Access Tutorial 4: Basic Queries Using QBE

4.1 Introduction: Using queries to get the information you need

At first glance, it appears that splitting information into multiple tables and relationships creates more of a headache than it is worth. Many people like to have all the information they need on one screen (like a spreadsheet, for instance); they do not want to have to know about foreign keys and relationships and so on.

Queries address this problem. They allow the user to join data from one or more tables, order the data in different ways, calculate new fields, and specify criteria to filter out certain records.

The important thing is that *the query itself contains no data*—it merely reorganizes the data from the table (or tables) on which it is built without changing the "underlying tables" in any way.

Once a query is defined, it can be used in exactly the same way as a table. Because of this, it is useful to think of queries as "virtual tables". Similarly, in some DBMSes, queries are called "views" because they allow different users and different applications to have different views of the same data.

4.2 Learning objectives

- Do queries contain any data?
- How do I create a query?
- What can I do with a query?
- How do I create a calculated field?
- Why does Access add square brackets around field names?
- What names should I give the queries I create?
- What does the ampersand operator (&) do?

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❒ What is a non-updatable recordset? How do I tell whether a query results in a non-updatable recordset?

4.3 Tutorial exercises

4.3.1 Creating a query

- Use the *New* button in the *Queries* pane of the database window to create a new query as shown in Figure 4.1.
- Add the `Courses` table to the query as shown in Figure 4.2.
- Examine the basic elements of the query design screen as shown in Figure 4.3.
- Save your query (*Control-S*) using the name `qryCourses`.

4.3.2 Five basic query operations

4.3.2.1 Projection

Projecting a field into a query simply means including it in the query definition. The ability to base a query on a subset of the fields in an underlying table (or tables) is particularly useful when dealing with tables that contain some information that is confidential and some that is not confidential. For instance, the `Employees` table you created in Tutorial 2 contains a field called `Salary`. However, most of the queries seen by end-users would not include this information, thereby keeping it private.

- Perform the steps shown in Figure 4.4 to project the `DeptCode`, `CrsNum`, and `Title` fields into the query definition.
- Select *View > Datasheet* from the menu to see the results of the query. Alternatively, press the datasheet icon () on the tool bar.

FIGURE 4.1: **Create a new query.**

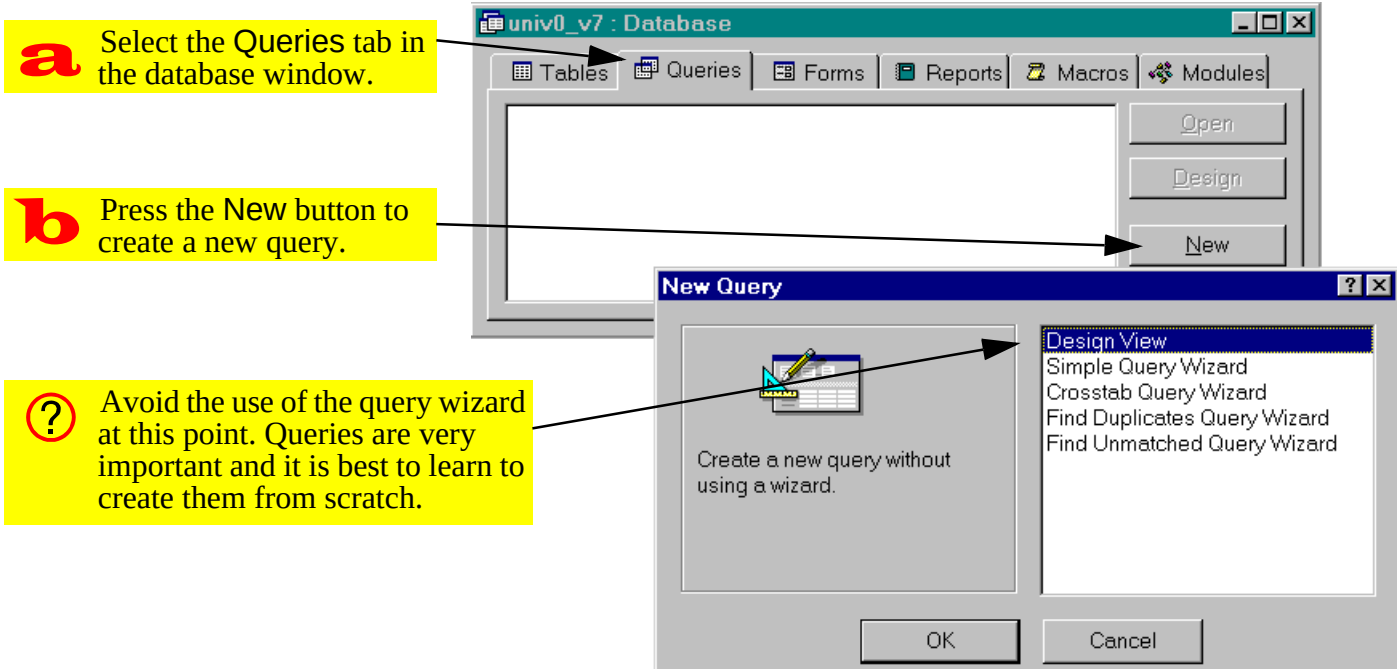
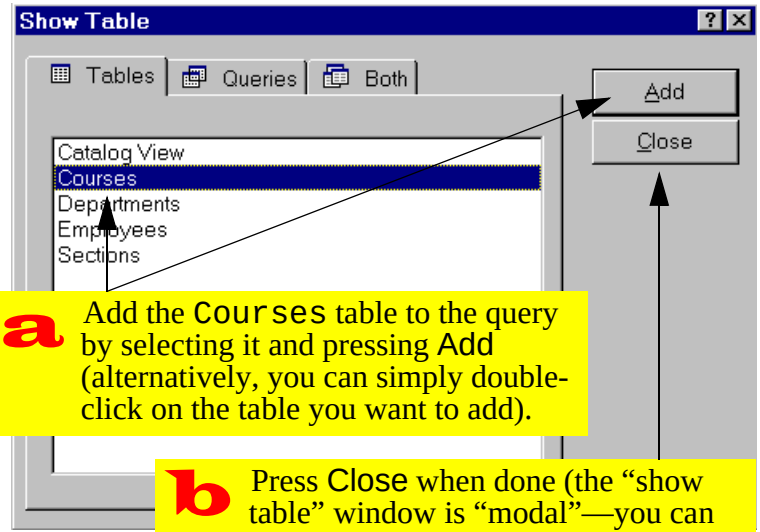
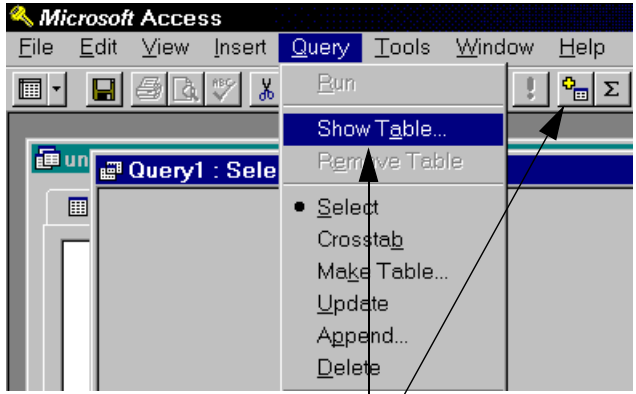


FIGURE 4.2: Add tables to your query using the "show table" window.



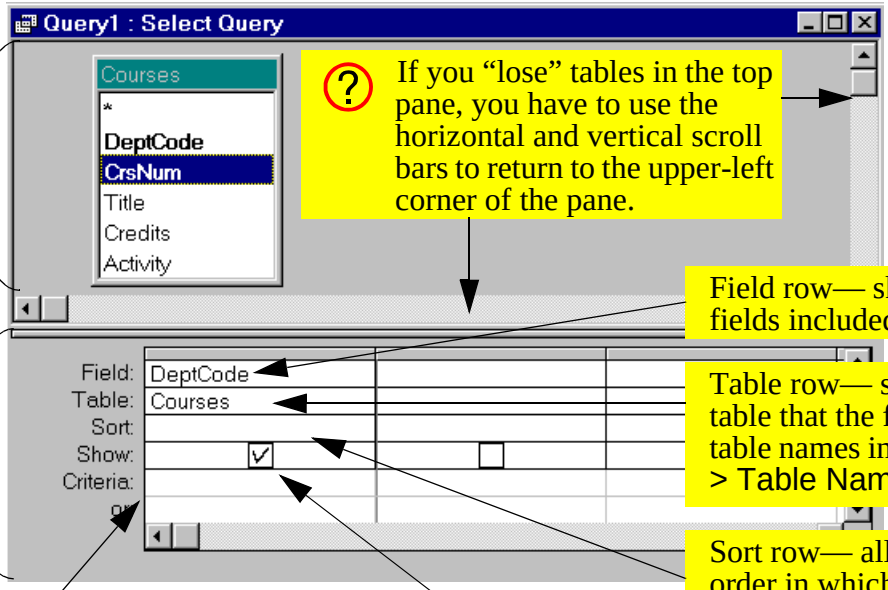
a Add the `Courses` table to the query by selecting it and pressing Add (alternatively, you can simply double-click on the table you want to add).

b Press Close when done (the "show table" window is "modal"—you can not do anything else in Access until a modal window is closed).



? The "show table" window is always available from the Query > Show Table menu. Alternatively, you can press the "show table" button on the tool bar.

FIGURE 4.3: The basic elements of the query design screen.



The upper pane contains field lists for the tables on which the query is based.

If you "lose" tables in the top pane, you have to use the horizontal and vertical scroll bars to return to the upper-left corner of the pane.

Field row— shows the name of the fields included in the query.

The lower pane contains the actual query definition.

Table row— shows the name of the table that the field comes from. To get table names in version 2.0, select View > Table Names from the menu.

Sort row— allows you to specify the order in which the records are displayed

Criteria row — allows you to specify criteria for including or excluding records from the results set.

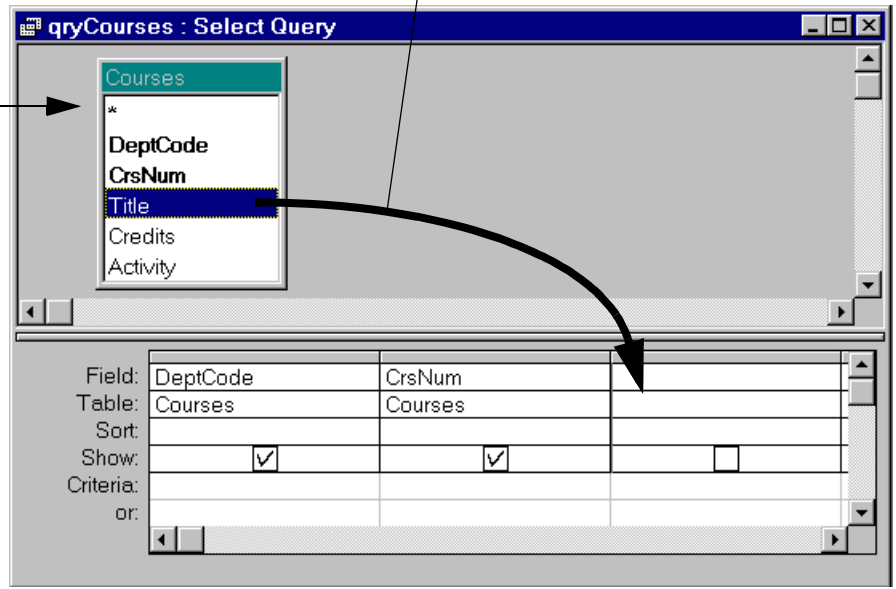
Show boxes— determine whether fields included in the query are actually displayed.

FIGURE 4.4: Project a subset of the available fields into the query definition.

a Select the field you wish to project and drag it into the query definition grid. Alternatively, double-click the field.

? To project all the fields in the `Courses` table (including any that might be added to the table after this query is created) drag the asterisk (*) into the query definition grid.

? To save time when projecting fields, select more than one field at once (by holding down the Control key) and dragging all the fields as a group.



- Select *View > Query Design* to return to design mode. Alternatively, press the design icon ( ) on the tool bar.

4.3.2.2 Sorting

When you use a query to sort, you do not change the physical order of the records in the underlying table (that is, you do not sort the table). As a result, different queries based on the same table can display the records in different orders.

- Perform the steps shown in Figure 4.5 to sort the results of `qryCourses` by `DeptCode` and `CrsNum`.

Since a query is never used to display data to a user, you can move the fields around within the query definition to get the desired sorting precedence. You then reorder the fields in the form or report for presentation to the user.

4.3.2.3 Selection

You select records by specifying conditions that each record must satisfy in order to be included in the results set. In “query-by-example” you enter examples of the results you desire into the criteria row.

- Perform the steps shown in Figure 4.6 to select only those courses with a `DeptCode = “COMM”`.

4.3.2.4 Complex selection criteria

It is also possible to create complex selection criteria using Boolean constructs such as AND, OR, and NOT.

- Project the `Credits` field into the query.
- Perform the steps shown in Figure 4.7 to create a query giving the following result:
  “Show the department, course number, and title of all courses in the Commerce department for which the number of credits is greater than three.”

FIGURE 4.5: Sorting the results set on one or more fields.

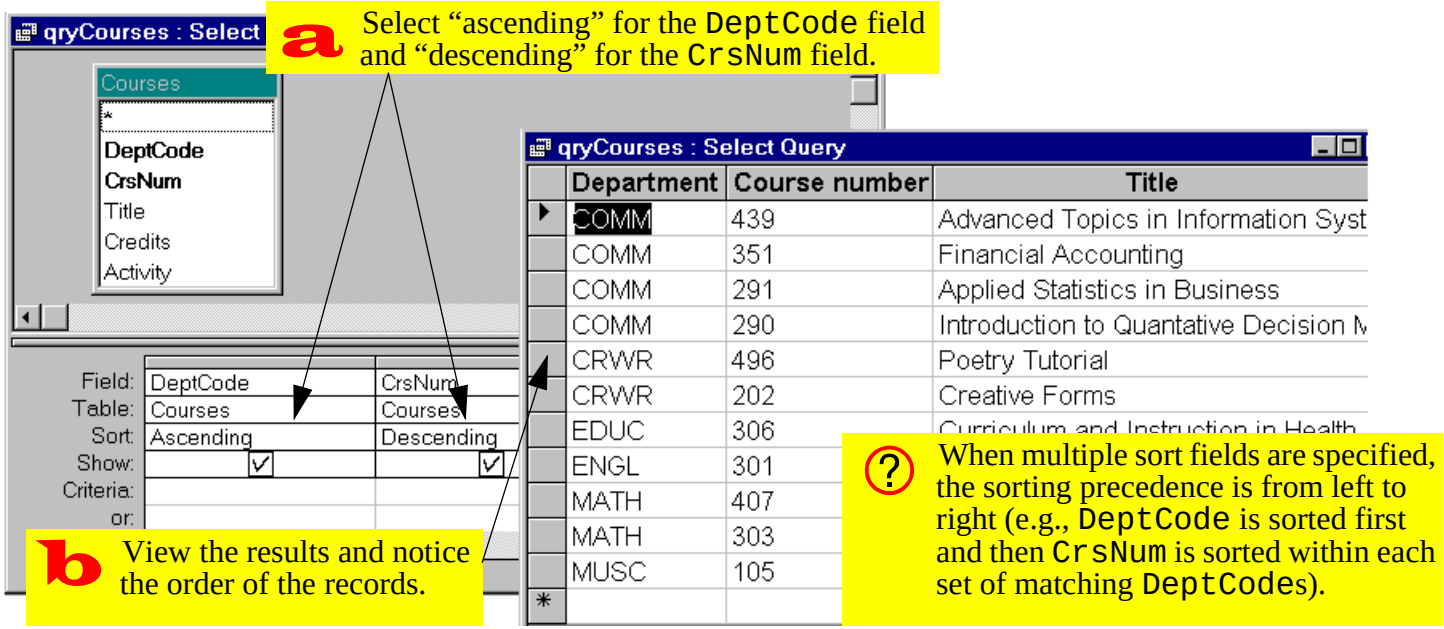


FIGURE 4.6: Select a subset of records from the `Courses` table matching a specific criterion.

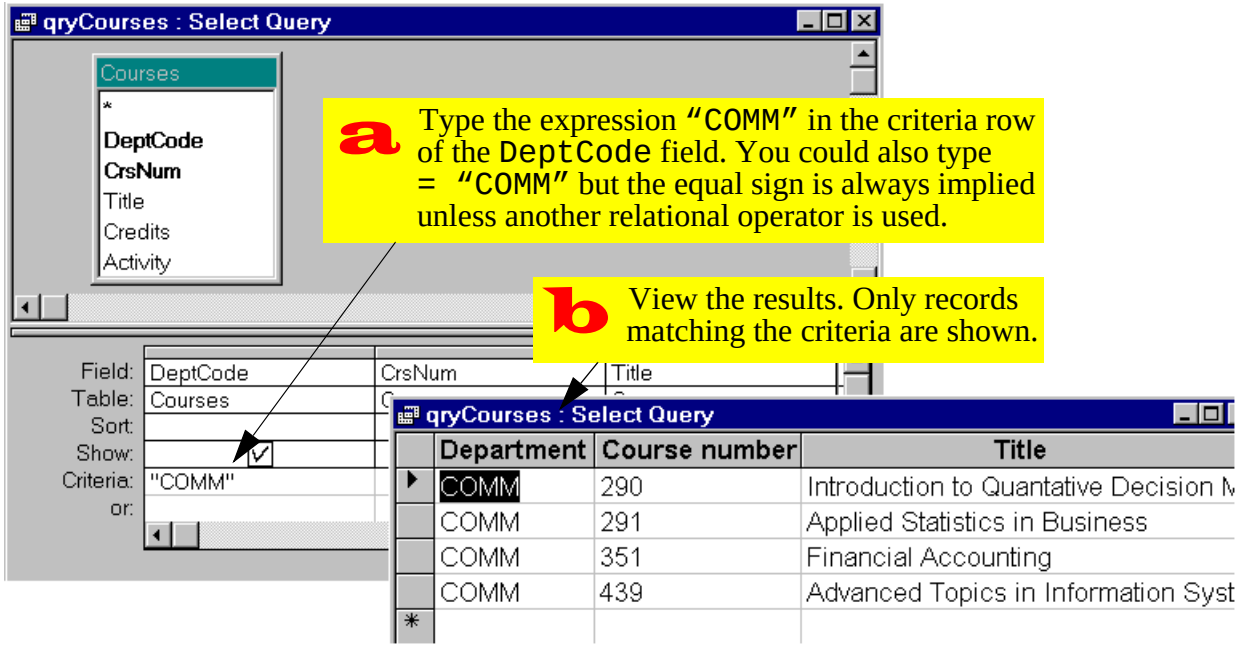
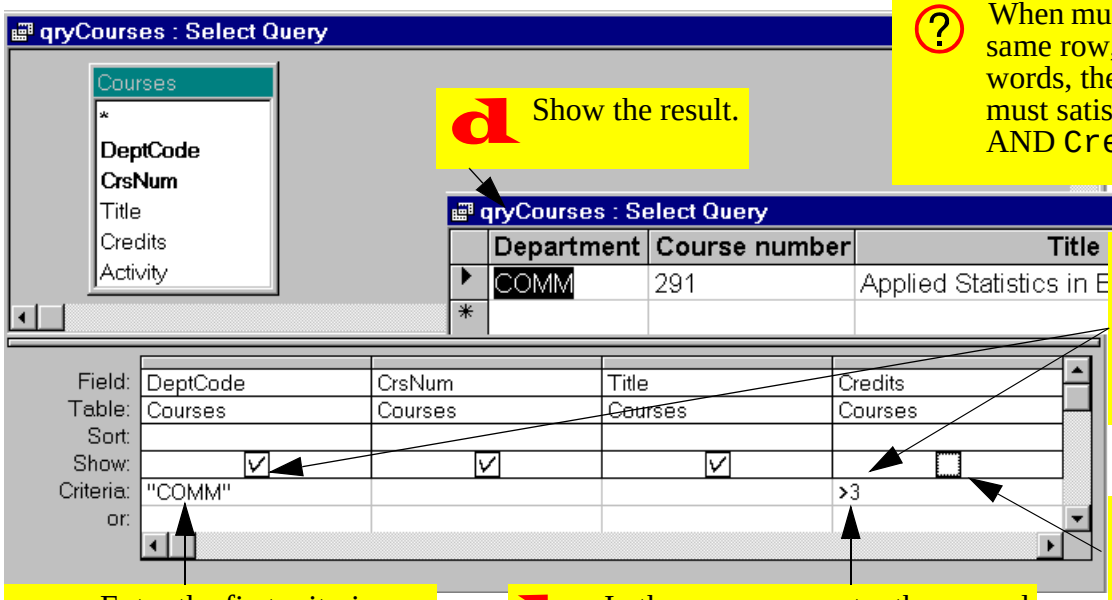


FIGURE 4.7: Select records using an AND condition.



d Show the result.

qryCourses : Select Query

Department	Course number	Title
COMM	291	Applied Statistics in E

When multiple criteria are placed in the same row, they are AND-ed. In other words, the records in the results set must satisfy `DeptCode = "COMM"` AND `Credits > 3`.

Note that the number 3 is not in quotation marks whereas the string of characters "COMM" is.

a Enter the first criteria: `"COMM"`

b In the same row, enter the second `> 3`

c Uncheck the "show" box (`Credits` is used as a criterion but it is not displayed in the results set)

- Perform the steps shown in Figure 4.8 to create a query giving the following result:
  "Show the department, course number, and title of *all* courses from the Commerce department and also show those from the Creative Writing department for which the number of credits is greater than three."

4.3.2.5 Joining

In Tutorial 3, you were advised to break you information down into multiple tables with relationships between them. In order to put this information back together in a usable form, you use a join query.

- Close `qryCourses`.
- Open the relationships window and ensure you have a relationship defined between `Courses` and `Sections`. If you do not, create one now (do not forget to enforce referential integrity).
- Create a new query called `qryCatalogNum` based on the `Courses` and `Sections` tables.
- Project `Title` from the `Courses` table and `DeptCode`, `CrsNum`, `Section` and `CatalogNum` from the `Sections` table (see Figure 4.9).
- Follow the instructions in Figure 4.10 to move `CatalogNum` to the far left of the query definition grid.

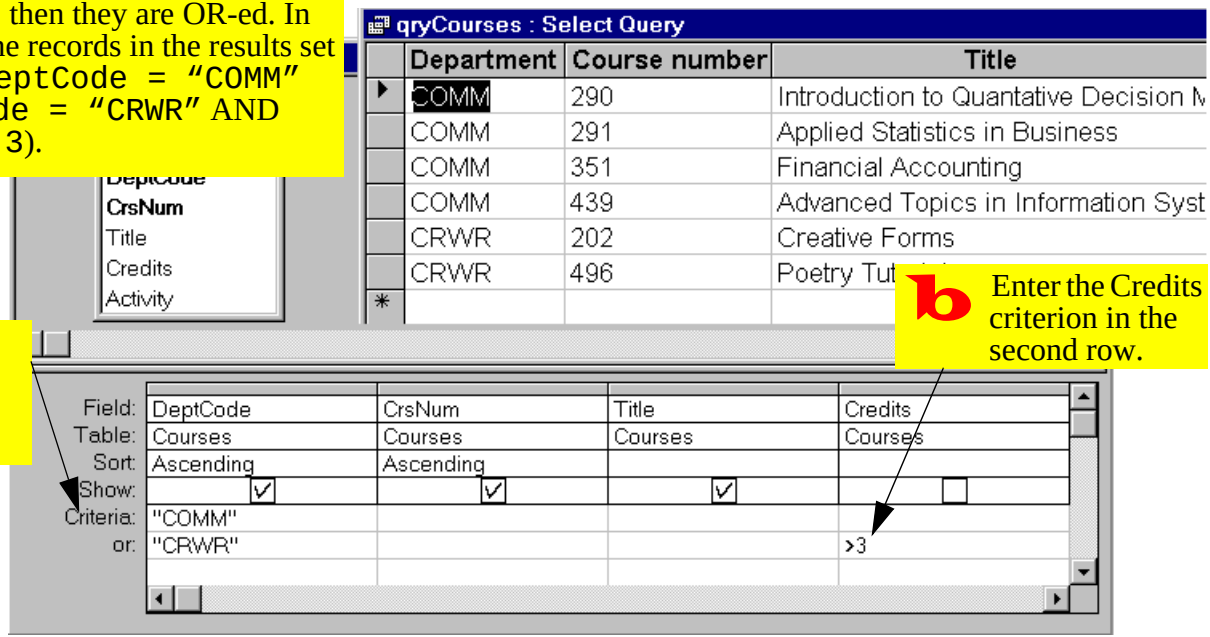
Access performs an automatic lookup of information from the "one" side of the relationship whenever the a valid value is entered into the foreign key of the "many" side of the relationship. To see how this works, create a new section of "MUSC 105":

- Scroll to the bottom of the query in datasheet mode and click on the department field.
- Enter "MUSC".
- Enter "105" in the course number field.

Once Access knows the `DeptCode` and `CrsNum` of a section, it can uniquely identify the course that the section belongs to (which means it also knows the values of `Title`, `Credits`, `Activity`, etc.)

FIGURE 4.8: Select records using an AND and an OR condition.

When multiple criteria are placed in different rows, then they are OR-ed. In other words, the records in the results set must satisfy `DeptCode = "COMM"` OR (`DeptCode = "CRWR"` AND `Credits > 3`).

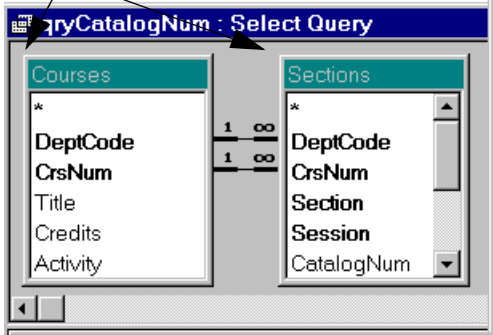


a Enter the `DeptCode` criteria in different rows.

b Enter the Credits criterion in the second row.

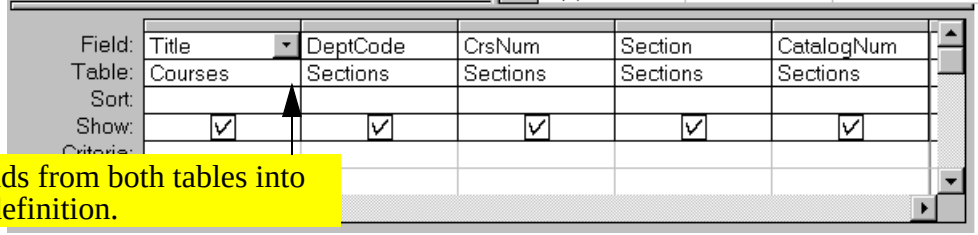
FIGURE 4.9: Create a query that joins `Courses` and `Sections`.

a Bring `Courses` and `Sections` into the query. Note that the relationship between the tables is inherited from the relationship window.



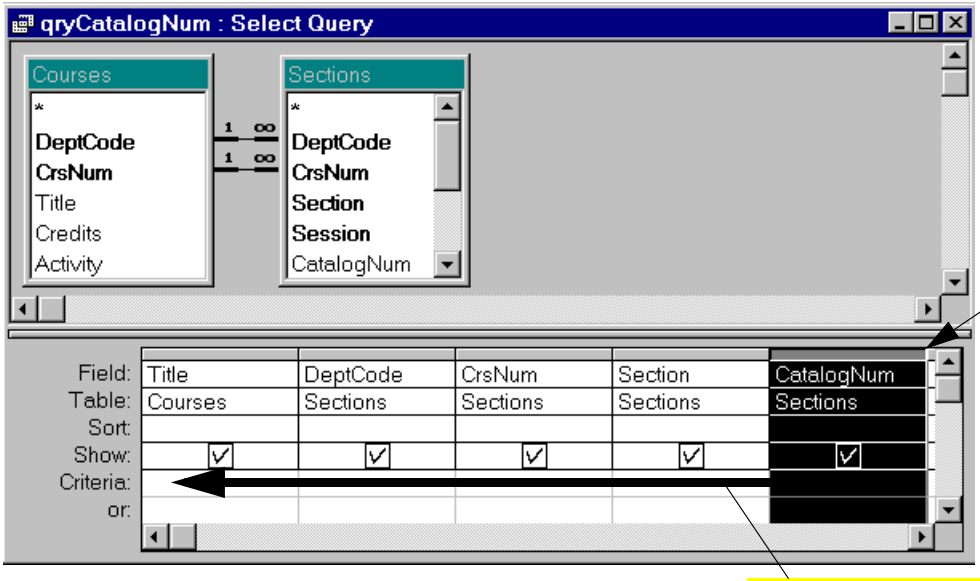
qryCatalogNum : Select Query

Title	Departmen	Course nur	Section	CatalogNur
Introduction	COMM	290	001	44411
Introduction	COMM	290	002	57455
Introduction	COMM	290	003	48516
Introduction	COMM	290	004	71845
Introduction	COMM	290	005	69495
Introduction	COMM	290	006	34134
Introduction	COMM	290	007	45938
Introduction	COMM	290	008	27839
Applied Stat	COMM	291	001	84203
Applied Stat	COMM	291	002	83920



b Project fields from both tables into the query definition.

FIGURE 4.10: Move a field within the query definition grid.



a Click once on the grey "column selector" above the field you want to move (if properly selected, the column turns black).

? To delete a field from the query definition, select it and press the Delete key.

b Drag the selected column to its new location.

4.3.3 Creating calculated fields

A calculated field is a "virtual field" in a query for which the value is a function of one or more fields in the underlying table. To illustrate this, we will create two calculated fields:

1. one to combine `DeptCode` and `CrsNum` into one field,
2. one to translate the `Credits` field into a dichotomous string variable (`full year` or `half year`).

The syntax of a calculated field is always the same:
`<calc field name>: <definition>`

For example, the syntax for the calculated field called `Course` is:
`Course: DeptCode & CrsNum`

The calculated field name can be just about anything, as long as it is unique. The definition is any expression that Access can evaluate. In this case, the expression involves two fields from the `Courses` table (`DeptCode` and `CrsNum`) and the ampersand operator (see Section 4.4.2 for more information on using the ampersand operator).

- Create a new query called `qryCourseLengths` based on the `Courses` table.
- Follow the instructions in Figure 4.11 to create the calculated field `Course`
- Run the query to verify the results, as shown in Figure 4.12.

When you use field names in expressions, Access normally adds square brackets. This is not cause for concern because in Access, square brackets simply indicate the name of a field (or some other object in the Access environment). However, if your field name contains blank spaces (e.g., `Dept Code`), the square brackets are NOT optional—you must

FIGURE 4.11: Create a calculated field based on two other fields.

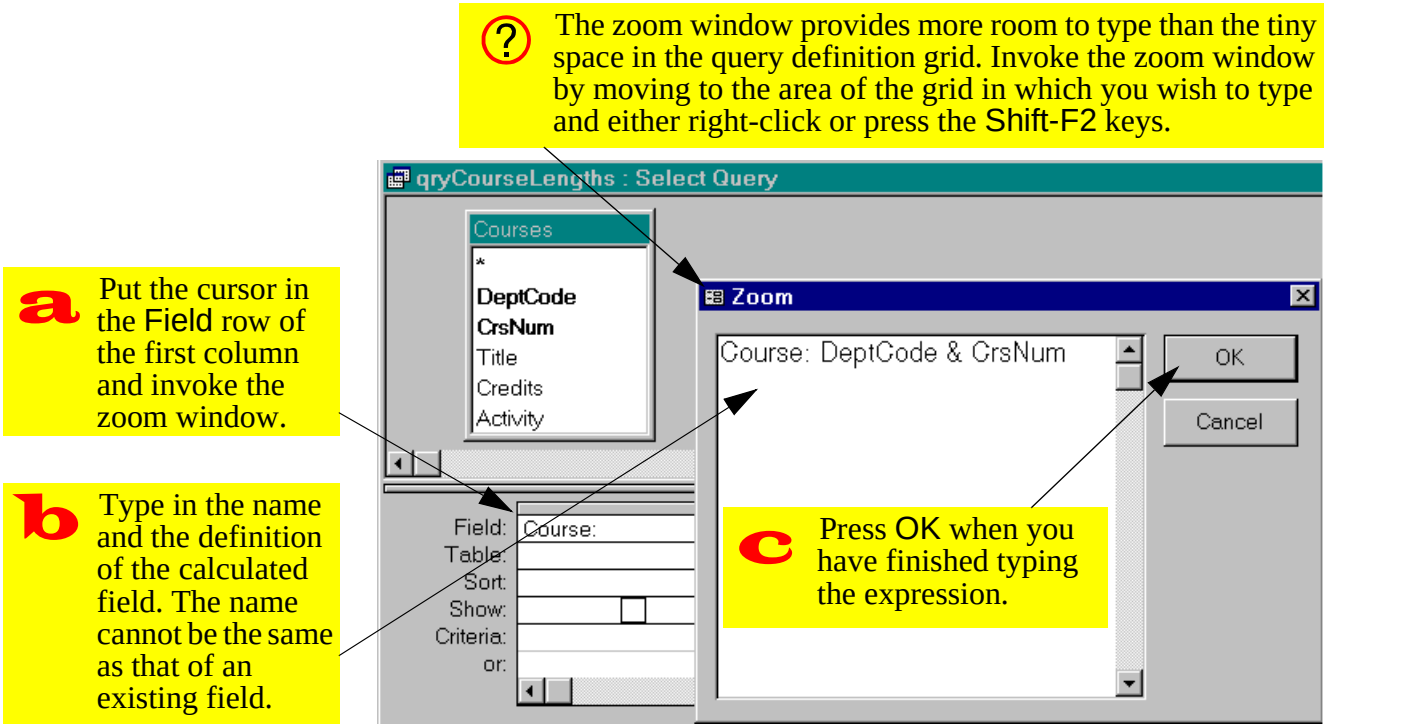
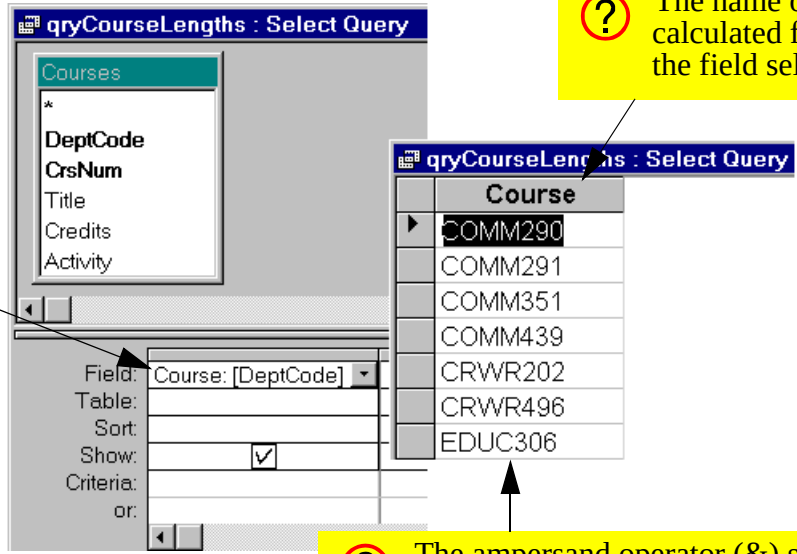


FIGURE 4.12: The resulting calculated field.



The name of the calculated field shows in the field selector.

When the zoom window is closed, Access adds square brackets to the field names. Since the field names in this example do not contain spaces, the brackets are optional.

The ampersand operator (&) simply tacks `CrsNum` onto the end of `DeptCode`.

type them every time you use the field name in an expression.

4.3.3.1 Refining the calculated field

Instead of having `DeptCode` and `CrsNum` run together in the new `Course` field, you may prefer to have a space separating the two parts.

- Edit the `Courses` field by clicking on the field row and invoking the zoom box.
- Add a space (in quotation marks) between the two constituent fields:
  `Course: DeptCode & " " & CrsNum`
- Switch to datasheet mode to see the result.

4.3.3.2 A more complex calculated field

To create a calculated field that maps `Credits` to a dichotomous string variable, we need a means of testing whether the value of `Credits` exceeds a certain threshold (e.g., any course with more than three credits is a full-year course). To do this, we will use the "immediate if" (`iif`) function.

- Search on-line help for information about the `iif()` function.

Basically, the function uses the following syntax:

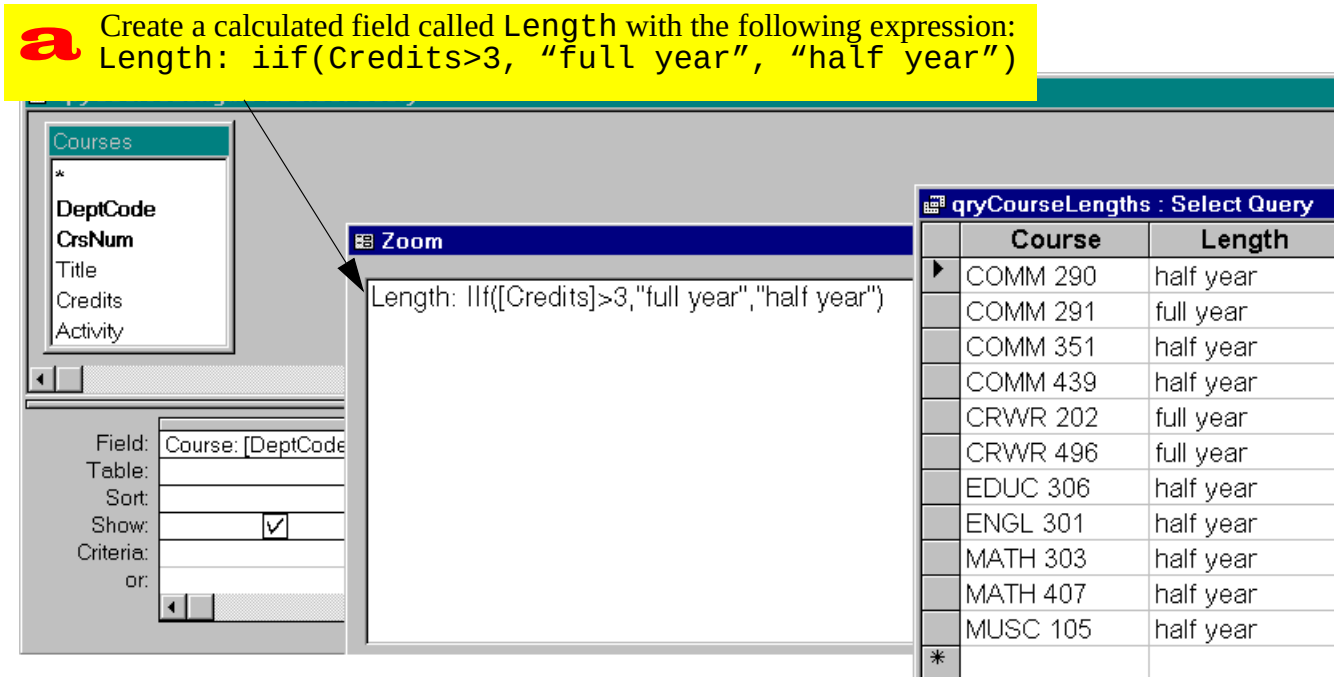
```
iif(<expression>, <true part>,
 <false part>)
```

to implement the following logic:

```
IF <expression> = TRUE THEN
   RETURN <true part>
ELSE
   RETURN <false part>
END IF
```

- Create a new calculated field called `Length`:
  `Length: iif(Credits > 3, "full year", "half year")`
- Verify the results, as shown in Figure 4.13.

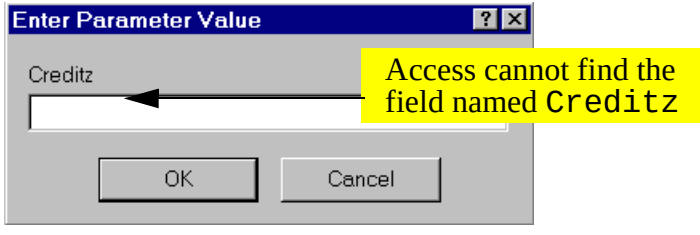
FIGURE 4.13: Create a calculated field using the "immediate if" function



4.3.4 Errors in queries

It may be that after defining a calculated field, you get the “enter parameter” dialog box shown in Figure 4.14 when you run the query. This occurs when you spell a field name incorrectly. Access cannot resolve the name of the misspelled field and thus asks the user for the value. To eliminate the problem, simply correct the spelling mistake.

FIGURE 4.14: A spelling error in a calculated field.



4.4 Discussion

4.4.1 Naming conventions for database objects

There are relatively few naming restrictions for database objects in Access. However, a clear, consistent method for choosing names can save time and avoid confusion later on. Although there is no hard and fast naming convention required for the assignment, the following points should be kept in mind:

- Use meaningful names — An object named `Table1` does not tell you much about the contents of the table. Furthermore, since there is no practical limit to the length of the names, you should not use short, cryptic names such as `s96w_b`. As the number of objects in your database grows, the time spent carefully naming your objects will pay itself back many times.

- Use capitalization rather than spaces to separate words — Unlike many database systems, Access allows spaces in object names. However, if you choose to use spaces, you will have to enclose your field names in square brackets whenever you use them in expressions (e.g., `[Back Orders]`). As such, it is slightly more efficient to use a name such as `BackOrders` than `Back Orders`.
- Give each type of object a distinctive prefix (or suffix) — This is especially important in the context of queries since tables and queries cannot have the same name. For example, you cannot have a table named `BackOrders` and a query named `BackOrders`. However, if all your query names are of the form `qryBackOrders`, then distinguishing between tables and queries is straightforward.
- Stick to standard alphanumeric characters — You should limit yourself to the characters [A...Z], [a...z], [0...9], and perhaps underscore (_) and dash (-). Although Access allows you to use virtually any character, undocumented problems have been encountered in the past with non-alphanumeric characters such as the pound sign (#).

Table 4.1 shows a suggested naming convention for Access database objects (you will discover what these objects are in the course of doing the tutorials).

4.4.2 The ampersand (&) operator

The ampersand operator is like any other operator (e.g., +, -, ×, ÷) except that it is intended for use on strings of characters. What the ampersand does is simply add one string on to the end of another string (hence its other name: the “concatenation” operator). For example, the expression

```
“First string” & “Second string”
```

Table 4.1: A suggested naming convention for Access database objects.

Object type	Prefix	Example
table	(none)	`OrderDetails`
query	qry	`qryNonZeroBackOrders`
parameter query	pqry	`pqryItemsInOrder`
form	frm	`frmOrders`
sub form	sfrm	`sfrmOrderDetails`
switchboard form	swb	`swbMainSwitchboard`
report	rpt	`rptInvoice`
sub report	srpt	`srptInvoiceDetails`
macro	mcr	`mcrOrders`
Visual Basic module	bas	`basUtilities`

yields the result

```
First stringSecond string
```

However, if a space is include within the quotation marks of the second string (`" Second string"`), the result is:

```
First string Second string
```

4.4.3 Using queries to populate tables on the "many" side of a relationship

In Section 4.3.2.5, you added a record to the `Sections` table to demonstrate the automatic lookup feature of Access. However, a common mistake when creating queries for entering data into tables on the "many" side of a relationship is to forget to project the table's foreign key. That is, faced with two tables containing the fields `DeptCode` and `CrsNum`, you project the fields from the wrong table (the "one" side) into your query definition.

To illustrate the problem, do the following:

- Open the `qryCatalogNum` query and make the changes shown in Figure 4.15.
- Attempt to save the new section of “MUSC 105” as shown in Figure 4.16.

There are two ways to avoid this error when deciding which fields to project into your join queries:

1. Always show the table names when creating a query based on more than one table. That way, you can quickly determine whether the query makes sense.
2. Always ask yourself: “What is the purpose of this query?” If the answer is: “To add new records to the `Sections` table,” you automatically have to include *all* the fields from the `Sections` table. Fields from the `Courses` table are only shown for validation purposes.

4.4.4 Non-updatable recordsets

Another problem that sometimes occurs when creating join queries is that the query is not quite right in some way. In such cases, Access will allow you to view the results of the query, but it will not allow you to edit the data.

In this section, will look at a nonsensical query that results from an incompletely specified relationship. As you will probably discover, however, there are many different way to generate nonsensical queries.

- Create a new query called `qryNonUpdate` based on the `Courses` and `Sections` tables.
- Delete the `CrsNum` relationship but leave the `DeptCode` relationship intact, as shown in Figure 4.17.

The result of this query is that every section in a Commerce course will be associated with every Commerce course. Since allowing the user to update

FIGURE 4.15: Create a data-entry query without a foreign key.

a Reorder the fields (by dragging and dropping) so that `DeptCode` and `CrsNum` are on the far left.

b Change the source table for `DeptCode` and `CrsNum` from `Sections` to `Courses`.

c Switch to datasheet mode and attempt to add a new section of "MUSC 105".

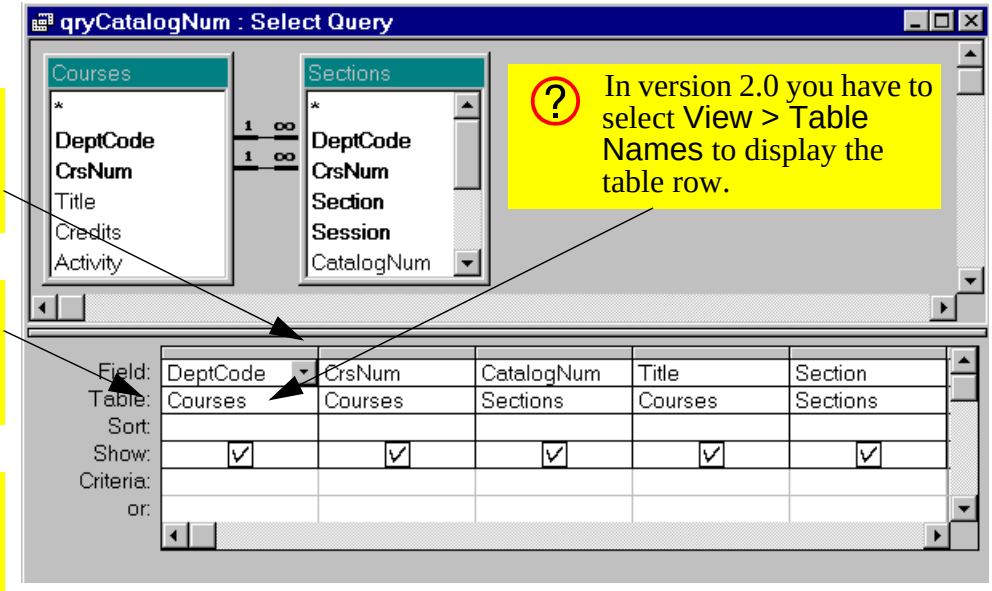


FIGURE 4.16: The result of attempting to save a record in which the foreign key is missing

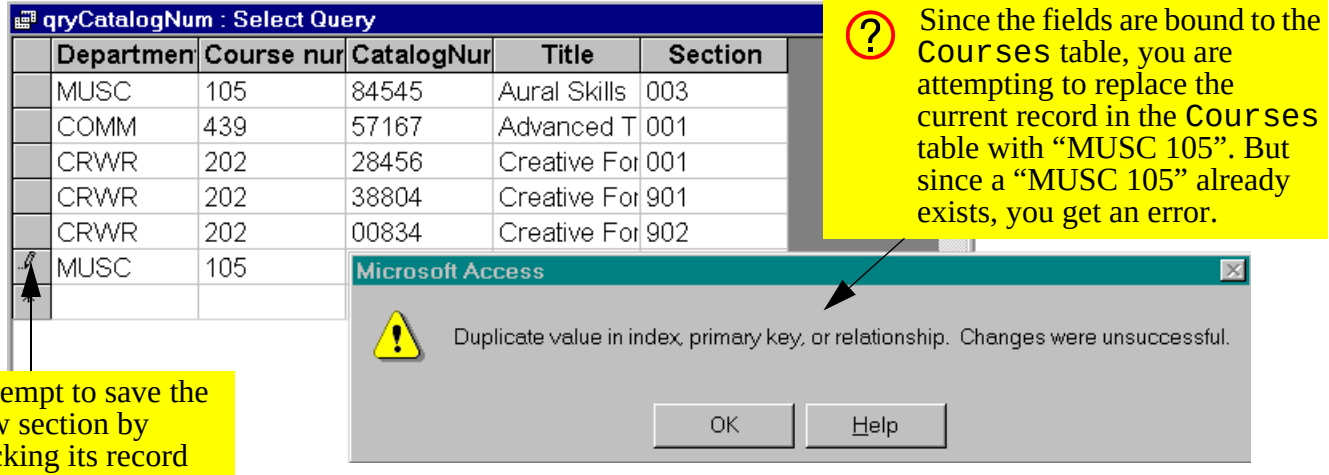
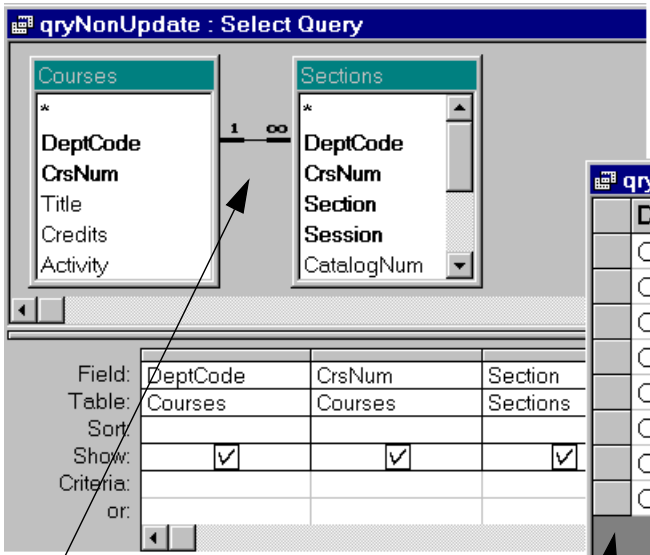
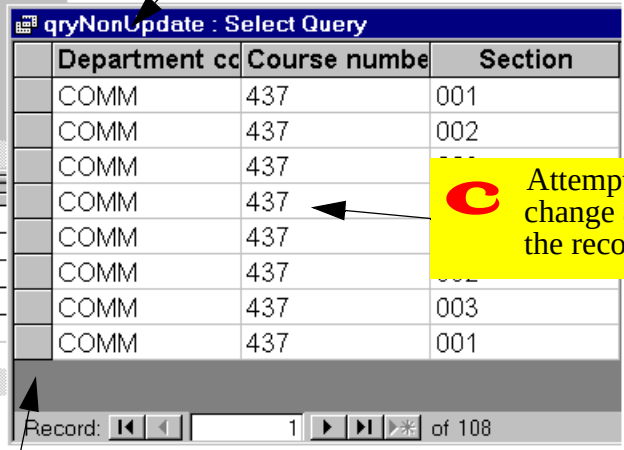


FIGURE 4.17: Create a non-updatable recordset.





b Project fields from both tables and view the query in datasheet mode (i.e., view the "recordset").

c Attempt to change a value in the recordset.

a To create a nonsensical query, delete the `CrsNum` relationship by clicking on it and pressing the Delete key. Leave the `DeptCode` relationship intact.

? Note the absence of the asterisk and the "new record" row. This is a sure sign that the recordset is non-updatable.

the values in this recordset would create anomalies, Access designates the recordset as non-updatable.

A common mistake is to build data entry forms on nonsensical queries and to assume that there is a mistake in the form when the forms do not work. Clearly, if a query is non-updatable, a form based on the query is also going to be non-updatable. A quick check for a “new record” row in the query can save time and frustration.

4.5 Application to the assignment

- Create a query to sort the `Products` table by `ProductID`.
- Create a query that joins the `OrderDetails` and `Products` tables. When you enter a valid `ProductID`, the information about the product (such as name, quantity on hand, and so on) should appear automatically. If they do not, see Section 4.4.3.
- Create a calculated field in your `qryOrderDetails` query that calculates the extended price (quantity shipped × price) of each order detail.
- Enter the first order into your system by entering the information directly into tables or queries. This involves creating a single `Orders` record and several `OrderDetails` records. You must also consult the `Products` and `BackOrders` tables to determine the quantity of each item to ship.

Entering orders into your system will be much less work once the input forms and triggers are in place. The goal at this point is to get you thinking about the order entry process and ways in which it can be automated.