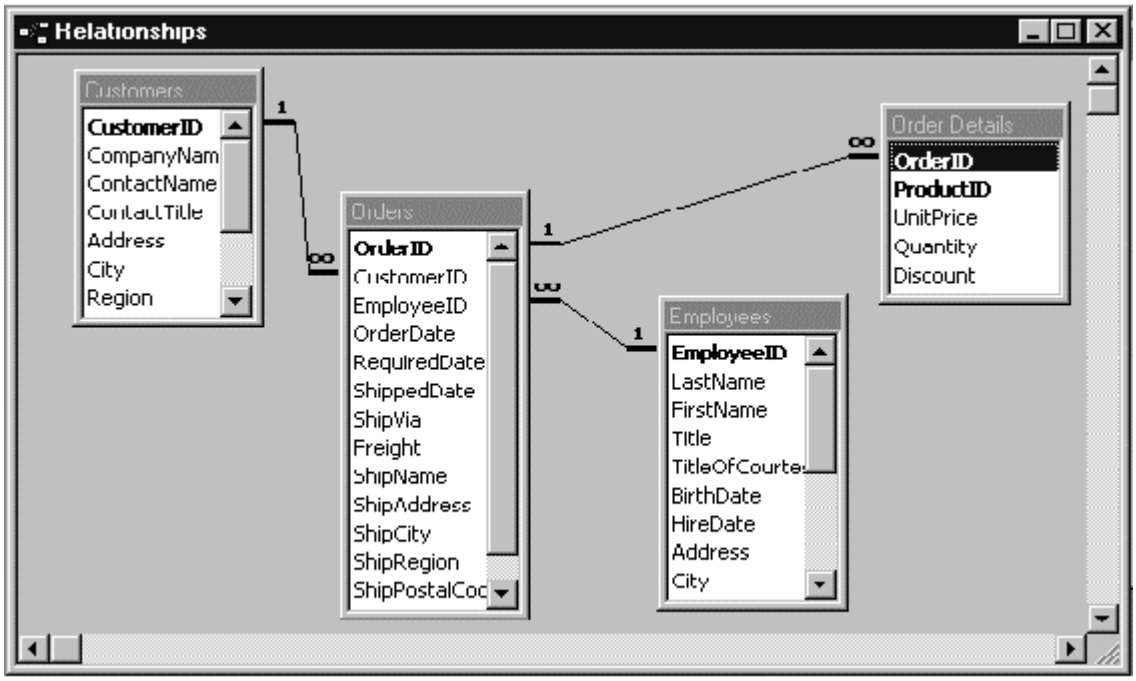
" A relational database is one where an association has been established between common fields in two tables. "

" A multi-file, relational database application (or RDBMS) is one in which the user's requirement for data entry retrieval, and reporting, cannot be satisfied by a single datafile structure. "

Once you have created the tables that make up a database, it's a good idea to define relationships between the tables. By defining relationships, you tell Microsoft Access how data is related between tables. This makes it easier to create queries, forms, and reports that include multiple tables. Defining a default relationship between two tables can save you time later when you create forms or reports that tie the information together.

To combine facts in a meaningful manner into information, you must define the relationships between facts: e.g. connect Nancy Jones with the sales that she makes, connect a customer Mr Smith with the invoices for his purchases and the payments he has made. A simple relationship diagram produced by Access is shown below. In the diagram a customer table (*Customers*) is related to an order table (*Orders*) which is itself related to an order detail table (*Order Details*).

Relationships:



A multi-file, **relational** database is an application in which the user's requirement for data entry, retrieval, and reporting, cannot be satisfied by a single datafile structure. A file of book references, for example, can be listed and grouped in many different ways (publisher, author, title etc.). Although a single datafile might be appropriate, it is inefficient to waste disk space and retrieval time by storing this repetitive information with every book. Instead you would create another datafile which would contain the extra information and you would link the two files together.

This illustrates the rule that a record should **not contain repeating fields.** If your database has a table that contains duplicate information in one or more fields, you should split the data into related tables so that you can store data more efficiently. This process is called **normalisation**.

8.1 Types of relationships

One to One

In a ***one-to-one*** relationship, a record in Table A can have no more than one matching record in Table B.

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 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 sponsored walk.

One to Many

In a ***one-to-many*** relationship, a record in *Table A* may have many matching records in *Table B*.

In this one to many example: One wine supplier can supply many wines. One wine is supplied by only one supplier.

Table A. **tblSuppliers**

Supplier ID	Company Name	Contact Name
WI001	Williams & Co	Fred Belling
WI002	Wilton & Sons	Jane Horrocks
WI003	Wilson Racket & Co	Jacque Lenain

Product ID	Product Name	Units in Stock	Units on Order	Supplier ID
0010	Haut Issy Beajolais Nouveau	39	12	W1001
0020	Vin Super Beajolais Villages	23	0	W1001
0030	Hamaeux Beajolais Nouveau	124	0	W1002
0040	Sud Ouest Beajolais Nouveau	24	64	W1002
0050	Ole Beajolais Nouveau	37	12	W1002

Many to Many

In a ***many-to-many*** relationship between two tables, one record in either table can relate to many records in the other table. To establish a many-to-many relationship, you need to create a third (***junction***) table and add the primary key fields from each of the other two tables to this table. For example, the Order Details table in the relationships diagram at the start of this section is an example of a junction table used to establish a many-to-many relationship between the Orders table and the Products table.

Many to many relationships are a problem for database design and must be broken down into two one to many relationships using link entities.Enforcing

8.2 Referential Integrity Rules

You can also tell Microsoft Access to enforce **referential integrity rules** while defining relationships. These rules allow you to preserve the defined relationship when you enter or delete records.

8.3 Extra Information - Relationships

To define relationships in Microsoft Access, it is common practice to match the **primary key** fields in one table with matching fields in the second table. See key words and phrases below:

Phrase/Word	Definition
Primary Table Or Parent	The table on the one side of the relationship which contains the unique **primary key** field (e.g. ID Number, Order Code etc.).
Related Table Or Child	The table related to the primary table containing a field which can be matched to the primary key field in the primary table. For example in Microsoft Access it is common to choose a counter field as the primary key field. For the relationship to work this would mean that the related table's matching field would need to be set up as a long integer in order to associate the two fields. In all cases it is essential that the field to be associated in the related table is defined with field format and properties which match the primary key field in the primary table. **Working Example:** ONE to MANY *ProductID* - *tblProducts* ⇒ *ProductID* - *tblSuppliers* Unique Primary Key / Primary Table / Field to be related (Foreign Key) / Related Table
Primary Key	A field value which uniquely identifies each record in a table. This field information must never change and, if the record is deleted, should not be repeated for another field.
Foreign Key	A field that refers to a field (or fields) in another table. Usually this field is used within relationships to associate the field information to the primary key field of a primary table.
Referential Integrity	Rules that are followed to preserve the defined relationships between tables when records are entered or deleted.

9. Documenting a Database Design

In order to build up a reliable database specification, it is necessary to document the contents of a database and the definitions of any objects that exist within that database. Using Microsoft Access, this can be done in a number of ways:

1. Use **TOOLS → Analyze → Documenter** to view, print, output, or save the design characteristics of database objects.
2. Use your keyboard's **PrintScrn** facility or any **screen capture** application to output the relationships screen as a graphic and then print it using a Windows application such as Paintbrush or Word.
3. When you have the relationships window open, use **FILE → Print Relationships** to produce a dated report showing the current layout of the relationships in your database.
4. Microsoft Access includes two tools that can help you to refine your database design:
    - The ***Table Analyzer Wizard*** can analyse the design of one table at a time, can propose new table structures and relationships if appropriate, and can restructure a table into new related tables if that makes sense.
    - ***The Performance Analyzer*** can analyze your entire database and make recommendations and suggestions for improving it. The wizard can also implement these recommendations and suggestions.

For additional ideas on designing and documenting a database, you may want to look at the ***Northwind*** sample database and the database schemas for one or more of the databases that you can create with the Database Wizard.

10. Queries

10.1 Access Query Overview

With queries, you can:

- Delete batch records
- Ask questions about data in several tables of data
- Perform calculations
- Create forms, reports, graphs based on the queries
- Create queries based on queries
- Ask questions about remote data.

The 6 types of query you will work with are:

- ***Select*** (the most frequently used)
- ***Crosstab*** (to display summarised values)
- ***Make Table*** (Action Query)
- ***Update*** (Action Query)
- ***Append*** (Action Query)
- ***Delete*** (Action Query)

10.2 Using Queries to Ask Questions

Access Queries give you real power over your database as they allow you to interrogate and extract the data you want, in any order you want to see it. With queries you can ask questions about the data in your tables.

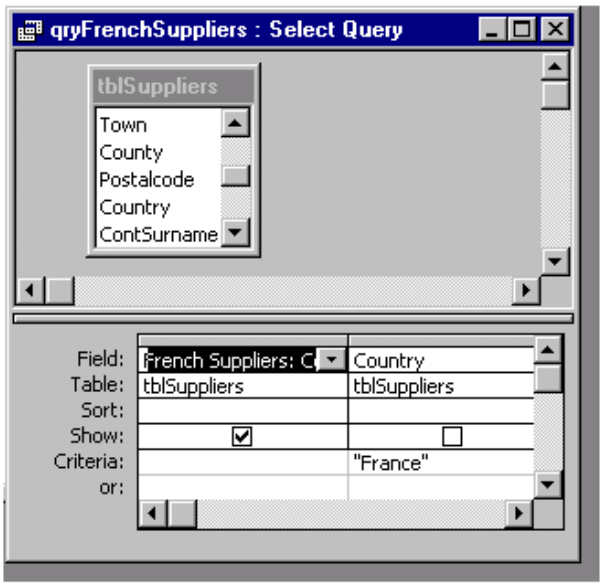
Using Bacchus as an example, you might need to ask:

- What are the names of our French suppliers?
- How many red wines do we currently stock?
- Which suppliers do we use for white wines, and in which countries are they located?
- What is the highest price received for a bottle of wine?

Below are shown the queries you would use to answer these four questions:

Q1: What are the names of our French Suppliers?

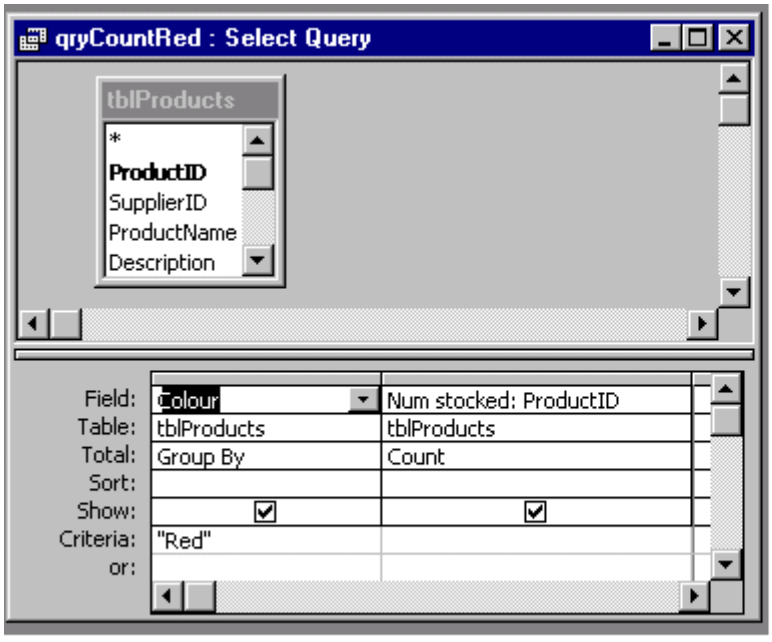
1. Create a Select query and enter a simple ***criteria expression*** to filter only the ***French*** wines.
2. Enter the ***label*** French Suppliers as the column heading for the Company field.
3. ***Uncheck*** the ***Show*** box for the Country field.



French Suppliers
Bodegas la Riojana
Le chateau de Noveau S.A
Frais Wines
Vinos Francais
Tolouse Cooperative
*

Q2: How many red wines do we stock?

1. Create a ***Totals*** query with a criteria expression to filter red wines and a ***COUNT*** function to total the result.
2. Note that the COUNT function is applied to the ProductID field as there is one ProductID for each wine stocked. In other words, the query is counting the number of ProductIDs for red wines.
3. Enter a ***label*** for the ProductID field.

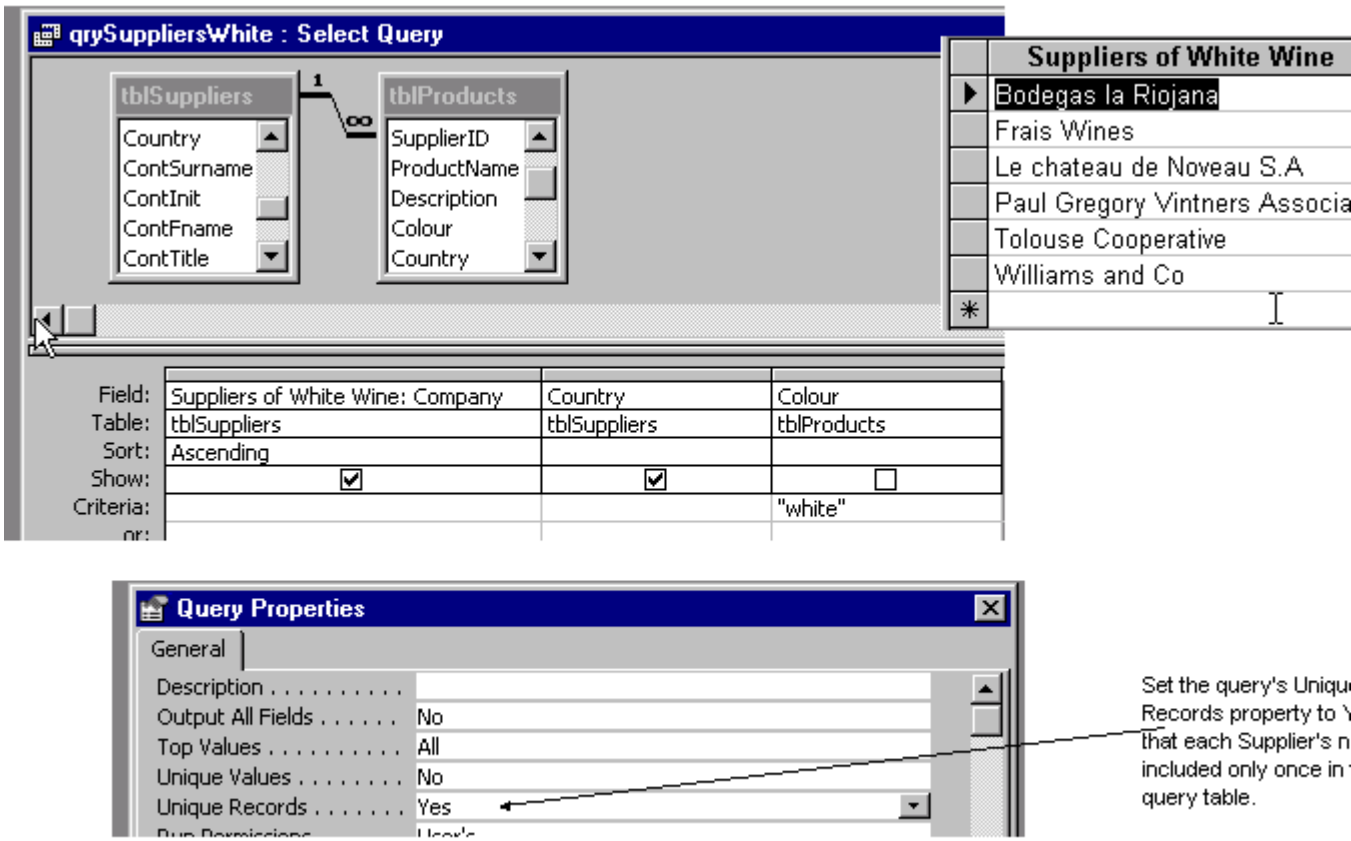


Colour	Num stocked
Red	15

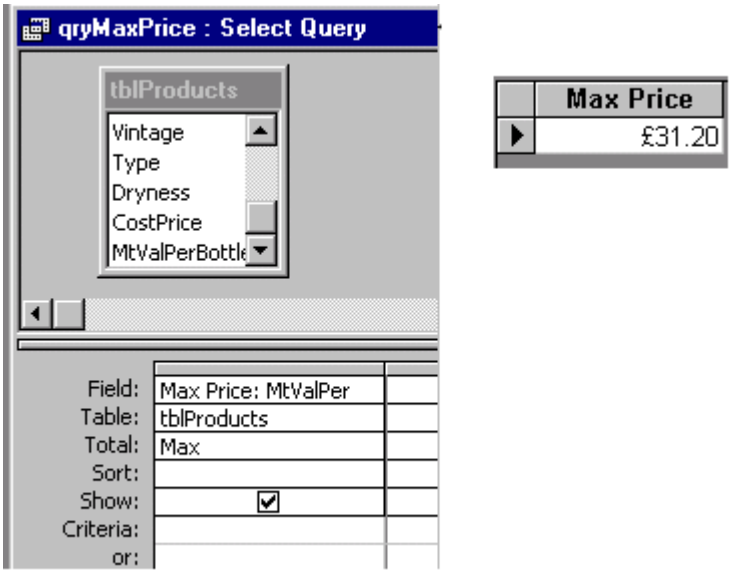
Q3: Which suppliers do we use for white wines and in which countries are they located?

1. Create a ***Select*** query and enter a ***criteria expression*** to filter only the ***white*** wines.
2. Note that this is a ***multi-table*** query as it needs data from both the Suppliers table and the Products table.
3. Enter a ***label*** for the Suppliers field.
   Some suppliers supply more than one type of white wine so they will appear more

than once in the query result. To list each supplier once only, click the ***Properties*** button  on the toolbar and set the ***Unique records*** property to Yes.



Q4: What is the highest price received for a bottle of wine?
Create a ***Totals*** query and then use the ***MAX*** function to find the highest market value per bottle of wine.

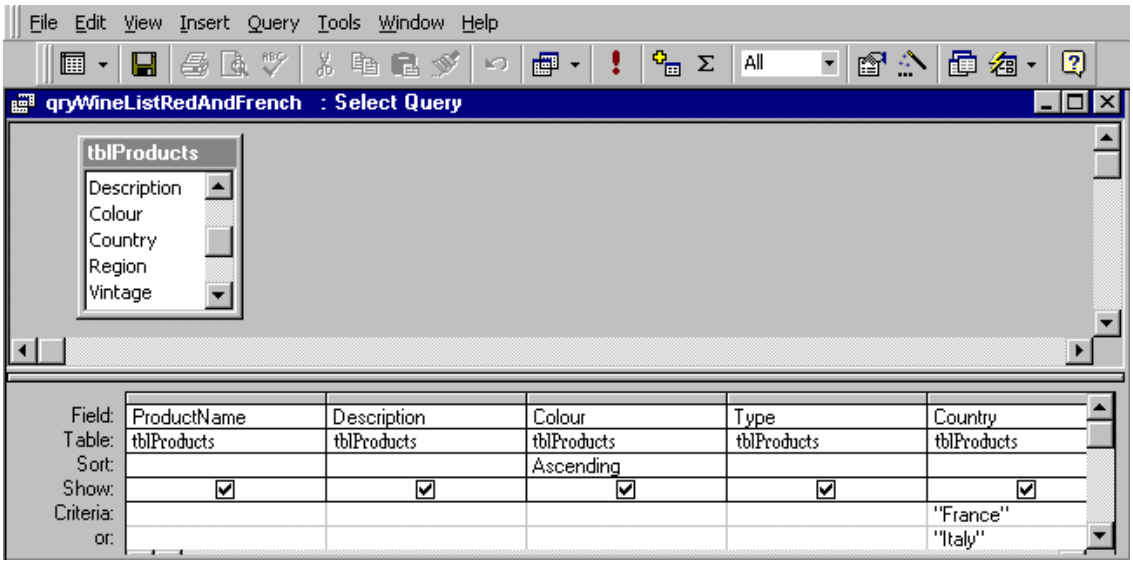


10.3 Creating and Running Queries

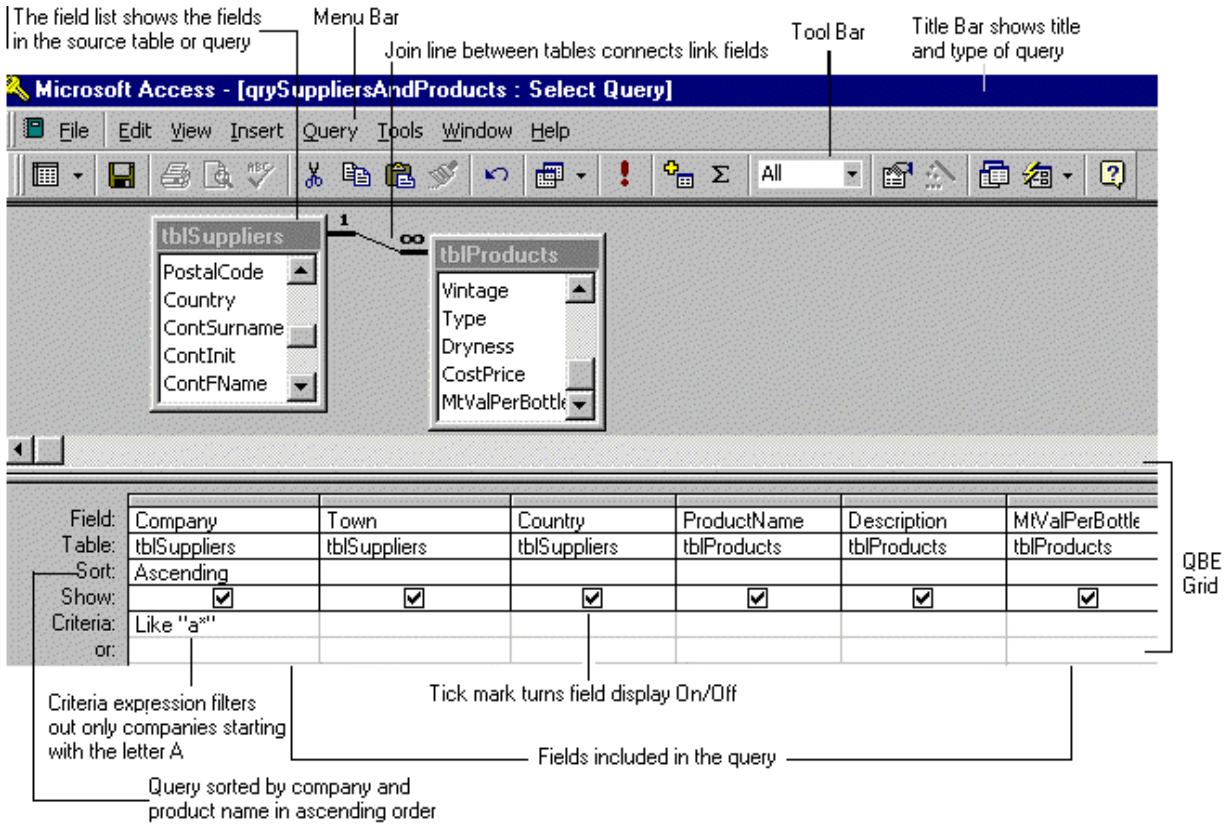
Using QBE (Query By Example) you can create your queries by dragging fields from the upper portion of the query window to the QBE grid in the lower portion of the window.

In the QBE grid each column contains information about a field included in the query.

The QBE Design Grid:

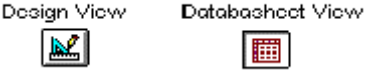


Detailed Query Design Overview:



You can open a query in either of two views:

1. In **Design View**, you can create and modify the structure of the query.
2. In **Datasheet View**, you can view and, in some cases, add and edit data.

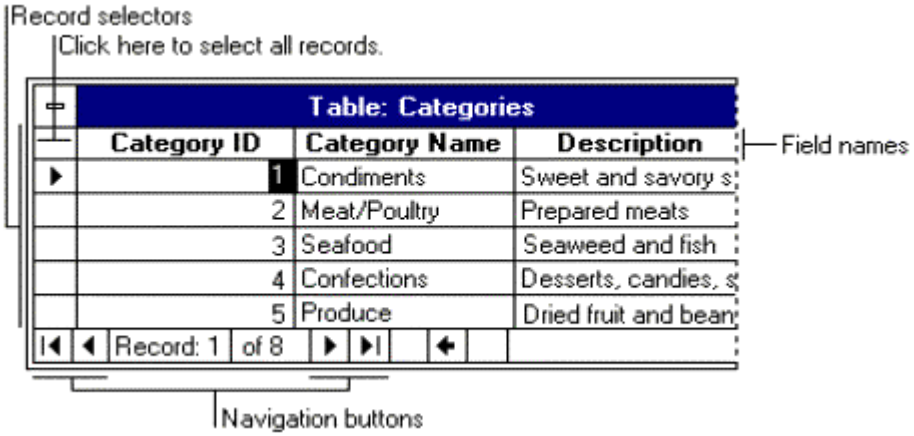


10.4 Viewing a Query's Results as a Datasheet

After you run a select query, a set of records fulfilling the specified criteria is displayed and this set of records is called a ***dynaset.***

A dynaset is a dynamic set of records that results from running a query or applying a filter. Microsoft Access updates the data in the underlying table or tables when you make changes to a dynaset.

The **Datasheet view** displaying the dynaset looks much like a table in Datasheet view:

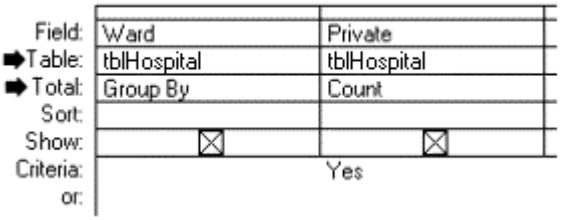


10.5 Totals Queries

In a select query, you can also add to the QBE grid a **Totals** row for entering summary calculations (counts, mean, average etc.) and a Table Names row to display the source table name for each field.

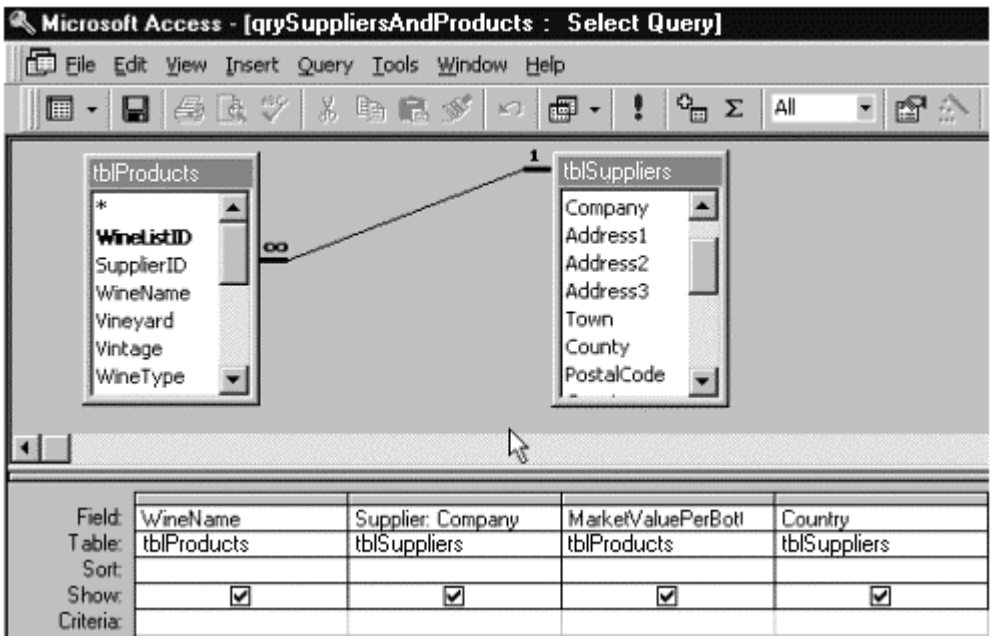
To turn a select query into a totals query press the sigma toolbar button  or select **VIEW, Totals**. To display the table name for each field select **VIEW, Table**.

Working with Totals Queries:



10.6 Multiple Tables and Query Joins

When you create a select query the fields included can be from tables, queries or calculated fields. Joins are created by dragging field names between tables and queries. If default relationships between tables have been defined, Microsoft Access automatically displays default join lines:



10.7 Criteria

A query can be refined by entering expressions for criteria, sorting, creating calculated fields, totalling data, and hiding fields.

Criteria are instructions you use to tell Microsoft Access which records to display. You can enter criteria in one or more fields in a query or filter. For example in the Figure below, the expression:

like "H*"

will display only information beginning with the letter H .

Field:	Company Name	Region	City
Table:	Customers	Customers	Customers
Sort:			
Show:	☒	☒	☒
Criteria:	Like "H*"	"RJ"	
or:		"SP"	Like "C*"

Company name begins with H **and** region is RJ,
or region is SP **and** city begins with C.

Select Query: Customers

Company Name	Region	City
Gourmet Lanchonetes	SP	Campinas
Hanari Carnes	RJ	Rio de Janeiro

10.8 Expressions

Expressions are a fundamental part of many Microsoft Access operations. You use expressions for calculations, to specify criteria for queries or to control macros, and as arguments in functions or parts of Access Basic modules.

For example:

Between 20 And 30

would find any number between 20-30.

Depending on where you enter the expression, Microsoft Access automatically inserts:

- Brackets ([]) around form, report, field or control names
- Number signs (#) around dates
- Quotation marks ("") around text.

The figure below shows that an expression can include a combination of operators, identifiers, functions, literal values, and constants:

Operator Overview

An operator is a symbol or word, such as > and Or, that indicates an operation to be performed on one or more elements. Microsoft Access has several classes of operators, including ***arithmetic***, ***comparison, concatenation,*** and ***logical*** operators.

Arithmetic		Logical		Concatenation	
^	Exponent - Used to raise a number to the power of an exponent.	**And**	Used to perform a logical conjunction on two expressions.	**&**	Used to force string concatenation of two expressions.
*****	Multiply - Used to multiply two numbers.	**Eqv**	Used to perform a logical equivalence on two expressions.	**Comparison**	
/	Division - Used to divide two numbers and return a floating-point result.	**Imp**	Used to perform a logical implication on two expressions.	**<**	Less than
****	Division - Used to divide two numbers and return an integer result.	**Not**	Used to perform logical negation on an expression.	**<=**	Less than or equal to
Mod	Division - Used to divide two numbers and return only the remainder.	**Or**	Used to perform a logical disjunction on two expressions.	**>**	Greater than
+	Plus - Used to sum two numbers.	**Xor**	Used to perform a logical exclusion on two expressions.	**>=**	Greater than or equal to
-	Minus - Used to find the difference between two numbers or to indicate the negative value of a numeric expression.			**<>**	Not equal to

10.9 Expression Examples

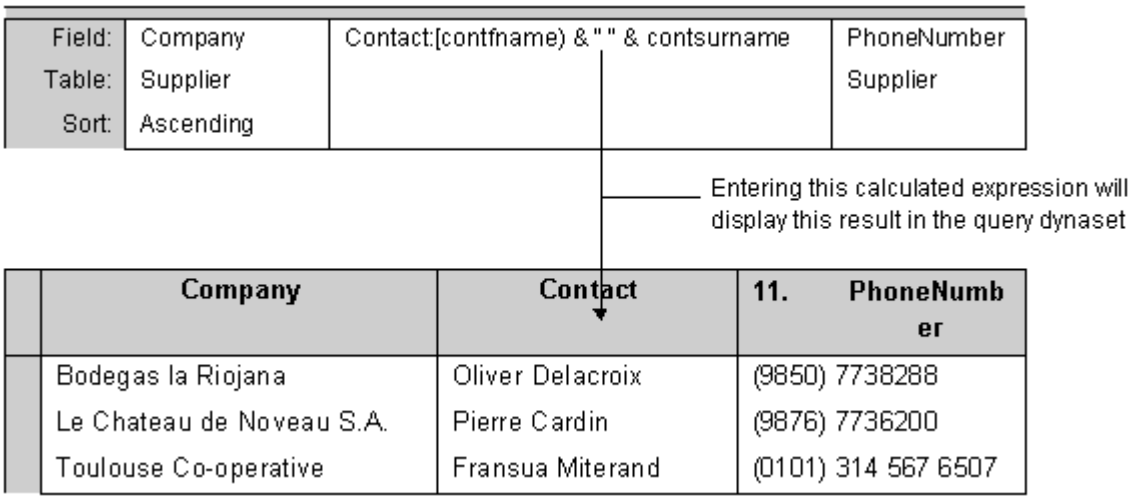
Some example expressions can be seen below. To see a more detailed set of examples, refer to the Access Help Index and search for ***Expressions / examples of***.

Criteria Expression	Shows records where:
France	Value is France
Not France	Value is not France
In(France, Germany, Italy)	Value is France, Germany, or Italy
<M	Value begins with letters A-L
>=M	Value begins with letters M-Z
100	Numeric value is 100
<=20	Numeric value is less than or equal to 20
Date()	Date is today's date
>=1/1/94	Date is on or after 1/1/94
Between 1/1/93 And 31/12/93	Date is in the year 1993
"/2/"	Date is in the month of February
Null	The field does not contain a value
Is Not Null	The field contains a value

10.10 Calculated Expressions

In the example given below, a calculated expression has been used to create a derived field that concatenates the results of two fields (forename and Surname). The field name (Contact) must be followed by a ***colon*** (:) in order to define it as a label and the **&** operator has been used rather than **+** because the calculation is joining text fields together.

Contact:[contfname) & " " & [contsurname]
Calculated Expression Example:



Brackets ([ ]) around an element of an identifier indicate that the element is the name of a table, query, form, report, field, or control. If the name you're entering doesn't contain a space or punctuation, you can type the name without brackets, and Microsoft Access often inserts them automatically.

Number signs (#) around an element of an expression indicate that the element is a date/time value. Microsoft Access automatically evaluates a value surrounded by number signs as a date/time value and lets you type the value in any common date or time format. Microsoft Access displays the value according to the International setting in the Microsoft Windows Control Panel. You can change the output format of a date using the Format property.

Quotation marks (") around an element of an expression indicate that the element is text. For example, if you type English Oak Microsoft Access displays the expression as "English Oak". The **LIKE** operator is used if the expression contains or is entered in a different case from the field entry.

10.11 Wildcard Characters

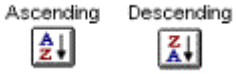
The asterisk (*), question mark (?), number sign (#), exclamation point (!), hyphen (-), and brackets ([ ]) are wildcard characters and you can use these characters in queries, commands, and expressions to include all records, file names, or other items that begin with specific characters or match a certain pattern. See examples which follow:

Symbol	Example	Usage
*	wh*	Finds what, white, and why whilst *at would find cat, bat, and what. Like the MS-DOS asterisk (*) wildcard character, this asterisk matches any number of characters. But unlike MS-DOS, it can be used as the first or last character in the character string.
?	b?ll	Finds ball, bell, and bill. Like the MS-DOS ? wildcard character, this symbol matches any single character.
#	1#3	Finds 103, 113, 123. Matches any single digit.
[ ]	b[ae]ll	Finds ball and bell but not bill. Matches any single character within brackets.

!	**b[!ae]ll**	Finds bill and bull but not bell or ball. Matches any character not in the list.
-	**b[a-c]d**	Finds bad, bbd, and bcd. Matches any one of a range of characters.

10.12 Sorting Records

- In table and form datasheets and in forms, you can click the Sort Ascending or Sort Descending buttons on the toolbar to quickly sort the current records based on the selected column:



- You can sort the records in a query in alphabetic or numeric sequence, in either ascending (A-Z, 0-9) or descending (Z-A, 9-0) order. You can sort on just one field, such as a Last Name field, or on as many as 10 fields.
- The order of fields on the QBE grid is important when you want to sort on multiple fields. Microsoft Access sorts on the leftmost Sort field first, then on the next Sort field to the right, and so on.
- When you close a query, Microsoft Access moves Sort fields to the leftmost columns on the QBE grid. If you later open the query in Design view, make changes to it, and save the changes, Microsoft Access displays the Sort fields at the left end of the datasheet. You can rearrange the fields if necessary.

Tips - Queries

- When naming the query, give it a ***name unique*** from all tables and queries within the database.
- You can create a ***quick query*** by selecting a table or query name in the Database window and then click the New Query button on the tool bar. The Query window opens in Design view with the table or query field list displayed.
- In ***multi-table queries***, you can keep track of which table each field is associated with by displaying the Table Name row beneath the Field row in the QBE grid. From the View menu, choose Table Names to display row.
- ***Select queries*** are the default query type.

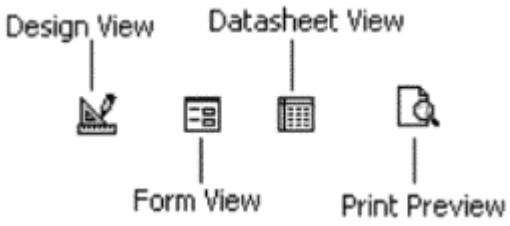
11. Forms

11.1 Forms overview

A form is used to view and edit information in your database record by record. With a form, you can:

- Display the information you want to see in the way you want to see it.
- Use familiar controls such as text boxes and check boxes that you already use in Windows.
- Make the job of viewing and entering data easy.
- Make your form colourful and distinctive because you have control over the size and appearance of everything on it.

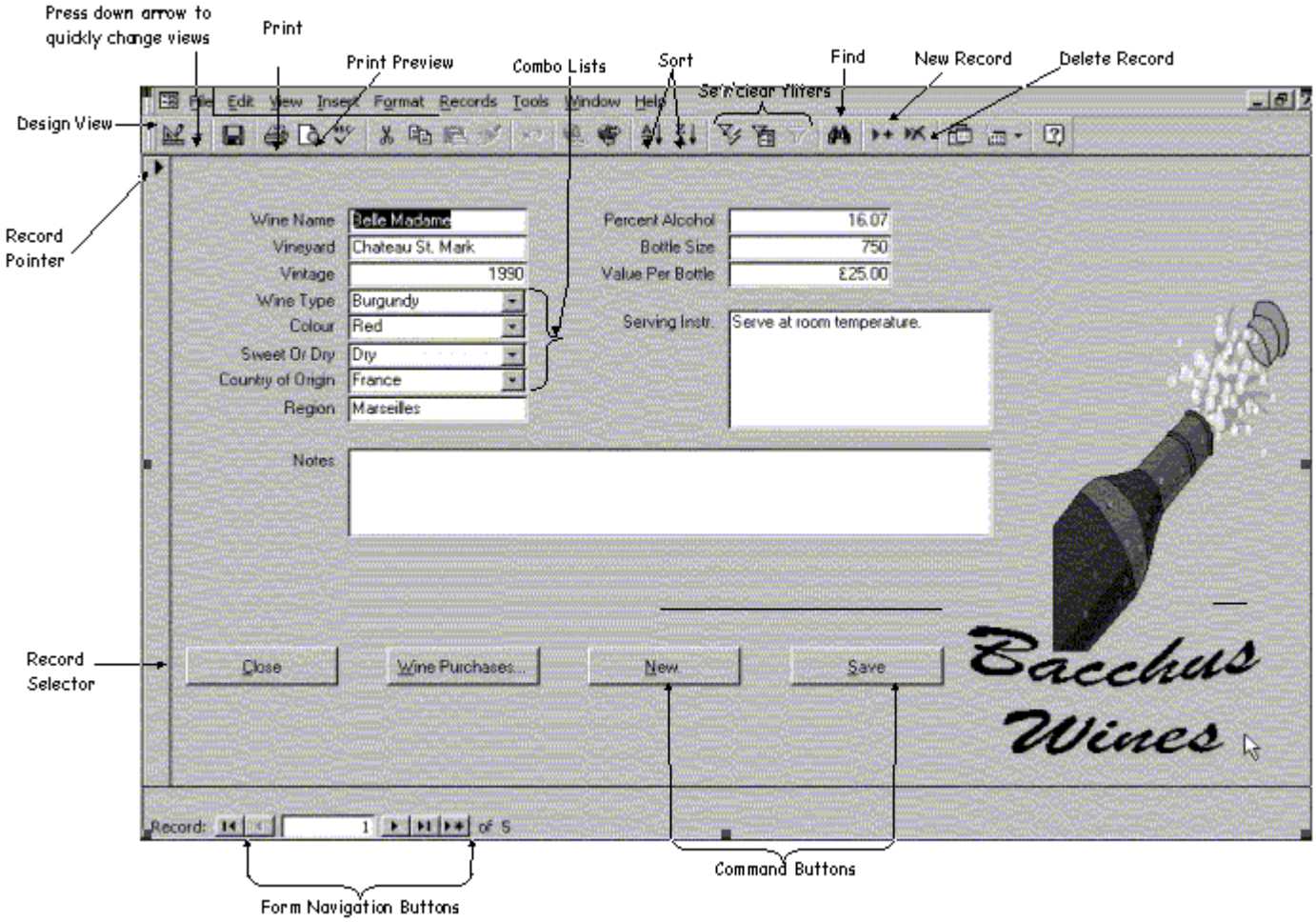
A form has 4 views: **Form Design**, **Form**, **Datasheet** and **Print Preview**.



You can create a form in two ways:

1. Using ***FormWizards*** you can create a form from a choice of number of styles. As you gain more experience you may find it easier to let FormWizards do all the basic work for you and then modify the basic design using Microsoft Access's Form design utilities.
2. You can also start with a ***blank form*** and design the form from scratch the way you want. This gives you greater control over how the form appears and works, but it will take longer.

You will use the Form window's ***Design View*** to create and modify a form. You can see how your form appears on screen by clicking the ***Form View*** button, view it in ***Datasheet*** View or how it will look in print by clicking the ***Print Preview*** button.



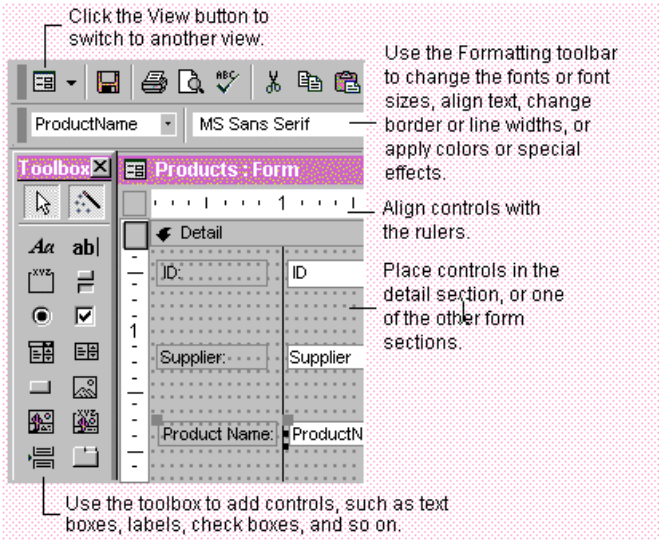
11.2 Form Design View

You can use the Form window's Design tools to create and modify a form. There are 5 elements that make up a form:

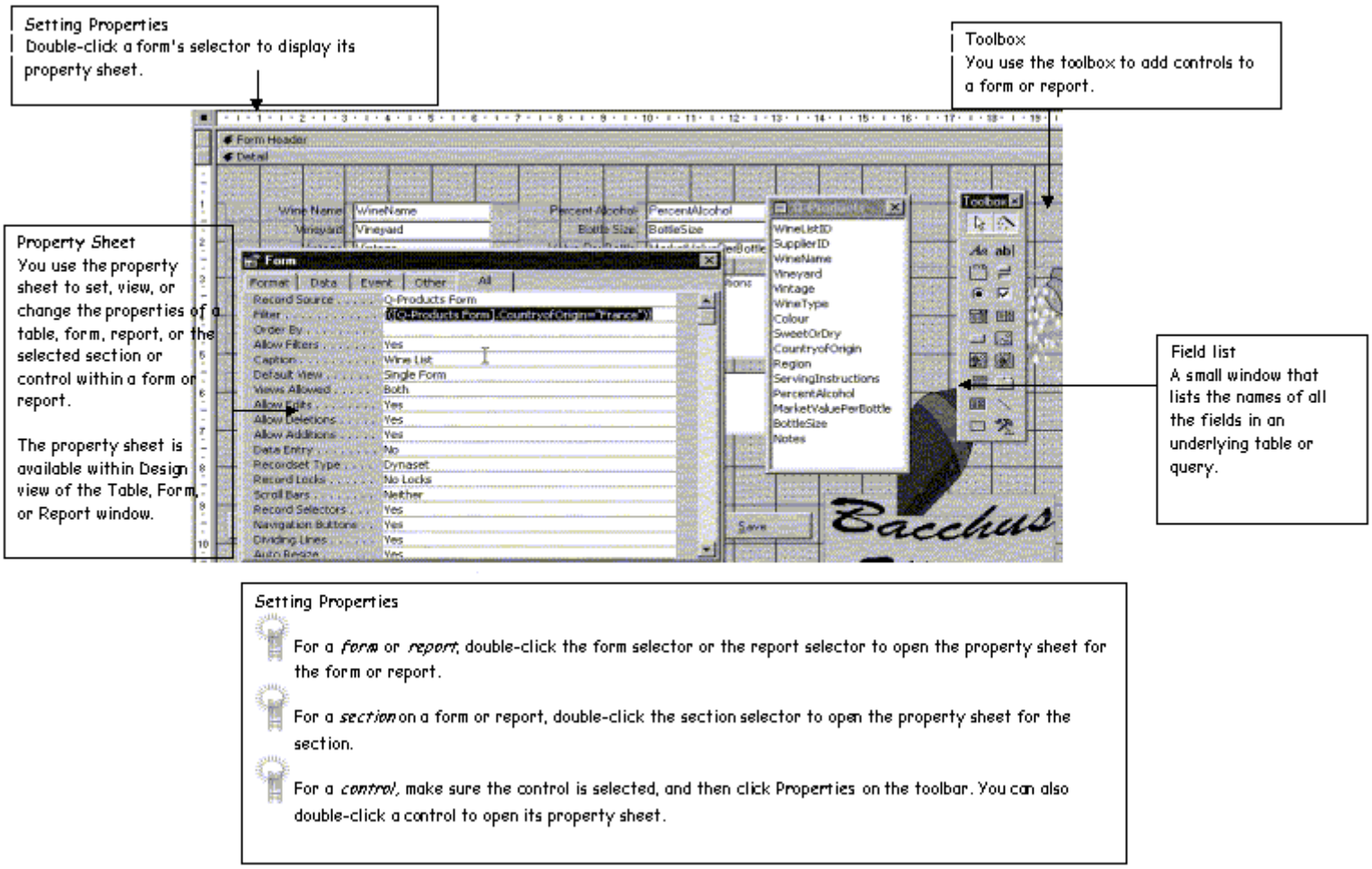
Element	Description
Detail section	Displays records. You can either display one record on the screen or page, or you can display as many as will fit.
Form header/ footer sections	Displays information that you want to show for every record, such as a title for the form, or command buttons that open related forms or carry out other tasks. A form header appears at the top of the screen in Form view and at the top of the first page when printed. To add or remove these sections (as a header-footer pair), choose Form Header/Footer from the VIEW menu.
Page header/footer sections	Displays information such as a title, graphics, column headings, or any information that you want at the top of every printed page. Page headers appear only on printed forms.To add or remove these sections (as a header-footer pair), choose Page Hdr/Ftr from the VIEW menu.

Rulers	Help you position controls and determine the size of sections on your form. To show or hide the rulers, choose Ruler from the VIEW menu.
Grid	Helps you position controls on your form. If the grid is too fine, it is invisible. To show or hide the grid, choose Grid from the VIEW menu.

To create a form, you work in Design view. Viewing a form in Design view is like sitting at a workbench surrounded by useful tools.

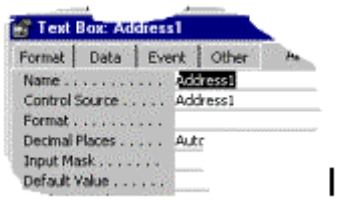


Form Design Example:



11.3 Control

A **control** is a graphical object, such as a text box, a check box, a command button, or a rectangle, that you place on a form or report in Design view to display data, perform an action, or make the form or report easier to read.



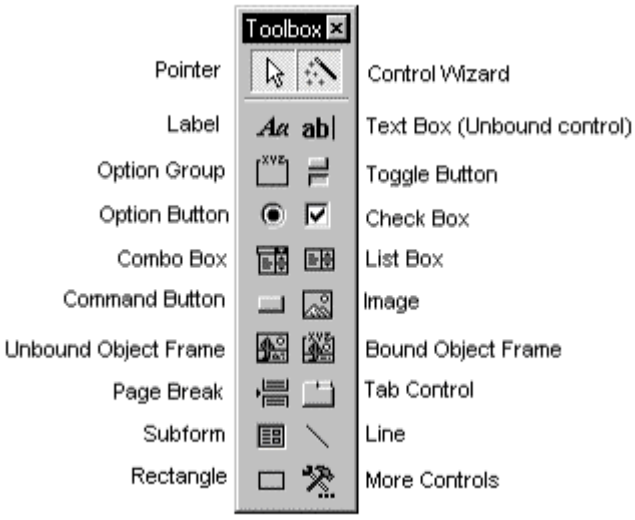
11.4 Form Design Tools

You can use the following tools to help you create and modify a form:

Use this tool:	To do this:
Toolbox	Place controls on the form.
Field list	Create controls bound to fields in the underlying table or query..
Property sheet	Set properties for selected control or section or for the form itself.
Formatting toolbar	Change the appearance and colours of the selected control or section within the form.

11.5 Toolbox

You can use the **toolbox** to add controls to a form or report.



- To open or close the toolbox select **VIEW / Toolbox** or press the **Toolbox button**  on the **Form Design Toolbar**
- To add **a control,** click to select the tool, drag it from the toolbox to the desired location in the form or report's Design View, and click again.

11.6 Field List

The **field list** is a small window that lists the names of all the fields in an underlying table or query. You can display field lists in forms, reports, and queries. Microsoft Access automatically displays the appropriate field lists in the Filter window:

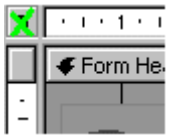
- The names of primary key fields appear in bold in a field list.
- Field lists in the Query and Filter windows include an asterisk (*) option. Select this option to move the table or query as a whole to the grid.
- Double-clicking the title bar of a field list selects all fields.
- To open or close the field list in a form's or report's design view, click the button  on the tool bar.

11.7 Property Sheet

You use the **property sheet** to set, view, or change the properties of a table, form, report, or the selected section or control within a form or report. The property sheet is available within Design view of the Table, Form, or Report window.

In the Form or Report window only, you can:

- **Double-click a section** or control or click the **Properties** tool  to display the property sheet. When the property sheet is displayed, you can select another section or control to see its properties.
- Display the properties of the form or report itself by choosing **EDIT / Select Form** or **Select Report,** by clicking in the **grey area** outside any of the sections or by double-clicking the **form selector** (marked here with a green cross):



- See the default properties for a particular control by clicking the associated tool in the toolbox.

11.8 Formatting a form in Design View

You can change the appearance of an entire form or just parts of it.

To change the font, font size, and line weight for all text and lines on the form at once, click AutoFormat on the toolbar  and then select a new autoformat for the form.

To change the appearance of one control, for example, a text box, you just click the control to select it. On the Formatting toolbar, you can then choose a different font, font size, or other formatting option.

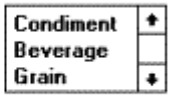
To add a background picture to a form, in the form's property sheet, type the name of a graphic file in the Picture property box, or click the Build button next to the property box to open the Insert Picture dialog box.

11.9 Combo Lists and List Boxes

On a form or report, you can create a ***list box*** or ***combo box*** yourself or, if you prefer, by using a Wizard.

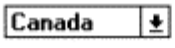
A list box or combo box can make data entry easier, quicker, and more accurate by presenting a scrollable list of values from which you can choose an option. These lookup lists cut down on repetitive data entry and minimise the risk of errors.

A **list box** is a control that provides a list of choices. A list box consists of a list and an optional label.

Control 

Tool 

A **combo box** is similar to a list box and text box combined in which you enter a value or select an item from a list.

Control 

Tool 

Tips - Choosing Between a List Box and a Combo Box

- Use a ***list box*** when you want a list that appears at all times and when you want to limit the options to those in the list.
- Use a ***combo box*** when you need to conserve screen space (since a combo box list appears only when you click its arrow), or when you want the option of selecting a value from a list or typing a value in the box. Like a list box, you can limit the options to those listed in the box.

11.10 Working with Form Filters

There are four methods you can use to filter records:

- Filter By Selection
- Filter By Form
- Filter For Input
- Advanced Filter/Sort

Filter By Selection

You would choose to use ***Filter By Selection***  if you want to choose the values you're searching for from a list without scrolling through all the records in a datasheet or form.

Filter By Form

If you want to specify multiple criteria at once, ***Filter By Form***  would be the easiest option.

Filter for Input

If the focus is in a field in a form or datasheet and you just want to type in place the exact value you're searching for or the expression whose result you want to use as your criteria, use ***Filter For Input***. 

. You can access this option by **right-clicking** in any field while entering data.

Advanced Filter/Sort

For complex filters you would choose to use ***Advanced Filter/Sort***. You can access Advanced Filter/Sort via the **RECORDS** menu 

.

Filter By Selection, Filter By Form, and Filter For Input are the easiest ways to filter records. Use Filter by Selection if you can easily find and select in the form, subform, or datasheet an instance of the value you want the filtered records to contain.

Extra Information - Filters

In a report, you can't create a filter using the filtering techniques mentioned previously. However, a report (as well as a form) can inherit a filter.

Extra Information - Comparison of Filtering Methods

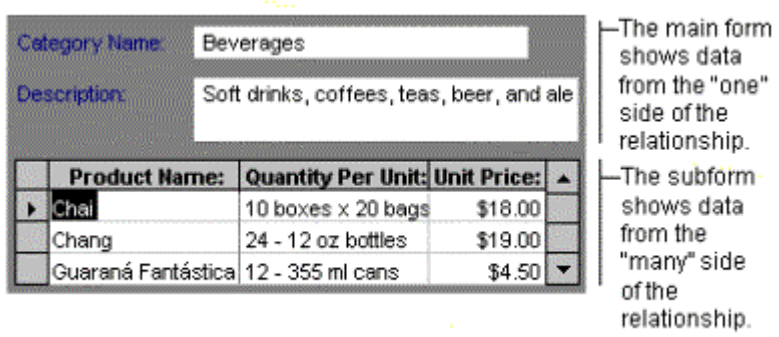
What do you want the filter to do?	Filter By Selection	Filter By Form and Filter For Input	Advanced Filter/Sort
Search for records that meet multiple criteria.	Yes (but you must specify the criteria one at a time)	Yes (and you can specify the criteria all at once)	Yes (and you can specify the criteria all at once)
Search for records that meet one criteria or another criteria.	No	Yes	Yes
Allow you to enter expressions as criteria.	No	Yes	Yes
Sort records in ascending or descending order.	No (however, after applying the filter, you can sort all filtered records by clicking **Sort Ascending** or **Sort Descending**	No (however, after applying the filter, you can sort all filtered records by clicking **Sort Ascending** or **Sort Descending**	Yes (you can sort some fields in ascending order and other fields in descending order)

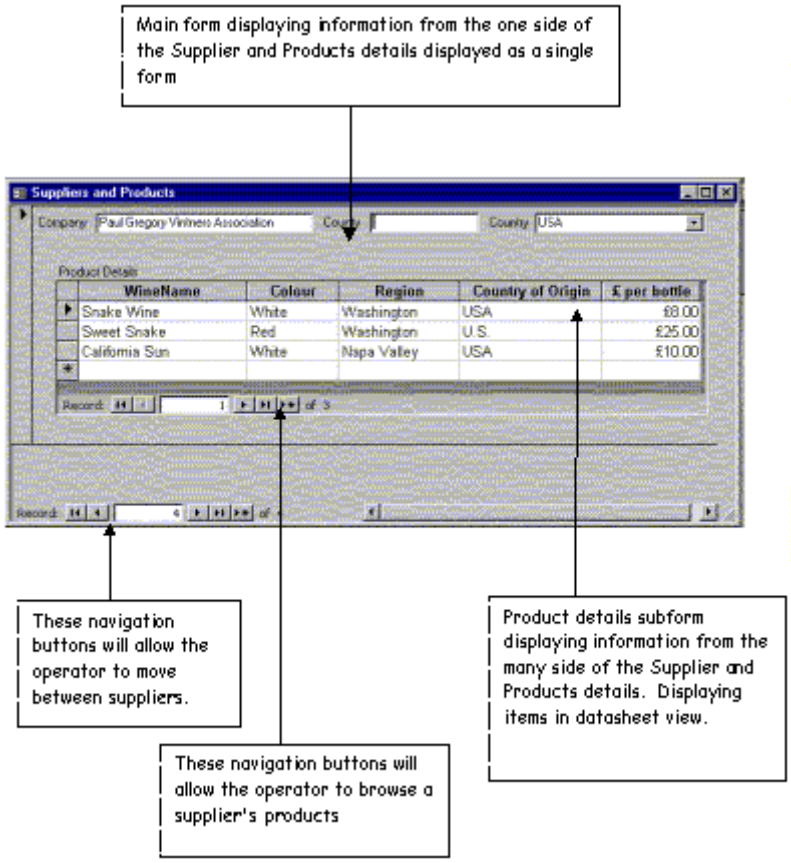
11.11 Subforms

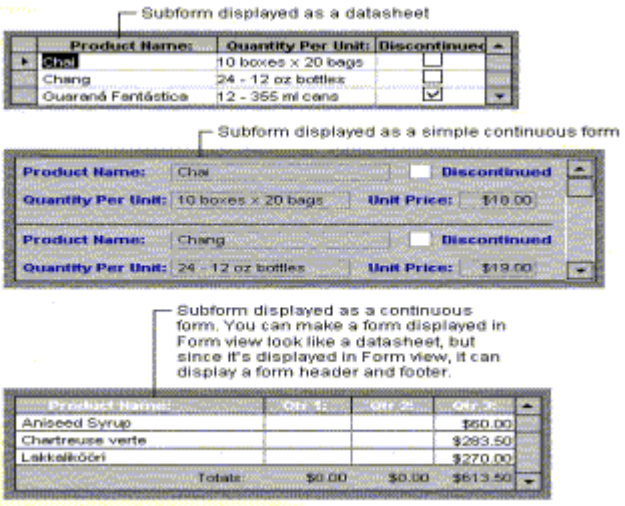
A subform is a form within a form. The primary form is called the main form, and the form within the form is called the subform. A form/subform combination is often referred to as a hierarchical form, a master/detail form, or a parent/child form.

Subforms are especially effective when you want to show data from tables or queries with a one-to-many relationship. For example, you could create a form with a subform to show data from a Categories table and a Products table. The data in the Categories table is the "one" side of the relationship. The data in the Products table is the "many" side of the relationship - each category can have more than one product.

Two Subform examples:







The main form and subform in this type of form are linked so that the subform displays only records that are related to the current record in the main form. For example, when the main form displays the Beverages category, the subform displays only the products in the Beverages category.

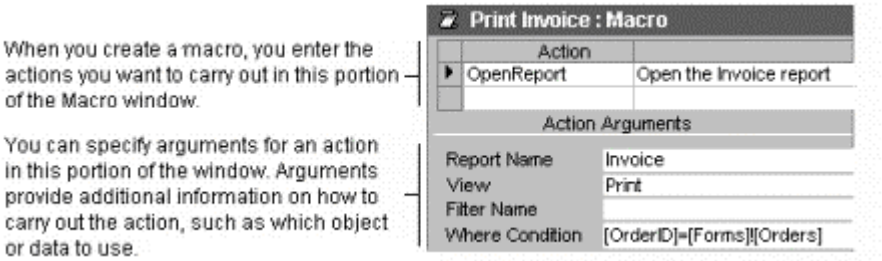
When you use a form with a subform to enter new records, Microsoft Access saves the current record in the main form when you enter the subform. This ensures that the records in the "many" table will have a record in the "one" table to relate to. It also automatically saves each record as you add it to the subform.

A subform can be displayed as a datasheet or it can be displayed as a single or continuous form. A main form can only be displayed as a single form.

12. Macros

12.1 Macro Overview

A macro is a named list of instructions that you create for Microsoft Access to follow. Each instruction is called an action. When you run the macro, Microsoft Access carries out the actions in the order they're listed, using the objects or data you've specified for the action arguments. You can use macros to automate repetitive tasks and to extend the capabilities of your database.



The following macro is composed of a series of actions. Microsoft Access carries out these actions each time the macro runs. To run this macro you refer to the macro name **ReviewProducts.**

Action	Comment
Echo	Freeze screen while form loads
OpenForm	Open the Product Listing
MoveSize	Position the Product Listing

12.2 The AutoExec Macro

You can create a special macro that runs automatically whenever you open a Microsoft Access database. For example, you may wish to open certain tables and forms every time you open a database. When you've finished entering the macro actions you must save it under the name **AUTOEXEC**.

Action	Comment
Echo	Freeze the screen while the macro is running (ECHO OFF)
Beep	Makes a beeping sound when the database loads
Hourglass	Displays an hourglass pointer
OpenForm	Open a form at Start-up
Maximize	Maximizes the loaded form

12.3 Group Macros

If you have numerous macros, grouping related macros in group macors can help you to manage your database more easily. To display the names of macros for a macro group, from the Macro Window select:

VIEW / Macro names

Shortcut: click  on the Macro toolbar

In the example below, the macro group named Buttons is made up of three related macros: Employees, Products, and Suppliers. Each macro carries out the OpenForm action, and the Products macro also carries out the MoveSize action.

Macro Name	Action
Employees	OpenForm
Products	OpenForm
	MoveSize
Suppliers	OpenForm

12.4 Conditional Actions

In some cases, you may want to carry out an action or series of actions in a macro only if a particular condition is true. To create a conditional macro from the Macro Window you select:

VIEW / Conditions

Shortcut: click  on the Macro toolbar

In the example below, the conditional macro carries out the StopMacro action when there is no value in the Country field (when the value is Null). It carries out one of several pairs of MsgBox and CancelEvent actions if the length or form of the PostalCode value isn't appropriate for the country in the Country field.

Condition	Action
IsNull([Country])	StopMacro
IsNull([Postalcode])	Msgbox
…	CancelEvent
[Country] In ("France","Italy","Spain") And Len([PostalCode])<>5	Msgbox
…	CancelEvent
[Country] In ("Australia","Singapore) And Len([PostalCode])<>4	Msgbox
…	CancelEvent
([Country] = "Canada") And [PostalCode] Not Like "[A-Z]# [A-Z]# [A-Z]#")	Msgbox
…	CancelEvent
	GoToControl

A condition is a logical expression. The macro follows different paths depending on whether the condition is true or false.

You enter conditions in the Condition column in the Macro window. If a condition is true, Microsoft Access carries out the action in that row. You can have Microsoft Access carry out a series of actions if the condition is true by typing an ellipsis **(...)** in the Condition column of the actions that immediately follow the condition.

12.5 Command Buttons

A ***command button,*** which is used to perform standard actions such as printing the current record or opening another form, is a control that runs a macro, calls an Access basic function, or executes an event procedure. A command button is added to a form from the Form Designer.

Access has the added advantage of being able to use the **Command Button** Wizard to help you to set up these buttons. The Wizard lets you choose an action you want the button to perform and a picture you want on the button. Buttons created with the Wizard are driven by Visual Basic event procedures.

All users can set up their own buttons using a ***macro***, an Access Visual Basic ***function*** or an ***event procedure***.

Tips - Command Buttons

- You can also create a command button on a form, and then In Design view, enter a macro name in the OnClick property box for the command button. Click the **Build** button to the right of the OnClick property box, and use the Macro Builder to create and attach a macro to the command button. This button runs the macro.
- If you want to attach a macro to a button make sure that the **Control Wizard** on the Toolbox is **switched off** when you create the button.
- To change the caption on a command button, edit the Caption property setting for the button.
- You may want to give a macro that you will run from a command button a short, descriptive name when you save it, so that the name fits easily into the button.

13. Reports

13.1 Overview

Although you can print records from a table or query datasheet or form, reports offer you much more flexibility for presenting your data.

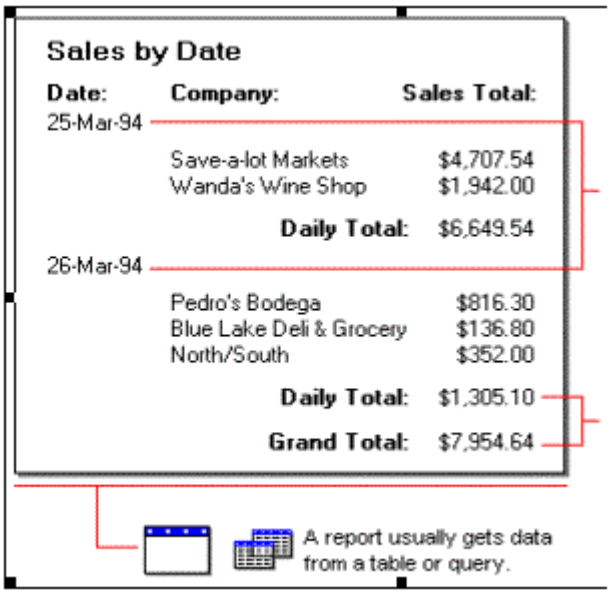
A report is an object that allows you to present your information formatted and organised to your specifications. You can choose how to group, sort and arrange your data on each page, include graphics to enhance your report's appearance and can create reports that calculate totals or even the percentage of total for each group of records.

A report:

- displays only the information you want in the way you want to see it
- can group records into many levels and compute totals and averages by checking values from many records at once
- is attractive and distinctive because you have control over the size and appearance of everything on it.

Some examples of typical reports are summaries,

address lists, mailing labels, monthly sales figures, etc.:



Product Listing - grouped by colour

	Country	Region	Product Name	Vintage	Dryness
Red					
	Australia	Koonunga	Victoria Shiraz	1996	Sweet
	Bulgaria	Plovdiv	Pomorie Cabernet/Merlot	1990	Dry
	California	Nappa Valley	Sutter Home Cabernet	1996	Dry
	California	Knihjts Valley	Sutter Home Pinot Noir	1995	Dry
	Chile	Maipo	Undurraga	1995	Medium
	France	Beaujolais	Beaujolais Village	1994	Dry
	France	Bordeaux	Chateau Camarsac	1995	Dry
	France	Bordeaux	Mouton Cadet	1994	Dry
	France	Loire	Saumur Cuvee	1991	Medium
	Italy	Frascati	Valipolicella	1993	Dry
	Spain	Rioja	Castillo de Quesa	1993	Dry
	Spain	Navarra	Marques de Murrieta Reserva 1985	1985	Dry
	Spain	Navarra	Ochoa Tinto	1995	Medium
	Spain	Valdepenas	Puerta Vieja	1996	Medium
	Spain	Rioja	Rioja Urbina Gran Reserva 1987	1987	Medium
White					
	Australia	Yalumba	Oxford Landing	1996	Medium

Creating a Report

You can create a report in 2 ways:

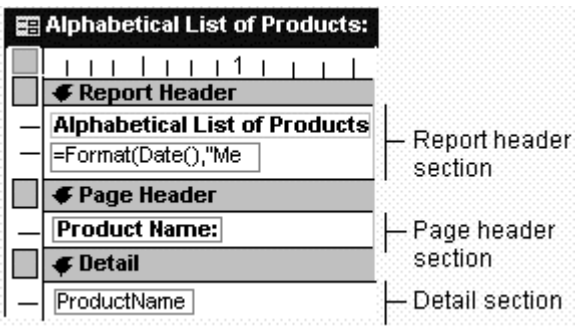
1. The **ReportWizard**s assist you in creating reports by asking you questions about the report you want to create and they will build the report based on your answers.
2. You can also start with a **blank report** and design your report from scratch the way you want. This gives you greater control over how the report appears and works, but it will take longer.

13.2 The Report Window

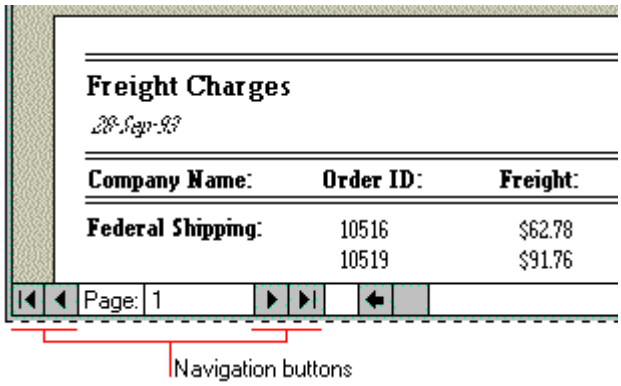
You will use the Report window to create and preview your reports. The Report window can be opened in one of three views:

1. Design View
2. Print Preview
3. Layout Preview

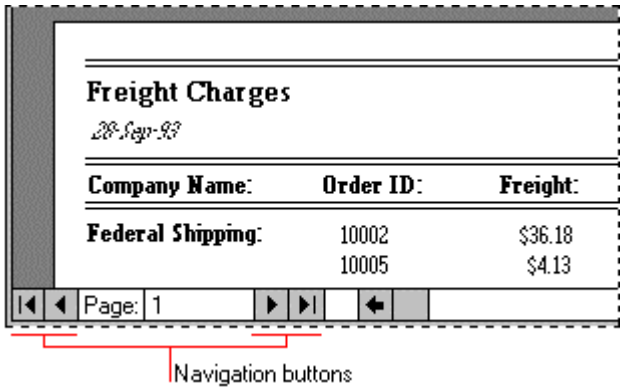
In **Design View,** you can create and modify the structure of a report.



In **Print Preview**, you can view a report exactly as it will appear when printed.



In **Layout Preview**, you can get a quick look at the basic layout of the report.



To **Switch Report Views** while you are working in the Report window, press the down arrow on the view tool and select a view .

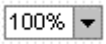
14. Printed Output

14.1 Previewing Access Objects

You can use the **View button**  on the toolbar to switch to other views of the database object.

Using **Print Preview** will allow an object prior to printing.The figure below shows a form displayed in Print Preview View. You can change to print preview by **selecting FILE / Print Preview** or by pressing the **Print Preview toolbar** button  .

You can use the features listed below to view your objects in the following ways:

- The **One Page**  button displays one page. The **Two Pages**  button displays two pages. The **Multiple Pages**  button allows you to select the number of pages to preview.
- The **Zoom box**  lists the zoom percentages at which you can view the object.
- The **Zoom tool**  will allow you to zoom in and out order to view the screen.
- Pressing the **printer icon**  will print the details and pressing **Close** will return to the previous view.

 **Printing**

- A datasheet will print as it appears on the screen. If you have changed the layout of your datasheet (font, row height, column width, etc) these changes will be reflected in your printed output. For large datasheets, Microsoft Access prints from left-to-right and then from top-to-bottom. For example, if your datasheet is three pages wide and two pages long, Microsoft Access prints the top three pages first, then the bottom three pages.
- A form can be printed from the Database window or any view of the form.
- To set the page orientation, margins, etc. you select **FILE / Page Setup**.
- To set printing options for objects, select **FILE / Print.**
