Introduction to Relational Databases

Microsoft Access

MS Access is a comprehensive personal DBMS (Database Management System). MS Access allows the user to create data tables, queries, reports, and forms for a complete database solution. MS Access has basic administrator features as well as ability to quickly create user interface to interact with enterprise grade DBMS applications such as MS SQL servers.

In Access, a database consists of a collection of tables. The rows in the tables are called records. A record contains information about a given person, product, or event. The columns in the tables are called fields. A field contains a specific piece of information within a record.

In this lab, you will create a simple client tracking database made up of two tables and associated relationships. You will import and copy data from an excel spreadsheet into the tables then create the relationships among the tables.

You will need the following file (available on Canvas): DatabaseData.xlsx.

Exercise:

For this lab, your job is to create the database according to the steps indicated in the instructions below.

Basic Terminologies

In Access, a database is a group of related objects saved into one file. An access object can be a table, a form, a query, or a report. You can identify an Access database file because it has the suffix ".mdb"/"accdb".

A table consists of data that is arrayed in rows and columns. A row of data is called a record. A column of data is called a field.

A field's values have a data type. When a table is defined, the nature of each field's data is declared. This allows the database software to validate and interpret the values of each entry. Data types in Access include the following:

- Text: for words
- Integer: for whole numbers
- Double: for numbers that can have a decimal value
- Currency: for numbers that should be treated as dollars and cents
- Yes/No: for variables that can have only toe values (1-0, on/off, yes/no)
- Date/Time: for variables that are dates or times

Each table should have a primary key field. Tables should be logically related to one another. Data can be entered into a table directly or by entering the data into a form, which is based on the table.

A query is a question that is posed about data in a table (or tables). A query may need to pull data from more than one table, so queries can be designed to query more than one table at a time. In that case, the tables must first be connected by a JOIN operation.

Access has a report generator feature that can be used to format a table's data or query's output.

Creating a Database

Unlike most computer applications, you must create the database file before you can edit it. To create a file in MS Access:

- Launch MS Access from your computer's start menu
- Select "Blank Database"
- Enter a "Client.accdb" as the database name, use the folder button to select your desktop as the save location for your file, then click on Create to save the file and start working with the database. Close the "Spreadsheet like" table that automatically opens up by clicking on the lower "**X**" (close button) in the top right corner of your screen.

A MS Access database contains many objects including: Tables, Queries, Forms, Module, and Reports. Use the navigation pane on the left side of your screen to explore the types of objects available (you will not see any objects yet as none have been created).

Microsoft Access uses the Ribbon just like other MS Office applications. Explore the ribbon tabs, specifically the "Create," "External Data," and "Database Tools" to get an idea of available features.

Creating Tables

Xtreme Technical Services is a new company offering a variety of technical services to its clients. Services the company provide include assistance with hardware and software problems, special backup services, archiving services, etc. Each client is assigned to one specific technician. Services are billed at the technician's hourly billing rate. The management of Xtreme Technical Services needs to maintain data on its technicians as well as its clients. Managers want to produce a variety of useful reports using Access.

You will create a simple client tracking database for Xtreme consisting of two tables:

- "Client" table to store the customers personal contact information
- "Technician" table to track products carried by the retailer

To create a table:

- Select the **Create → Table** function from the ribbon
- Right click on the newly opened "**Table1**" tab and select design View. Enter **Client** as the name of the table and click OK to save it.

This is the Design Window that allows the users to define the Metadata for each Table. Recall that Metadata is the data that describes data! That is, you will define the attributes for each field using this screen. Each row in the screen allows you to enter the following:

- First Column – Field Name: the name to appear at the top of each column in the table
- Second column – Data Type: The type of data that is expected to be entered in the field (eg, text or numerical data). A drop-down list different allowable data types can be accessed by clicking the down arrow in this column. Once the data type is selected, you'll be able to further customize the data type using the field properties available in the lower portion of the design window.

Enter the following fields and associated data types to create the data structure for the Client and Technician Table:

Structure of Client Table				
Field name	*Data Type*	*Field Size*	*Primary Key*	*Description*

Client Number	Text	5	Yes	Client Number (Primary Key)
Name	Text	20		Client Name
Address	Text	50		Street Address
City	Text	15		City
State	Text	2		State (abbreviation)
Zip Code	Text	5		Zip code
Billed	Currency			Current Billed Amount
Paid	Currency			Current Paid Amount
Tech Number	Text	2		Number of Client's Technician

Reminder: The Field Size is set using the Field Properties at the lower portion of the design window

Structure of Technician Table				
Field name	*Data Type*	*Field Size*	*Primary Key*	*Description*
Tech Number	Text	2	Yes	Technician Number (Primary Key)
Last Name	Text	10		Last Name of Technician
First Name	Text	8		First Name of Technician
Address	Text	50		Street Address
City	Text	15		City
State	Text	2		State (abbreviation)
Zip Code	Text	5		Zip code
Hourly Rate	Currency			Hourly Rate of Technician
YTD Earnings	Currency			YTD Earning of Technician

To ensure that we maintain data integrity, it is important to set the Primary Key using a field that we know is a unique identifier for each record in the table. The Client Number field is a natural primary key. To set the primary key, place your cursor anywhere in the Client Number field then click **Design → Primary Key.** (Note: MS Access may have already flagged the first field as the Primary Key). The primary key is identified with a Key icon to the left of the field name.

__Short Text__ date type has a limit field size of 255 characters. __Long Text__ has an unlimited field size. Advantages of using __Short Text__ include less storage memory and the field can be easily searched using "find" build-in features. Disadvantages include limited size of entered text. Use __Short Text__ when you are sure that field content will not exceed 255 characters.

Importing and Copying Data

Entering data into your tables can be entered using several different methods including (but not limited to): direct input into the table, using an input form, importing from a spreadsheet, or copy and paste from external sources. The latter two methods will be discussed next.

Client Table

ClientNumber	*Name*	*Address*	*City*	*State*	*Zip Code*	*Billed $*	*Paid $*	*Tech Num*
AM035	Alan-Mill	216 Rivard	Grattan	MA	58120	215.5	155	11
AS602	Albert-Scripps	772 Fisher	Empire	MA	58126	425	435	12
BL260	Blake Inc.	5752 Maumee	Grattan	MA	58120	129.5	0	12
DE076	D & E Inc.	464 Linnell	Marshall	VT	52018	385.75	300	17
GR056	Grant Cleaners	737 Allard	Partage	NH	59130	215	165	11
GU210	Grand Union	247 Fuller	Grattan	MA	58120	128.5	0	12
JE777	Jones Electric	57 Giddings	Marshall	VT	52018	0	0	12
MI206	Mill Inc.	665 Whittier	Frankfort	MA	56152	212.5	223.25	11
SA056	Sam Inc.	31 Lafayette	Empire	MA	58216	352.5	250	17
SI082	Simon Ind.	752 Cadieux	Fernwood	MA	57412	154	0	12

Technician Table

Tech Num	*L-Name*	*F-Name*	*Address*	*City*	*State*	*Zip Code*	*Hourly rate $*	*YTD Earnings $*
11	Chan	Jo	26 Main	Carlton	MA	59712	25	6245
12	Roger	Brad	7972 Marsden	Kaleva	VT	57253	50	7143.3
17	Lee	May	263 Topsfield	Hudson	MA	57240	35	7745.5

Import from an Excel File

Download the save the **DatabaseData.xlsx** file from the course website to your desktop. To import data into the **Client** Table by importing data from Excel:

- Launch the import from Excel Function using the Ribbon: **External Data → Excel** (in the Import and Link function group)

A new "Get External Data – Excel Spreadsheet" Window will pop open. Complete the steps:

- Click on Browse to select the **DatabaseData.xlsx** file you saved on your desktop.
- Select **"Append a copy of the records to the table:"**
- Choose the **Client** table.
- Click OK. The **Import Spreadsheet Wizard** window will open
- Select the **Client** worksheet (the workbook contains three worksheets, so it is important the correct worksheet is selected).
- Click Next
- Look at the resulting information then click Next again
- Click Finish to import the data into your database then click close to the return to the database

You can view the data by double clicking on the Client table to open it up. Note: if you encounter a problem with importing the data into your table, then it is possible that one or more of the field names was entered incorrectly as you created the data table. Double check your field names and data types, fix any errors, and try the import again.

Copy and Paste Append from an Excel Spreadsheet

Another method of importing data into an Access table is a direct copy/paste from an Excel worksheet. Note that it is important that the field layout is the same in Access and Excel.

To import data into the **Technician** table:

- Open the **DatabaseData.xlsx** file and select the **Technician** worksheet to view the list of technicians.
- Select all cells from the worksheet and copy this data.
- Switch to the Client Database and Open the **Technician** table (double click on the table name to open it)
- Under the Home tab, select the **Paste → Paste Append** function. Click Yes to paste the records.

Congratulations! You have imported data using another method.

The Relational Database Concept

After importing data into multiple tables, you need a way of telling Access how to bring that information back together again. The first step in this process is to define relationships between your tables. Then you can create queries, forms, and reports to display information from several tables at once.

A relationship works by matching data in key fields - usually a field with the same name in both tables. In most cases, these matching fields are the primary key from one table, which provides a unique identifier for each record, and a foreign key in the other table. For example, a technician can be associated with more than one client (one to many relationship) by creating a relationship between the technician's table and the client's table using the Tech Number.

Relational databases like Access allow the separation of data into many smaller related data tables to increase data storage and processing efficiency. These relationships tell Access which data in each of the tables is related using primary and foreign keys.

Select the **Database TOOLS > RELATIONSHIPS** functions to view and edit the relationship diagram for the current file.

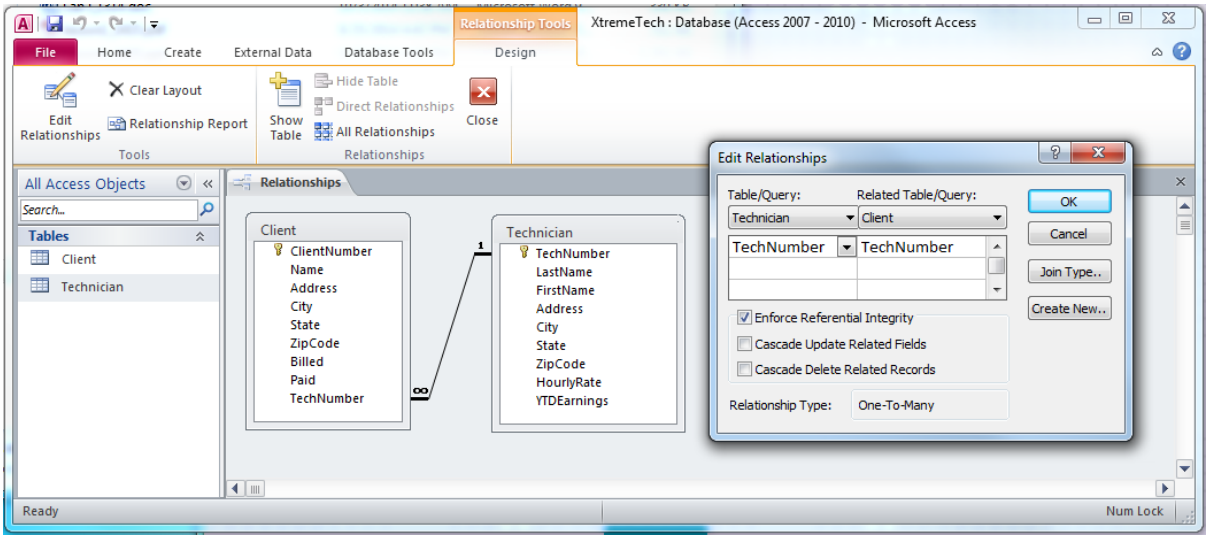
To create the relationships, the related tables must be visible in the Relationships workspace. Click and drag the **Client** table from the navigation pane on the left of your screen to the Relationships to add the table. Add the **Technician** table using the same method.

Creating a relationship in MS Access is easy once the Primary and Foreign keys are identified. In this example, a relationship using the **Client Number** field as the Primary Key in the **Client** table and the Foreign Key in the **Technician** table needs to be created. This relationship will allow you to easily identify the client information related to each technician. To create this relationship:

- Click and Drag the **TechNumber** field in the **Client** Table and drop it onto TechNumber field in the **Technician** table. Note: it is important that your mouse pointer is over the TechNumber field in the Technician table for this relationship to be created successfully.
- Once you drop the field, a new "Edit Relationship" window pops open. Make sure that the TechNumber field appears under both Tables in the relationship then place check marks next to:
  - Enforce Referential Integrity
- Click Create to relate the two tables.
- Create and Save the relationship.

Congratulations! You successfully developed your first relationship ☺

The line between two tables represents a relationship and should always include a "**Key Field**". The line between the **Client** and **Technician** table shows an **infinite** (the sideways 8 symbol) **to 1** relationship using the **TechNumber** field. This indicates that each technician's record can have infinite client records related to it.



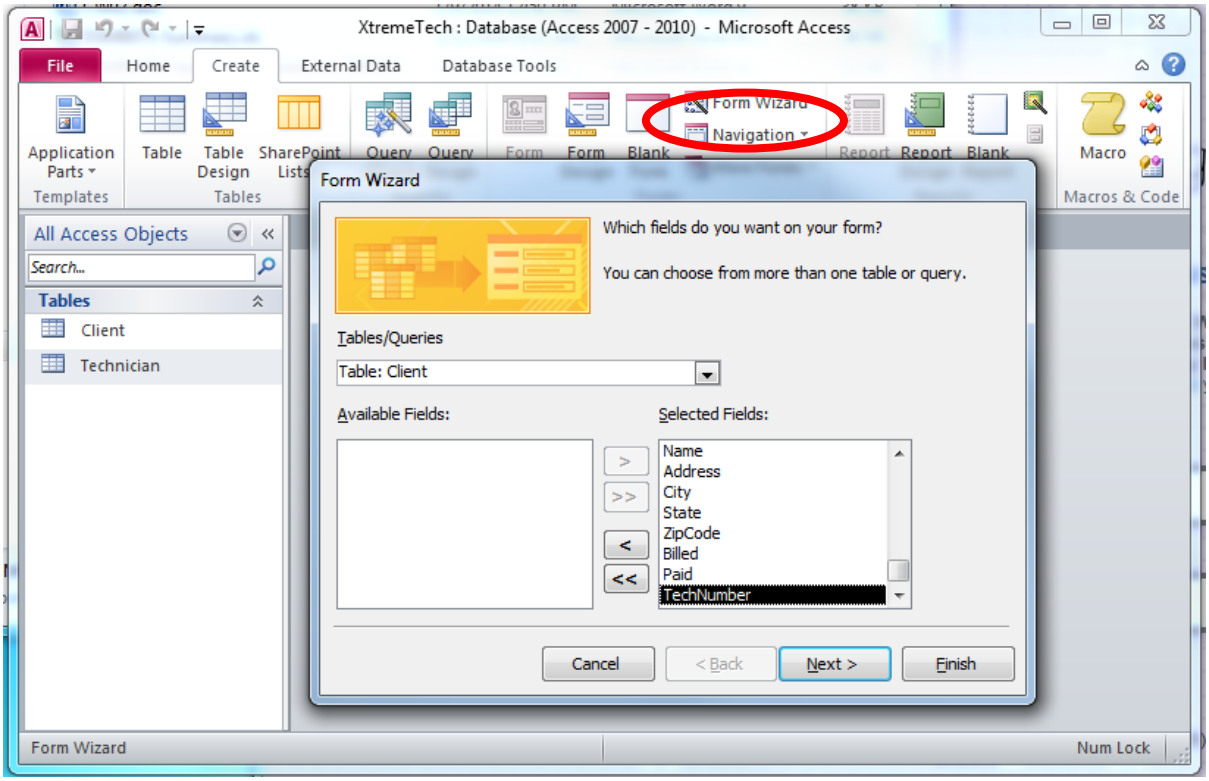
*A check mark next to "**Cascade Update Related fields**" tells MS Access to automatically update values of all related fields to the primary key. This allows the user to change the value of the Primary Key without having to manually change values in related fields. "**Cascade Delete Related Records**" instructs MS Access to delete all transactional records related to a deleted master record*

Create Forms Using Wizard

A form is a graphical representation of a table. You can add, update, and delete records in your table using a form. NOTE: Although a form can be named differently from a table, it manipulates *the underlying data.*

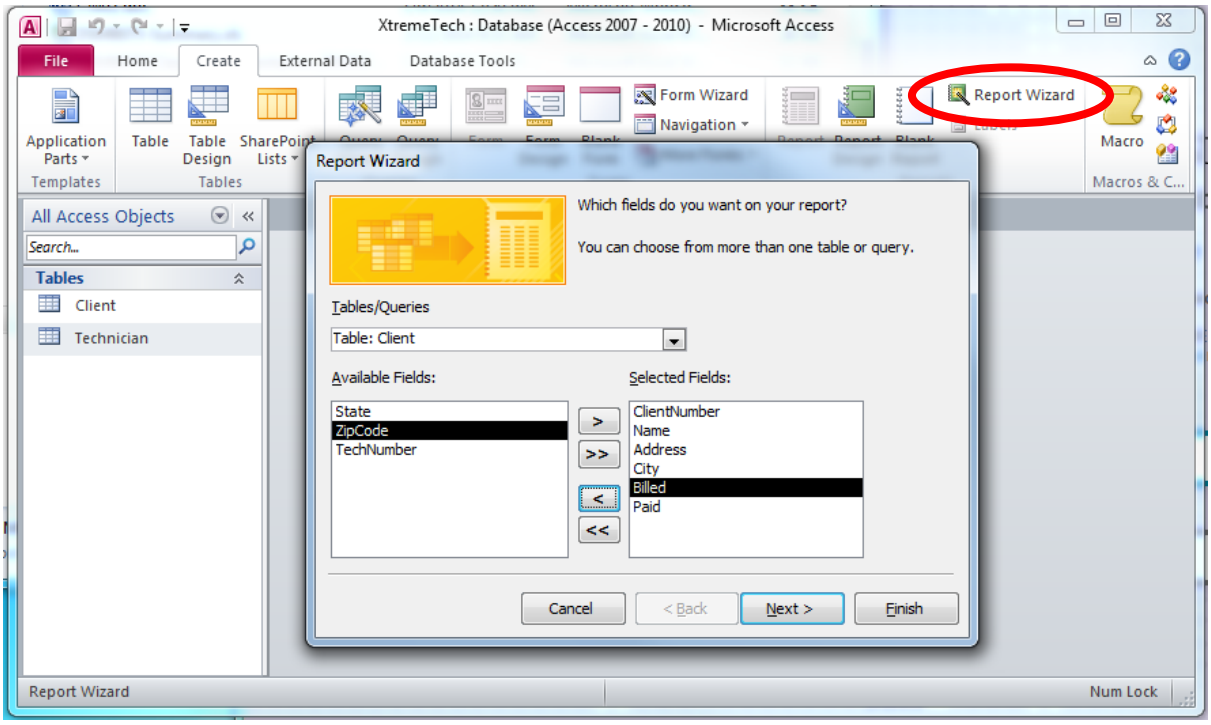
A form is useful when you have numerous fields in a table. All the fields are visible on one screen as compared to the table view (datasheet) you would have to keep scrolling to get the field you desire.

You can create a form using the wizard by clicking the "Form" button under the "Create" menu by following the prompts.



Create Reports Using Wizard

You can present data from your database using a report and format it according to your desire. To create a report, click the "Report" button under the "Create" menu.



Create Mailing Labels

Microsoft Access allows you to create Mailing Labels from your database. To do this you need to:

1 Switch to the Database Window. You can do this by pressing F11 on the keyboard.
2 Select the Client Table
3 Click on the "Label" button next to the Reports button under "Create" menu. A Label Wizard window will appear.
4 Select the layout of your labels
5 Select the font size and color on each label
6 Select the field you want to show in the label and how you want your label to look
7 Select how you want your labels to be sorted
8 Give your label report a name and preview it