ASSIGNMENT 2

2 CREATING TABLES AND FIELDS

ASSIGNMENT OBJECTIVES

When you complete Assignment 2, you'll be able to

2. Create a database

ASSIGNMENT 2

VOCABULARY

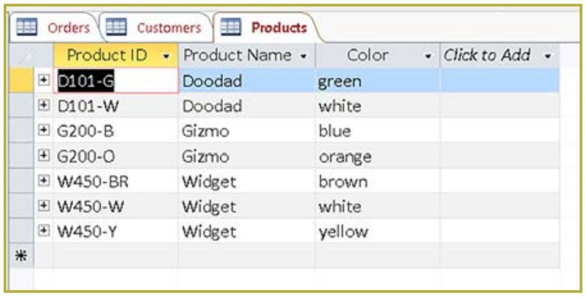
The terms you need to know for this assignment are

- Table
- Field
- Data redundancy
- Normalization
- Field properties
- AutoNumber
- Lookup field
- Data integrity
- Validation rules
- Record
- Primary key
- Datasheet view
- Design view
- Active field
- Foreign key
- One-to-many
- Referential integrity

Learning how to create and use a database is exciting when you consider that many aspects of your life are affected by databases. For example, have you ever Googled for information? Google uses a database to deliver search results. Did you know that massive databases such as CODIS help investigators use DNA information to solve cold cases? And how about online shopping? It's all processed through databases.

DESIGNING A RELATIONAL DATABASE

Tables are used to store all of the data in a database. For example, the Clever Acme Corp. database is divided into three tables: orders, customers, and products (Figure 6).



Product ID	Product Name	Color	Click to Add
D101-G	Doodad	green	
D101-W	Doodad	white	
G200-B	Gizmo	blue	
G200-O	Gizmo	orange	
W450-BR	Widget	brown	
W450-W	Widget	white	
W450-Y	Widget	yellow	
*			

FIGURE 6—There are three tables in the database for Clever Acme Corp.

Before creating a database, you must give thought to the database design, which has four major steps:

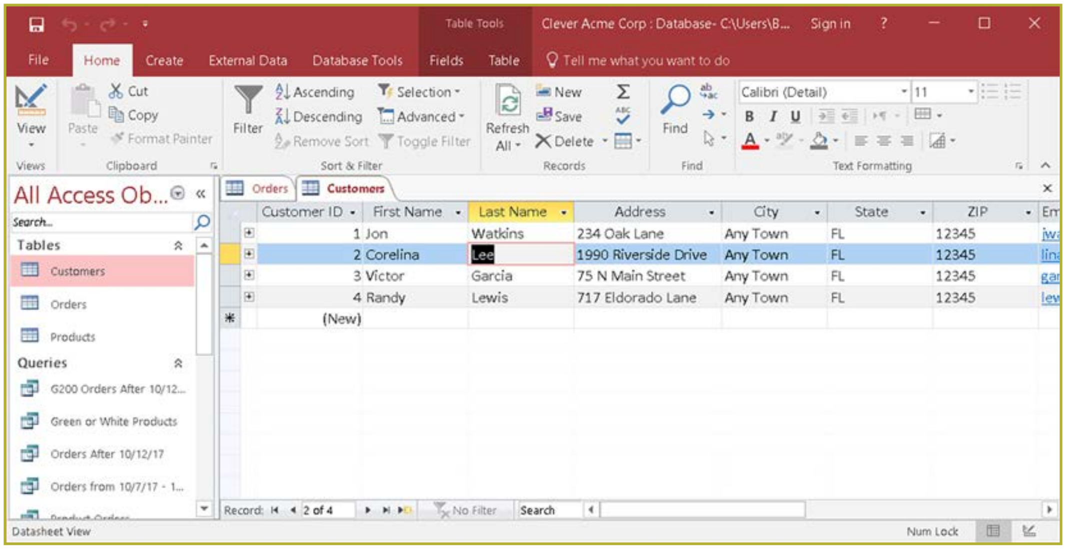
1. **Clearly define the purpose of the database.** Do you want to keep track of customers and orders for your business? Are you trying to organize your comic book collection and related memorabilia? With the purpose in mind, decide on the data you need to store for the queries and reports you want to generate.

2. **Divide data into tables that don't duplicate data.** Eliminating unnecessary data duplication, or *data redundancy*, is a guiding principle of good database design. The process of organizing data to reduce redundancy is called *normalization*. For example, an Orders table shouldn't contain customer addresses when the Customers table already stores that information. However, the Orders table should include a Customer ID field so it can indirectly access the address by looking it up in the Customers table.

3. **Choose the primary key for each table.** The *primary key* is the field in a table that contains unique entries only. For example, Order ID is never the same for any two orders.

4. **Specify table relationships.** As the name implies, in a *relational database* every table must have a field that relates it to at least one other table. For example, the Orders table and Customers table are related by Customer ID. You may need to add a field to a table to achieve a relationship, but if you can't relate a table to at least one other table, then it doesn't belong in the database.

Within a table, *fields* contain data about a certain aspect of the subject. *Records* contain all the field data about a specific item. *Field values* hold each individual piece of data being stored (Figure 7). How you group data into tables and further divide it into named fields determines how useful your database will be.



Customer ID	First Name	Last Name	Address	City	State	ZIP	Em
1	Jon	Watkins	234 Oak Lane	Any Town	FL	12345	jwa
2	Corelina	Lee	1990 Riverside Drive	Any Town	FL	12345	lin
3	Victor	Garcia	75 N Main Street	Any Town	FL	12345	gar
4	Randy	Lewis	717 Eldorado Lane	Any Town	FL	12345	lew
(New)							

FIGURE 7—Last Name is the field, the blue highlight is the record, and "Lee" is the field value.

FIELD PROPERTIES

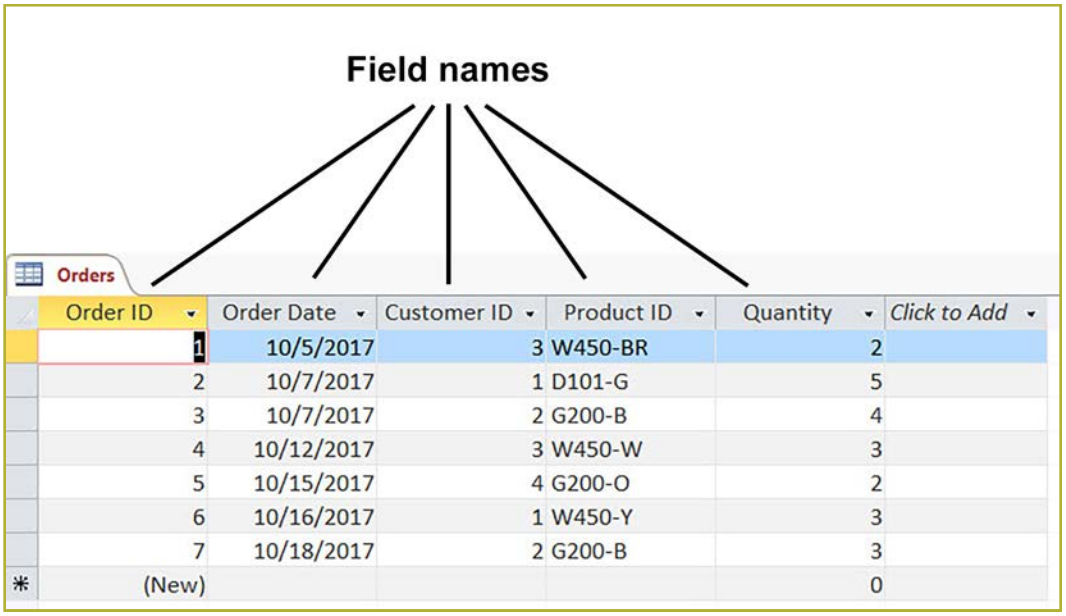
Your database design should also include determining the properties for each field. *Field properties* refer to the name, type, size, format, and number of decimal places, if any. *Data types* include

- Text Short (up to 255 characters) Long (up to 1GB of data)
- Number (digits)
- Date/Time
- Currency
- Hyperlink
- Yes/No (displayed as a checkbox)
- Attachment (stores a file)
- *AutoNumber* (a unique number that's generated by Access for each record; useful for ID fields)
- *Calculated* (an expression that uses data from fields)
- *Lookup field* (stores a value from another table)

In the Orders table, the Customer ID and Product ID fields are Lookup fields. When you click a Lookup field, an arrow is displayed so you can select an existing value from the related table.

The Orders table includes several data types, as shown in Figure 8:

- AutoNumber in the first column
- Date in the second column
- Text in the fourth column
- Number in the fifth column



Order ID	Order Date	Customer ID	Product ID	Quantity	Click to Add
1	10/5/2017	3	W450-BR	2	
2	10/7/2017	1	D101-G	5	
3	10/7/2017	2	G200-B	4	
4	10/12/2017	3	W450-W	3	
5	10/15/2017	4	G200-O	2	
6	10/16/2017	1	W450-Y	3	
7	10/18/2017	2	G200-B	3	
(New)				0	

FIGURE 8—Examples of Different Data Types

Your field names should describe the data being stored accurately while using the shortest name possible. Some words, such as *Name* and *Date*, are reserved by Access and can't be used as field names. You should also avoid special characters and use complete words rather than abbreviations.

ENFORCING DATA INTEGRITY

If you design your database tables properly and without data redundancy, you need only check the accuracy of your data in one place. This is a good start to enforcing *data integrity*, the accuracy and consistency of data. Another way you can enforce data integrity is by using *validation rules*, which check your data for a value outside a specified range of values. For example, your order quantity should be a number greater than 0. Validation rules can include *relational operators*, such as < and > (less than and greater than) as well as the *logical operators* AND, OR, and NOT. For a color field, you may want to limit entries to "orange OR blue" but "NOT red." These rules cause an error message to display if the user attempts to enter data that doesn't fit the rule.

- The *AND* logical operator requires that both criteria be met.
- The *OR* logical operator requires that one of the two criteria be met.
- The *NOT* logical operator requires that both criteria be absent.

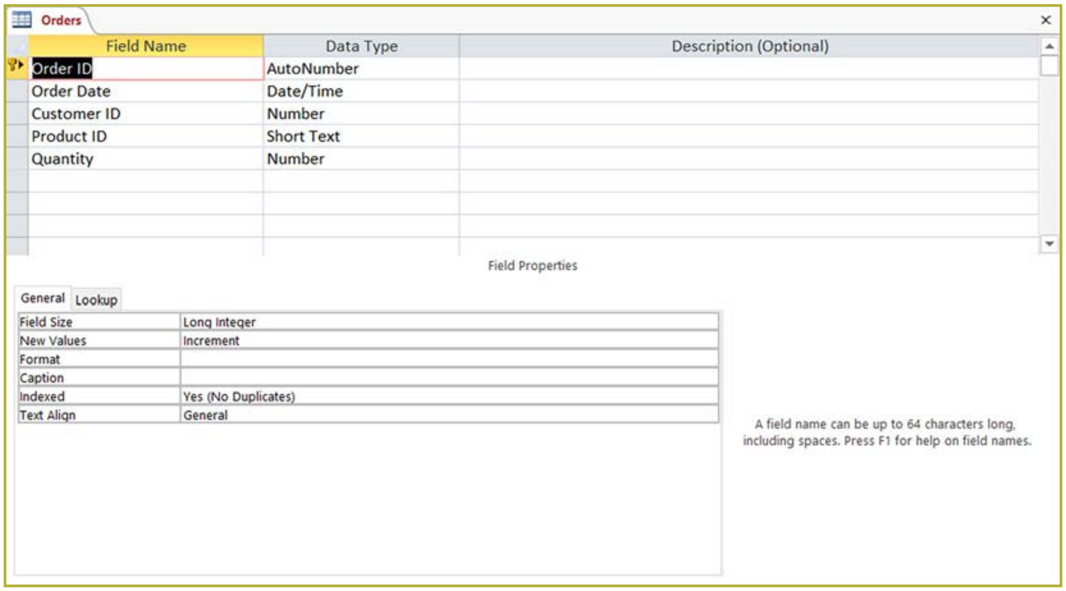
CHOOSING THE PRIMARY KEY

A table is organized into rows and columns, with each column being a field. Each row in a table is a *record*. Your database must have unique records for it to be reliable. To ensure no two records are the same, Access requires every table to have a *primary key*, which is a field that must contain a unique entry. An ID field is commonly designated the primary key, as in the Orders table in Figure 8.

CREATING TABLES

After you've designed the tables, fields, field properties, validation rules, and primary keys, you're ready to create your database tables.

When you create a database, Access automatically displays the new table in *Datasheet view*, which shows rows and columns. Although you can type field names and select most field properties from this view, you can more easily define field properties from *Design view*, which looks similar to Figure 9. (Note the different data types.)



Field Name	Data Type	Description (Optional)
Order ID	AutoNumber	
Order Date	Date/Time	
Customer ID	Number	
Product ID	Short Text	
Quantity	Number	

Field Properties

Field Size	Long Integer
New Values	Increment
Format	
Caption	
Indexed	Yes (No Duplicates)
Text Align	General

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

FIGURE 9—Design view makes database design easier.

To display a table in Design view, click **View** on the **Home** tab. You may be prompted to enter a table name before switching to Design view. Type a descriptive name because this will be the object name in the Navigation pane. If the table is already named, clicking **View** toggles between Design and Datasheet view.

In Design view, you create one field per line. If you want a Lookup field, select **Lookup Wizard** as the data type and then follow the instructions in the dialog boxes. The Field Properties at the bottom of the window apply to the *active field*, which is highlighted. Type any validation rules into the Validation Rule box as well as any text that will appear if invalid data is entered in Validation Text.

To designate a field as the primary key, click the field and then click **Primary Key** on the **Table Tools Design** tab. In some cases, you may need to designate a combination of two fields as the primary key. To do this, click the gray box to the left of the first field, and then press and hold the **Ctrl** key while you click the gray box of the second field before clicking **Primary Key**.

After creating your fields, save the table and then click **View** on the **Home** tab to switch to Datasheet view. You can close a table by clicking the **Close** box in the upper-right corner of the table. To create another table, click **Table** or **Table Design** on the **Create** tab.

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INPUT MASKS

An *input mask* is another way to enforce data integrity. An input mask guides data entry by displaying underscores, dashes, asterisks, and other placeholder characters to indicate the type of data expected. For example, the input mask for a date might be __/__/____. Click **Input Mask** in the Field Properties area of Design view to get started.

TABLE RELATIONSHIPS

A *relationship* specifies how one field in a table corresponds to a field in a different table. Often a relationship is based on the primary key and the foreign key. The *foreign key* is a field that's a primary key in one table and is referenced in another table. For example, the Product ID field is the primary key in the Products table and a foreign key in the Orders table (Figure 10).

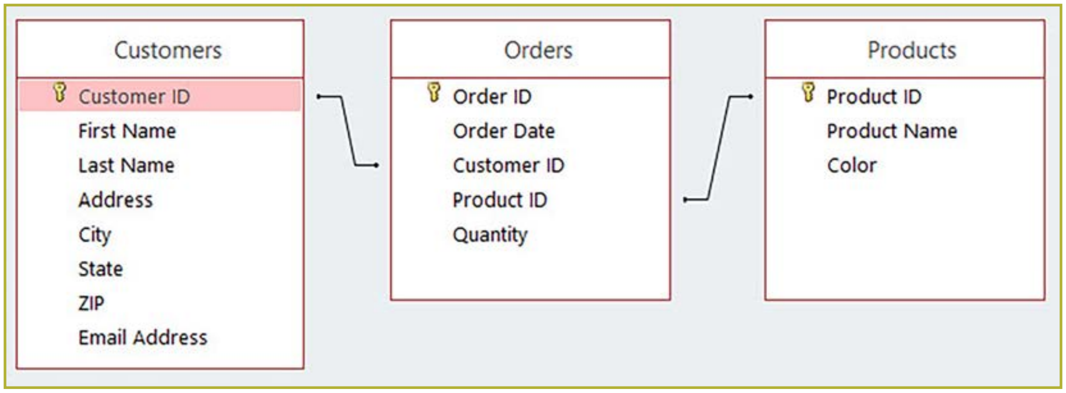


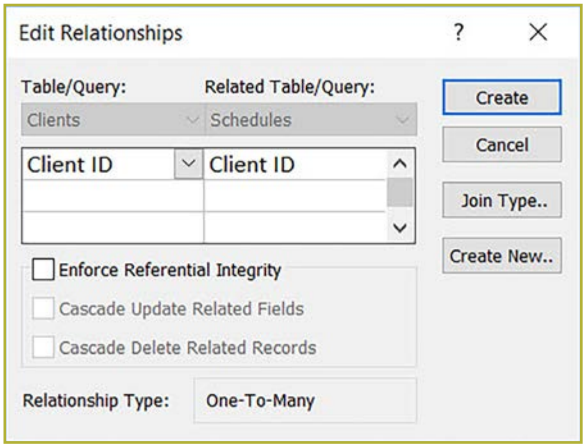
FIGURE 10—The key symbol indicates the primary key in the table, and the lines indicate relationships.

A relationship should be *one-to-many*, which means that for one field in a table there can be many fields with that same data in the related table. For example, in the Products table, Product IDs are unique. However, in the Orders table, the same Product ID can occur many times. If a relationship isn't one-to-many, then you probably need to go back to the design stage and break data down into more tables.

When building your database, you should ensure that relationships are arranged to preserve *referential integrity*. This simply means that you want Access to notify you when a deletion or other change in one table will create invalid records in a related table. For example, if you delete a record from the Products table, then records in the Orders table might refer to nonexistent products. This loss of integrity reduces the reliability of the database. You choose to have Access notify you of an issue when designating relationships.

If you created Lookup fields, Access automatically defined relationships for you. However, you should still check to be sure that every table in your database has been related to another table. Without relationships, the queries and reports you create later may not work properly.

To view your tables and any specified relationships, click **Relationships** on the **Database Tools** tab. If a table is missing from this view, click **Show Table** on the **Relationship Tools Design** tab to add missing tables. To specify a relationship, drag the field name from one table to the corresponding field in another table. A line will appear to show that the relationship is specified, and the Edit Relationships dialog box allows you to select **Enforce Referential Integrity** (Figure 11).



Edit Relationships

Table/Query: Clients

Related Table/Query: Schedules

Client ID	Client ID

☐ Enforce Referential Integrity

☐ Cascade Update Related Fields

☐ Cascade Delete Related Records

Relationship Type: One-To-Many

FIGURE 11—The Edit Relationships Dialog Box

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APPLY YOUR KNOWLEDGE

As a manager at Healthy Home Care, Inc. you want to use a database to keep track of clients and the services they've requested. Follow the steps below to create a database to generate schedules:

1. Design the database carefully. Consider the following information:

    - Healthy Home Care has a menu of services, which include visiting nurse, phlebotomist, physical therapist, nutrition counseling, cooking, cleaning, grocery shopping, and companionship. Each service has an assigned time in minutes and a charge if not billed to insurance.

    - You have client information, including first and last names, addresses, email addresses, and special requests such as hobbies and other interests for companionship.

    - You want to email your clients PDF copies of their weekly schedules.

    - Based on the purpose of your database, you've decided you need three tables: Services (Service ID, Service Name, Time (minutes), Charge, Clients (Client ID, First Name, Last Name, Address, City, State, Zip, Email, Special Requests), and Schedules (Schedule ID, Client ID, Service ID, Appointment, Start Time).

    - You'll use the Service ID, Client ID, and Schedule ID fields as the primary keys for your tables.

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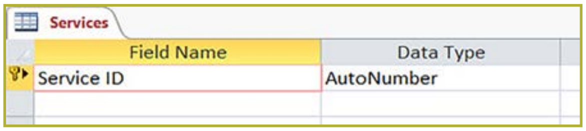
- The Client ID and Service ID fields will be Lookup fields in the Schedules table, so this will automatically define relationships for all three tables.
- You want to validate that the Charge field is >=0.

2. Start Access and click **Blank desktop database**. A dialog box is displayed.
3. Type “Healthy Home Care” and then click the folder icon to display a dialog box in which you navigate to the appropriate location for the file. Click **OK** when you’ve selected the location and then click **Create**. The Access database window is displayed with a new table.
4. On the **Home** tab, click **View**. You’re prompted to enter a name for the table.
5. Type “Services” and then click **OK**. The new table is displayed in the Design view.
6. Edit the ID field to be “Service ID.” Note that it’s an AutoNumber data type, which means that it will automatically change when records are later added (Figure 12).

FIGURE 12—The Service ID field is an AutoNumber data type.



Services

Field Name	Data Type
Service ID	AutoNumber

7. Type “Service Name” in the next Field Name box.
8. Click in the **Data Type** box, click the drop-down arrow, and then click **Short Text**.

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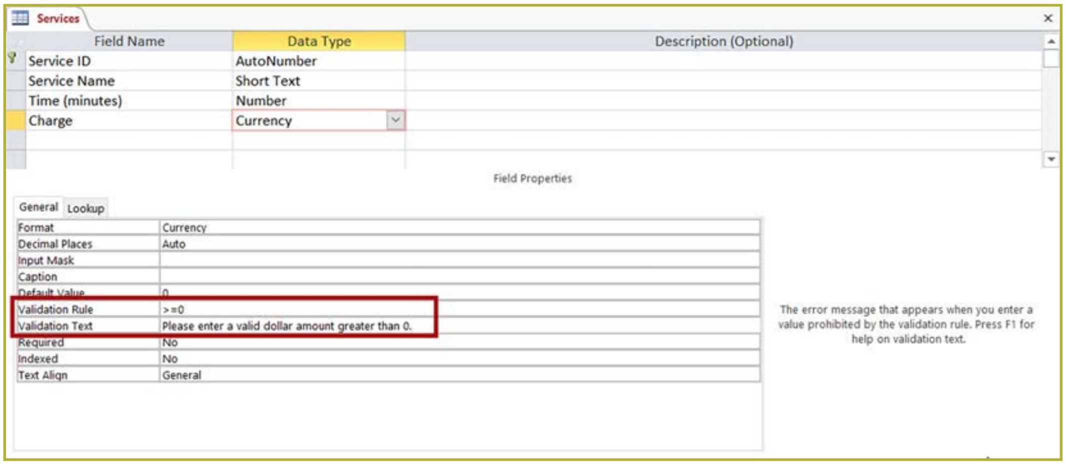
9. Add the remaining fields so that your Design view looks similar to Figure 13. Be sure that you enter the validation rule and validation text for the Charge field (Figure 13).



Services

Field Name	Data Type	Description (Optional)
Service ID	AutoNumber	
Service Name	Short Text	
Time (minutes)	Number	
Charge	Currency	

Field Properties

General | Lookup

Format	Currency
Decimal Places	Auto
Input Mask	
Caption	
Default Value	0
Validation Rule	>=0
Validation Text	Please enter a valid dollar amount greater than 0.
Required	No
Indexed	No
Text Align	General

The error message that appears when you enter a value prohibited by the validation rule. Press F1 for help on validation text.

FIGURE 13—Add a validation rule and validation text.

10. Save the modified table.

11. On the **Table Tools Design** tab, click **View**. Note that Access places default values in your numeric fields until you add data of your own.

12. In the upper-right corner of the Services table, click the **Close** box to remove it from the Access window. Note the Services object in the Navigation pane.

13. On the **Create** tab, click **Table Design**. A new table is displayed in Design view.

14. Create the fields for the table as shown in Figure 14.

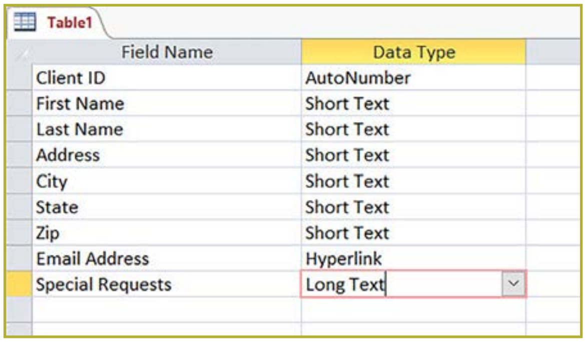


Table1

Field Name	Data Type
Client ID	AutoNumber
First Name	Short Text
Last Name	Short Text
Address	Short Text
City	Short Text
State	Short Text
Zip	Short Text
Email Address	Hyperlink
Special Requests	Long Text

FIGURE 14—Create the fields as shown.

(Continued)

15. Click in the **Client ID** field and then on the **Table Tools Design** tab, click **Primary Key**. A small key appears next to the field name.

16. On the **Table Tools Design** tab, click **View**. When prompted to save the table, name it “Clients.”

17. Close the table.

18. Create a new table. Add a new field named “Schedule ID” and make it the primary key.

19. In the next **Field Name** box, type “Client ID” and then select **Lookup Wizard** for the **Data Type** (Figure 15). A Lookup Wizard dialog box is displayed.

    a. Click **I want the lookup field to get the values from another table or query** and then click **Next**.

    b. Click **Table: Clients** and then click **Next**.

    c. Click **Client ID**, click > to move it to the **Selected Fields** list, and then click **Next**.

    d. In the **1**. list, click **Client ID** and then click **Next**.

    e. Click **Next** to skip the width adjustment.

    f. If necessary, type “Client ID” for the label name and then click **Finish**.

    g. When you’re prompted to save the table, save it with the name “Schedules.”

FIGURE 15—Use the Lookup wizard to link the tables.

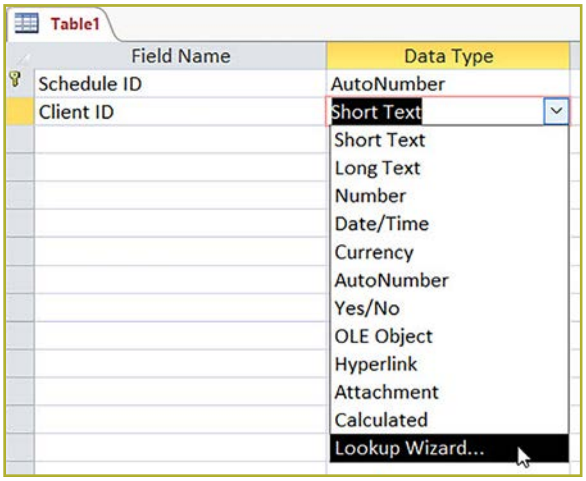


Table1

Field Name	Data Type
Schedule ID	AutoNumber
Client ID	Short Text

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20. In the next **Field Name** box, type “Service ID” and then select **Lookup Wizard** for the **Data Type**. Use the Services table and the Service ID field to define the lookup field.

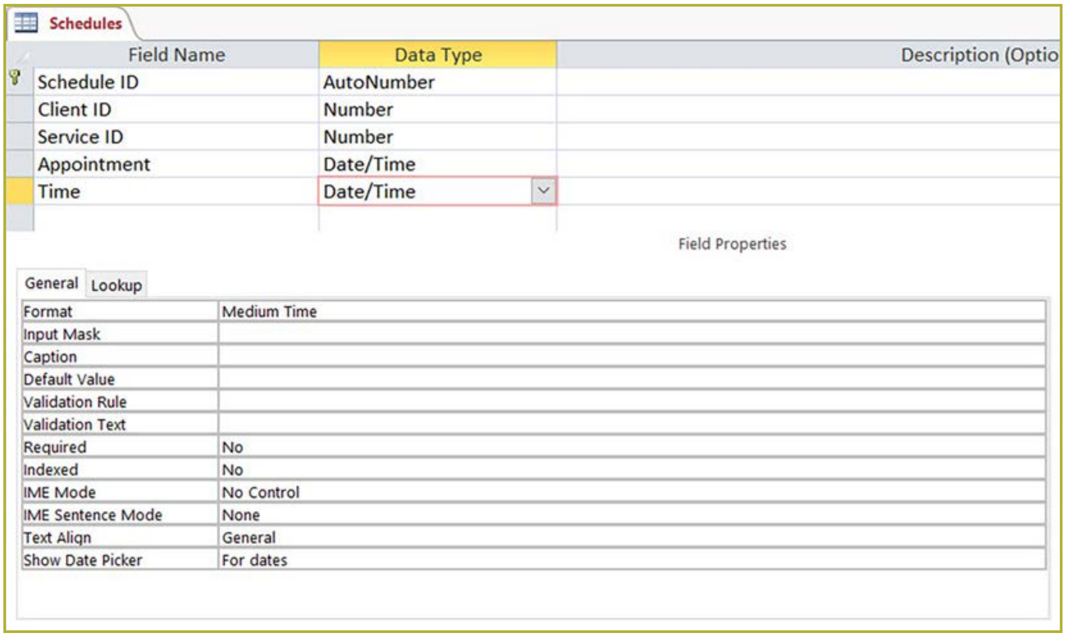
21. In the next **Field Name** box, type “Appointment.”

22. For the **Data Type**, click **Date/Time**.

23. In the **Field Properties** in the bottom of the window, click **Format**, click the drop-down arrow, and then select **Long Date** from the list.

24. Create the last field, naming it “Time” with data type **Date/Time**.

25. In the **Field Properties** in the bottom of the window, click **Format**, click the drop-down arrow, and then select **Medium Time** from the list. Your fields should look similar to Figure 16.



Field Name	Data Type	Description (Optio
Schedule ID	AutoNumber	
Client ID	Number	
Service ID	Number	
Appointment	Date/Time	
Time	Date/Time	

Format	Medium Time
Input Mask	
Caption	
Default Value	
Validation Rule	
Validation Text	
Required	No
Indexed	No
IME Mode	No Control
IME Sentence Mode	None
Text Align	General
Show Date Picker	For dates

FIGURE 16—The Schedules Table

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26. Switch to Datasheet view and close the table. You now have three database objects in the Navigation pane.

27. You need to check the relationships of your table. On the **Database Tools** tab, click **Relationships**. All three tables are displayed with relationships defined because you created Lookup fields.

28. Double-click the line between the Clients table and the Schedules table. A dialog box is displayed.

29. Note that the dialog box indicates that the relationship is One-To-Many. Click **Enforce Referential Integrity** and click **OK**.

30. Edit the relationship between Schedules and Services to **Enforce Referential Integrity**. Your relationships should look similar to Figure 17.

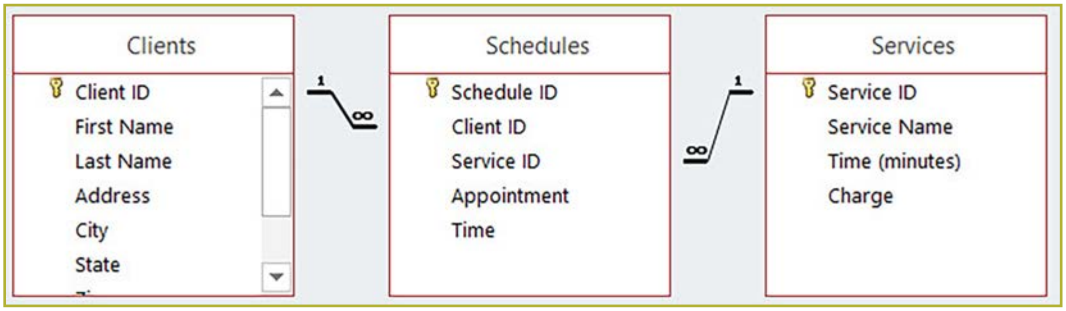

FIGURE 17—The Database Relationships

31. Close the Relationships window and then close the Healthy Home Care database.

ASSIGNMENT 2

REFLECT AND RESPOND

DATABASE DESIGN

What kind of problems do you think might surface if you don't put enough time and thought into creating your database design?

ASSIGNMENT 2

SELF-CHECK

1. What are the four steps to designing a database?
2. Name the best field type for the following fields:
    a. Last Name
    b. Date of Birth
    c. Price
    d. Company Website
3. What is the purpose of the primary key?
4. What is a foreign key?
5. How do you create a Lookup field?

Check your answers.