Tutorial 2
Building a Database
and Defining Table Relationships

Microsoft® Access® 2013
Objectives

• Session 2.1
  – Learn the guidelines for designing databases and setting field properties
  – Create a table in Design view
  – Define fields, set field properties, and specify a table’s primary key
  – Modify the structure of a table
  – Change the order of fields in Design view
  – Add new fields in Design view
  – Change the Format property for a field in Datasheet view
  – Modify field properties in Design view
Objectives (Cont.)

• Session 2.2
  – Import data from an Excel worksheet
  – Create a table by importing an existing table structure
  – Add fields to a table with the Data Type gallery
  – Delete and rename fields
  – Change the data type for a field in Design view
  – Set the Default Value property for a field
  – Add data to a table by importing a text file
  – Define a relationship between two tables
Guidelines for Database Design

- Case - Chatham Community Health Services
  - Database currently contains one table (Visit table)
  - User wants to track information about the clinic’s patients and the invoices sent to them for services provided
    - This information includes such items as each patient’s name and address, and the amount and billing date for each invoice
  - Create two new tables — named Billing and Patient — to contain the additional data the user wants to track
Guidelines for Database Design (Cont.)

• Case - *Chatham Community Health Services*
  – After adding records to the tables, you will define the necessary relationships between the tables in the Chatham database to relate the tables
Guidelines for Database Design (Cont.)

STARTING DATA FILES

Access1
- Chatham.accdb (cont.)
- Invoices.xlsx
- Kelly.accdb
- Patient.txt

Tutorial
- Agreements.xlsx
- Client.accdb
- O'Brien.accdb (cont.)
- Students.txt

Review
- Supplies.xlsx
- Vendor.accdb (cont.)

Case1
- Customers.txt
- Gopher.accdb (cont.)

Case2
- Bookings.txt
- Donations.xlsx
- Shelter.accdb (cont.)
- Stanley.accdb (cont.)
- Travel.accdb
Guidelines for Database Design (Cont.)

Design view allows you to define or modify a table structure or the properties of the fields in a table.

The default name for a new table you create in Design view is Table1. This name appears on the tab for the new table.

The top portion of the Table window in Design view is called the Table Design grid. Here, you enter values for the Field Name, Data Type, and Description field properties.

After you assign a data type to a field, the General tab displays additional field properties for that data type. Initially, most field properties are assigned default values.

When defining the fields in a table, you can move from the Table Design grid to the Field Properties pane by pressing the F6 key.

In the Field Name column, you enter the name for each new field in the table. When you first open a new Table window in Design view, Field Name is the current property.

In the Data Type column, you select the appropriate data type for each new field in the table. The data type determines what field values you can enter for a field and what other properties the field will have. The default data type for a new field is Short Text.

You can use the Description property to enter an optional description for a field to explain its purpose or usage. A field’s Description property can be up to 255 characters long, and its value appears on the status bar when you view the table datasheet.

The bottom portion of the Table window in Design view is called the Field Properties pane. Here, you select values for all other field properties, most of which are optional.

The purpose or characteristics of the current property (Field Name, in this case) appear in this section of the Field Properties pane.

You can display more complete Help information about the current property by pressing the F1 key.

New Perspectives on Microsoft Access 2013
Guidelines for Database Design (Cont.)

- Identify all the fields needed to produce the required information
- Organize each piece of data into its smallest useful part
- Group related fields into tables
- Determine each table’s primary key
- Include a common field in related tables
- Avoid data redundancy
Guidelines for Database Design

(Cont.)

Figure 2-3 Incorrect database design with data redundancy

<table>
<thead>
<tr>
<th>PatientID</th>
<th>LastName</th>
<th>FirstName</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>22542</td>
<td>Diaz</td>
<td>Anna</td>
<td>93 Gates Ln</td>
</tr>
<tr>
<td>22544</td>
<td>Sutherland</td>
<td>Max</td>
<td>48 Vine St</td>
</tr>
<tr>
<td>22546</td>
<td>Ingram</td>
<td>Julia</td>
<td>834 Kiefer Rd</td>
</tr>
<tr>
<td>22560</td>
<td>Lewis</td>
<td>Patrice</td>
<td>15 Prince Rd</td>
</tr>
<tr>
<td>22561</td>
<td>Shaw</td>
<td>Daniel</td>
<td>33 Agnes Ct</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VisitID</th>
<th>PatientID</th>
<th>LastName</th>
<th>VisitDate</th>
<th>Walkln</th>
</tr>
</thead>
<tbody>
<tr>
<td>1535</td>
<td>22546</td>
<td>Ingraham</td>
<td>11/12/2015</td>
<td>Yes</td>
</tr>
<tr>
<td>1570</td>
<td>22561</td>
<td>Shaw</td>
<td>1/11/2016</td>
<td>Yes</td>
</tr>
<tr>
<td>1571</td>
<td>22546</td>
<td>Ingraham</td>
<td>1/15/2016</td>
<td>No</td>
</tr>
<tr>
<td>1591</td>
<td>22544</td>
<td>Sutherland</td>
<td>1/26/2016</td>
<td>Yes</td>
</tr>
<tr>
<td>1601</td>
<td>22542</td>
<td>Diaz</td>
<td>2/2/2016</td>
<td>No</td>
</tr>
<tr>
<td>1620</td>
<td>22546</td>
<td>Ingraham</td>
<td>3/7/2016</td>
<td>No</td>
</tr>
<tr>
<td>1638</td>
<td>22560</td>
<td>Lewis</td>
<td>3/11/2016</td>
<td>Yes</td>
</tr>
</tbody>
</table>

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Guidelines for Setting Field Properties

• Naming Fields and Objects
  – You must name each field, table, and other object in an Access database

• Assigning Field Data Types
  – Each field must have a data type
    • Data types are assigned automatically by Access or specifically by the table designer
    • The data type determines what field values you can enter for the field and what other properties the field will have
### Guidelines for Setting Field Properties (Cont.)

#### Common data types

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Description</th>
<th>Field Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short Text</td>
<td>Allows field values containing letters, digits, spaces, and special characters. Use for names, addresses, descriptions, and fields containing digits that are not used in calculations.</td>
<td>0 to 255 characters; default is 255</td>
</tr>
<tr>
<td>Long Text</td>
<td>Allows field values containing letters, digits, spaces, and special characters. Use for long comments and explanations.</td>
<td>1 to 65,535 characters; exact size is determined by entry</td>
</tr>
<tr>
<td>Number</td>
<td>Allows positive and negative numbers as field values. A number can contain digits, a decimal point, commas, a plus sign, and a minus sign. Use for fields that will be used in calculations, except those involving money.</td>
<td>1 to 15 digits</td>
</tr>
<tr>
<td>Date/Time</td>
<td>Allows field values containing valid dates and times from January 1, 100 to December 31, 9999. Dates can be entered in month/day/year format, several other date formats, or a variety of time formats, such as 10:35 PM. You can perform calculations on dates and times, and you can sort them. For example, you can determine the number of days between two dates.</td>
<td>8 bytes</td>
</tr>
<tr>
<td>Currency</td>
<td>Allows field values similar to those for the Number data type, but is used for storing monetary values. Unlike calculations with Number data type decimal values, calculations performed with the Currency data type are not subject to round-off error.</td>
<td>Accurate to 15 digits on the left side of the decimal point and to 4 digits on the right side</td>
</tr>
<tr>
<td>AutoNumber</td>
<td>Consists of integer values created automatically by Access each time you create a new record. You can specify sequential numbering or random numbering, which guarantees a unique field value, so that such a field can serve as a table’s primary key.</td>
<td>9 digits</td>
</tr>
<tr>
<td>Yes/No</td>
<td>Limits field values to yes and no, on and off, or true and false. Use for fields that indicate the presence or absence of a condition, such as whether an order has been filled or whether an invoice has been paid.</td>
<td>1 character</td>
</tr>
<tr>
<td>Hyperlink</td>
<td>Consists of text used as a hyperlink address, which can have up to four parts: the text that appears in a field or control; the path to a file or page; a location within the file or page; and text displayed as a ScreenTip.</td>
<td>Up to 65,535 characters total for the four parts of the hyperlink</td>
</tr>
</tbody>
</table>

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Guidelines for Setting Field Properties (Cont.)

• Setting Field Sizes
  – The Field Size property defines a field value’s maximum storage size for Short Text, Number, and AutoNumber fields only
  – The other data types have no Field Size property because their storage size is either a fixed, predetermined amount or is determined automatically by the field value itself

• Setting the Caption Property for Fields
  – The Caption property for a field specifies how the field name is displayed in database objects
  – If you don’t set the Caption property, Access displays the field name as the column heading or label for a field
Creating a Table in Design View

- Creating a table in Design view involves entering the field names and defining the properties for the fields, specifying a primary key for the table, and then saving the table structure.

- **Defining Fields**
  - When you first create a table in Design view, the insertion point is located in the first row’s Field Name box, ready for you to begin defining the first field in the table.
  - Enter values for the Field Name, Data Type, and Description field properties, and then select values for all other field properties in the Field Properties pane.
  - These other properties will appear when you move to the first row’s Data Type box.

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Data Type</th>
<th>Field Size</th>
<th>Description</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>InvoiceNum</td>
<td>Short Text</td>
<td>5</td>
<td>Primary key</td>
<td></td>
</tr>
<tr>
<td>VisitID</td>
<td>Short Text</td>
<td>4</td>
<td>Foreign key</td>
<td></td>
</tr>
<tr>
<td>InvoiceAmt</td>
<td>Currency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>InvoiceDate</td>
<td>Date/Time</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>InvoicePaid</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Creating a Table in Design View (Cont.)

Figure 2-6  Table window after entering the first field name

- field name entered
- default data type
- clicking the arrow displays a list of data types
- properties for a Short Text field
- pressing the F1 key displays Help information
- default property values for a Short Text field
Creating a Table in Design View (Cont.)

Figure 2-7 InvoiceNum field defined

- Short Text data type is selected
- Description property entered
- Field Size property set
- Caption property set
Creating a Table in Design View (Cont.)

Figure 2-8  Table window after defining the first three fields

- Current field
- Property values set for the current field
Creating a Table in Design View (Cont.)

Figure 2-9  Selecting a value for the Data Type property

Figure 2-10  Displaying available formats for Date/Time fields
Creating a Table in Design View (Cont.)

**Figure 2-11** Symbols for some custom date formats

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>/</td>
<td>date separator</td>
</tr>
<tr>
<td>d</td>
<td>day of the month in one or two numeric digits, as needed (1 to 31)</td>
</tr>
<tr>
<td>dd</td>
<td>day of the month in two numeric digits (01 to 31)</td>
</tr>
<tr>
<td>ddd</td>
<td>first three letters of the weekday (Sun to Sat)</td>
</tr>
<tr>
<td>dddd</td>
<td>full name of the weekday (Sunday to Saturday)</td>
</tr>
<tr>
<td>w</td>
<td>day of the week (1 to 7)</td>
</tr>
<tr>
<td>ww</td>
<td>week of the year (1 to 53)</td>
</tr>
<tr>
<td>m</td>
<td>month of the year in one or two numeric digits, as needed (1 to 12)</td>
</tr>
<tr>
<td>mm</td>
<td>month of the year in two numeric digits (01 to 12)</td>
</tr>
<tr>
<td>mmm</td>
<td>first three letters of the month (Jan to Dec)</td>
</tr>
<tr>
<td>mmmm</td>
<td>full name of the month (January to December)</td>
</tr>
<tr>
<td>yyyy</td>
<td>last two digits of the year (01 to 99)</td>
</tr>
<tr>
<td>yyyy</td>
<td>full year (0100 to 9999)</td>
</tr>
</tbody>
</table>

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• Specifying the Primary Key
  – A primary key uniquely identifies each record in a table
  – Access does not allow duplicate values in the primary key field
  – When a primary key has been specified, Access forces you to enter a value for the primary key field in every record in the table (entity integrity)
  – You can enter records in any order, but Access displays them by default in order of the primary key’s field values
  – Access responds faster to your requests for specific records based on the primary key

• Saving the Table Structure
  – The last step in creating a table is to name the table and save the table’s structure
Modifying the Structure of an Access Table

• **Moving a Field in Design View**
  – To move a field, you use the mouse to drag it to a new location in the Table Design grid
    • You can move a field in Datasheet view by dragging its column heading to a new location, doing so rearranges only the *display* of the table’s fields; the table structure is not changed
    • To move a field permanently, move the field in Design view

• **Adding a Field in Design View**
  – To add a new field between existing fields, you must insert a row
    – Begin by selecting the row below where you want the new field to be inserted
Creating a Table in Design View (Cont.)

Figure 2-14  Moving the InvoiceAmt field in the table structure

Figure 2-15  Table structure after inserting a row
Creating a Table in Design View (Cont.)

Figure 2-16  InvoiceItem field added to the Billing table

- New field
- Field Size property set to 40
- Caption property set
Modifying Field Properties

• Changing the Format Property in Datasheet View
  – The Formatting group on the FIELDS tab in Datasheet view allows you to modify formatting for certain field types
  – When you format a field, you change the way data is displayed, but not the actual values stored in the table

New Perspectives on Microsoft Access 2013
Modifying Field Properties (Cont.)

- Changing Properties in Design View
  - Each of the Short Text fields has the default field size of 255, which is too large for the data contained in these fields

![Image of a modified visit table in Design View]

- Description property values entered
- Caption property for current field
- Default Value property for current field
- Column headings display Caption property values
Understanding Table Relationships

A one-to-many relationship exists between two tables when one record in the first table matches zero, one, or many records in the second table, and when one record in the second table matches at most one record in the first table. Here, the Patient and Visit tables have a one-to-many relationship because a patient can have many visits, and each visit is associated with only one patient. The two tables are still separate tables, but because they are joined, you can use the data in them as if they were one table.

The join line connects the common field used to create the relationship between two tables. Here, the common field VisitID is used to create the one-to-many relationship between the Visit and Billing tables.

The "one" side of a one-to-many relationship is represented by the digit 1 at the end of the join line.

The "many" side of a one-to-many relationship is represented by the infinity symbol at the end of the join line.

When you add a table to the Relationships window, the fields in the table appear in a field list. Here, the window contains three field lists, one for each table: Patient, Visit, and Billing.

The key symbol next to a field name indicates that the field is the table’s primary key. For example, PatientID is the primary key for the Patient table.

Click the Close button to close the Relationships window.

You click the Show Table button to open the Show Table dialog box. From there, you can choose a table to add to the Relationships window.

The Relationships window illustrates the relationships among a database’s tables. Using this window, you can view or change existing relationships, define new relationships between tables, and rearrange the layout of the tables in the window.

New Perspectives on Microsoft Access 2013
Adding Records to a New Table

- Adding Records to a New Table
- The Billing table design is complete and you would like to add records to the table so it will contain the invoice data
- Add records to a table in Datasheet view by typing the field values in the rows below the column headings for the fields

**Figure 2-21** Records to be added to the Billing table

<table>
<thead>
<tr>
<th>Invoice Num</th>
<th>Visit ID</th>
<th>Invoice Date</th>
<th>Invoice Amt</th>
<th>Invoice Item</th>
<th>Invoice Paid</th>
</tr>
</thead>
<tbody>
<tr>
<td>35801</td>
<td>1527</td>
<td>11/10/2015</td>
<td>$100.00</td>
<td>Office visit</td>
<td>Yes</td>
</tr>
<tr>
<td>35818</td>
<td>1536</td>
<td>11/18/2015</td>
<td>$100.00</td>
<td>Office visit</td>
<td>Yes</td>
</tr>
<tr>
<td>35885</td>
<td>1570</td>
<td>01/12/2016</td>
<td>$85.00</td>
<td>Pharmacy</td>
<td>No</td>
</tr>
<tr>
<td>35851</td>
<td>1550</td>
<td>12/02/2015</td>
<td>$85.00</td>
<td>Pharmacy</td>
<td>No</td>
</tr>
</tbody>
</table>

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Adding Records to a New Table (Cont.)

**Figure 2-22** First record entered in the Billing table

- Field value displayed in the Currency format with two decimal places
- Field value displayed according to the custom date format
- Checkmark indicates a “Yes” value for the field

**Figure 2-23** Billing table with four records added

- “Yes” values
- “No” values
Importing Data from an Excel Worksheet

- When data you want to add to an Access table exists in another file -- like Word or Excel -- you can bring the data from other files into Access in different ways
  - Copy and paste the data from an open file
  - Import the data, which is a process that allows you to copy the data from a source without having to open the source file
Importing Data from an Excel Worksheet

(Cont.)

Figure 2-24  Get External Data - Excel Spreadsheet dialog box

click to find the Excel workbook containing the data you want to import

you might see a different path here

option for adding records to an existing table
Importing Data from an Excel Worksheet (Cont.)

Figure 2-25  First Import Spreadsheet Wizard dialog box

- selected check box confirms that the first row contains column headings
- data from the worksheet to be imported
Importing Data from an Excel Worksheet (Cont.)

Figure 2-26  Billing table after importing data from Excel

- Records displayed in order by the values in the Invoice Num column.
- Table contains a total of 204 records.
Creating a Table by Importing an Existing Table Structure

- If another Access database contains a table—or even just the design, or structure, of a table—that you want to include in your database, you can import the table and any records it contains or import only the table structure into your database.

**Figure 2-27** Design for the Patient table

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Data Type</th>
<th>Field Size</th>
<th>Description</th>
<th>Caption</th>
</tr>
</thead>
<tbody>
<tr>
<td>PatientID</td>
<td>Short Text</td>
<td>5</td>
<td>Primary key</td>
<td>Patient ID</td>
</tr>
<tr>
<td>LastName</td>
<td>Short Text</td>
<td>25</td>
<td></td>
<td>Last Name</td>
</tr>
<tr>
<td>FirstName</td>
<td>Short Text</td>
<td>20</td>
<td></td>
<td>First Name</td>
</tr>
<tr>
<td>BirthDate</td>
<td>Date/Time</td>
<td></td>
<td></td>
<td>Date of Birth</td>
</tr>
<tr>
<td>Phone</td>
<td>Short Text</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Address</td>
<td>Short Text</td>
<td>35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>City</td>
<td>Short Text</td>
<td>25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>State</td>
<td>Short Text</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zip</td>
<td>Short Text</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Email</td>
<td>Short Text</td>
<td>50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Creating a Table by Importing an Existing Table Structure (Cont.)

Figure 2-28 Import Objects dialog box

Figure 2-29 Imported Patient table in Datasheet view
Adding Fields to a Table Using the Data Type Gallery

- The Data Type gallery (in the Add & Delete group on the FIELDS tab) allows you to add a group of related fields to a table at the same time, rather than adding each field to the table individually.

Figure 2-30  Patient table with the Data Type gallery displayed

Figure 2-31  Patient table after adding fields from the Data Type gallery

five fields added with Address Quick Start selection

new fields will be inserted to the left of the current field

available Quick Start selections
Modifying the Imported Table

- Deleting Fields from a Table Structure
  - After you’ve created a table, you might need to delete one or more fields (which also deletes all the values for that field from the table)
  - Before you delete a field, you should make sure that you want to do so and that you choose the correct field to delete
  - Fields can be deleted in either Datasheet view or Design view
Modifying the Imported Table (Cont.)

• Renaming Fields in Design View
  – To match the design for the Patient table, you need to rename the StateProvince and ZIPPostal fields
  – Fields can be renamed in Datasheet view or Design view

Figure 2-33 Patient table after deleting fields | Figure 2-34 Patient table after renaming fields
Modifying the Imported Table (Cont.)

• Changing the Data Type for a Field in Design View
  
  – All of the fields in the Patient table, except BirthDate, should be Short Text fields
  
  – The table structure you imported specifies the Number data type for the Phone field -- it should be Short Text
  
  – The Data Type can be changed in Datasheet view or Design view
Setting the Default Value Property for a Field

- The **Default Value** property for a field specifies what value will appear, by default, for the field in each new record you add to a table.

**Figure 2-37** Specifying the Default Value property for the State field

- State field is current
- Default Value property entered and enclosed within quotation marks
Adding Data to a Table by Importing a Text File

• Many ways to import data into an Access database
  – Importing an Excel spreadsheet
  – Created a new table by importing the structure of an existing table
  – Import data contained in text files
Defining Table Relationships

Figure 2-40  One-to-many relationship and sample query

primary table

common field

related table

query that joins fields from the Patient and Visit tables

fields from the Patient table

fields from the Visit table
Defining Table Relationships (Cont.)

- **One-to-Many Relationships**
  - A one-to-many relationship exists between two tables when one record in the first table matches zero, one, or many records in the second table, and when one record in the second table matches at most one record in the first table

- **Referential Integrity**
  - A set of rules that Access enforces to maintain consistency between related tables when you update data in a database
Defining Table Relationships (Cont.)

• **Referential Integrity**
  
  – When you add a record to a related table, a matching record must already exist in the primary table, preventing the possibility of orphaned records.
  
  – If you attempt to change the value of the primary key in the primary table, Access prevents this change if matching records exist in a related table.
  
  – With the **Cascade Update Related Fields** option, Access permits the change in value to the primary key and changes the appropriate foreign key values in the related table.
  
  – If you attempt to delete a record in the primary table, Access prevents the deletion if matching records exist in a related table. However, if you choose the **Cascade Delete Related Records** option, Access deletes the record in the primary table and also deletes all records in related tables that have matching foreign key values.
Defining Table Relationships (Cont.)