FIT 100
Introduction to Relational Databases through Microsoft Access
Creating tables for data storage

Reading to be done for this lab:

- Chapter 13, of *Fluency with Information Technology: Skills, Concepts and Capabilities*

Objectives:

1. To connect the abstract concepts of Entities, Attributes (properties of an entity) and Tuples (instances of an entity) in the Relational Database Model with the corresponding objects in Access that are concrete representations of those concepts.
2. To become familiar with MS Access, one of many different Relational Database Systems that can create complete database applications.
3. To create tables that are associated with each other based on a specific type of attribute, a key attribute.

1. Create the Database Structure

A. Open Microsoft Access
Programs>Microsoft Access

> The first thing you have to do is save the database. This may seem weird, since other applications allow you to add text or create objects and then save, but this is what Access requires. You are defining/creating a database structure and that space will be the only way to access the tables and queries created in it.

B. Select the "Blank Access database" option and click OK.

C. When the window called "File New Database" shows up, name the database as **YourName.mdb** and save it to the Desktop.

After you create the database, the next window lists the database objects available on the left and the methods available for creating them on the right.

Creating a table in Design view will let you build the table from scratch, adding attributes (the names of the columns) and deciding what data types will be allowed for stored values in each cell.

2. Identify the Important Entities and Relationships

The Student/Advisor Database

You are creating your first database today in order to hold/track information about two different entities: the **Student entity** and the **Advisor entity**. In layman's terms - you're going to create two tables: **tblStudent** and **tblAdvisor.** The "tbl" at the front is a naming convention so that you know you are dealing with a table and not, as we will do later, dealing with queries or forms

The Student table will hold data about, what else? Students! This table (Entity) should contain attributes for *Student ID*, *Last Name*, *First Name*, *Major*, and the *student's advisor*.

The Advisor table will hold data about the Advisor. This table should contain attributes for *Advisor ID*, *Last Name*, *First Name* and *Department*.

These tables are associated with each other in the following manner:

> *A student, when they first enter school, is assigned an advisor to help them plan out the courses they will take each quarter. That student may change advisors- for example, if they change majors- but they will only have one advisor at a time during their college career.*
>
> *An advisor, on the other hand, may have many students that they advise over the duration of a quarter or a year.*

We indicate the association between the Advisor and the Student in the following manner:

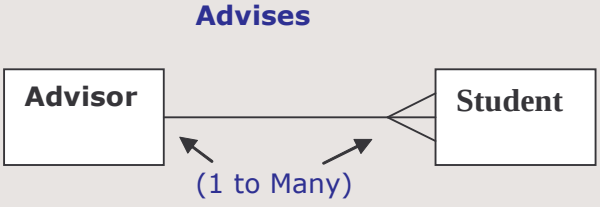
> *An Advisor may have many students that they advise, but a student will have one and only one advisor at any given time*.

The formal way to say this when talking about the relational database model is:

> *There is a one-to-many relationship between the Advisor table and the Student table.*

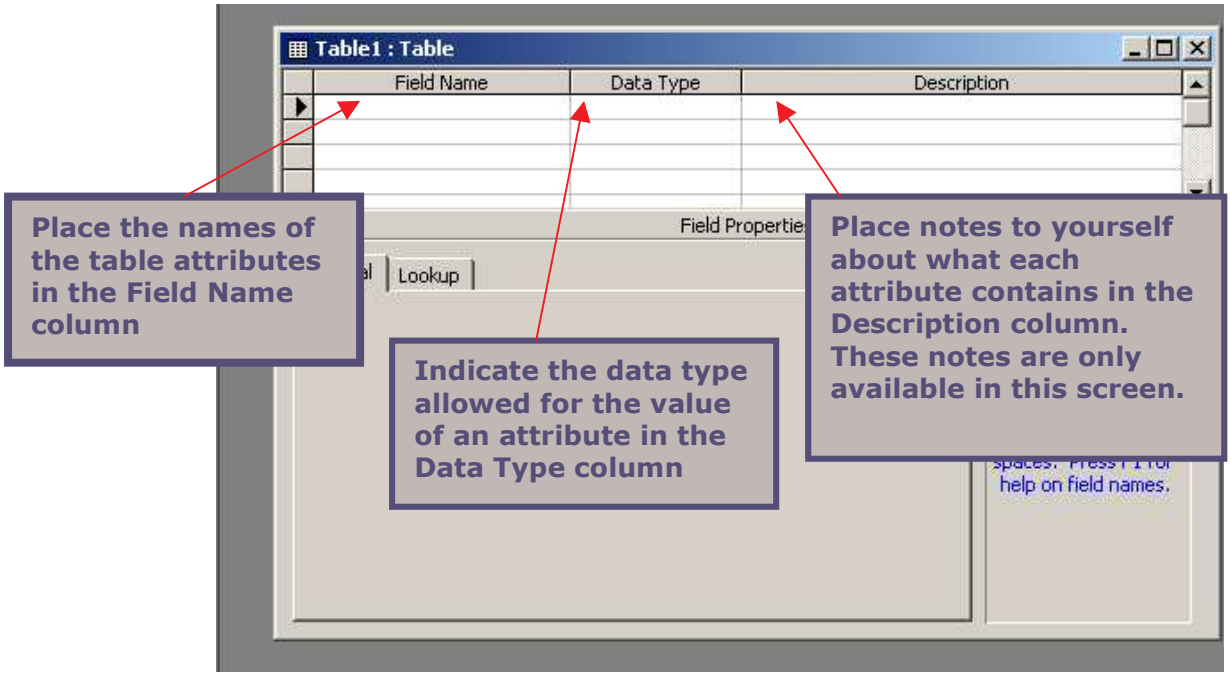
A one-to-many relationship is the most common type of relationship used in the Relational Database Model. In a one-to-many relationship, like the one between Advisor and Student, a record in the Advisor table can be associated with many matching records in the Student table, but a record in the Student table has only one matching record in the Advisor table.

Here is how you can indicate this relationship in graphical terms:



3. Creating Entity Tables

A. Double Click on "Create table in Design view" to start building your tables. The screen that comes up will look like this:



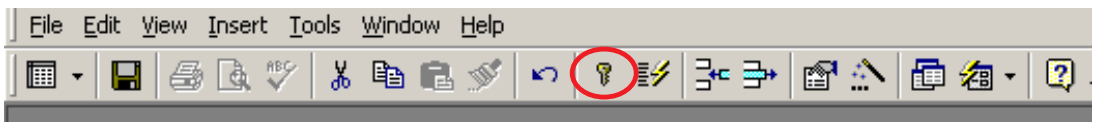
B. Create the Advisor table with the following attributes:

Field Name	**Data Type**	
AdvisorID	AutoNumber	*(use AutoNumber so that Access will produce a unique number to be used as a Primary Key)*
LName	Text	*(Text is one data type that Access uses to indicate a String value)*
Fname	Text	
Department	Text	

C. Identify the primary key for the table.

The last thing to do after adding the attributes and data types (and maybe some notes to yourself), is to indicate the attribute(s) that will be used to hold the unique key value in this table: **AdvisorID**

Highlight the AdvisorID row in table design view by clicking the area just to the left of the AdvisorID. Then click on the key icon on the tool bar.



Once you do that, a small key icon should appear just to the left of **AdvisorID**.

D. When you have finished establishing the Primary Key, save your table with the name **tblAdvisor:**
File>Save

E. Close the table.

F. Create the Student table with the following attributes and data types. (Repeat steps 3A-3C)

Field Name	**Data Type**	
StudentID	AutoNumber	*(use AutoNumber so that Access will produce a unique number to be used as a Primary Key)*
LName	Text	
Fname	Text	
Major	Text	
AdvisorID	Number	*(This is the column where you will indicate the AdvisorID number that matches the student's assigned advisor name. It is known as the **foreign key** when used here because it is a primary key sitting in a table not defined as its own.)*

G. Save your table with the name **tblStudent**.

H. Explain to the person sitting next to you how these two Entities (tables) are associated with (related to) each other?

You now have 2 tables holding data related to 2 different entities. One is the Student entity. The other is the Advisor entity.

4. Add Data to Entity Tables

A. Go to the Tables Window and open tblAdvisor.

Notice that the table opens up in Datasheet View. This view allows us to see all instances of the advisor entity that have been entered so far. The table is currently empty.

B. Add the following 2 *instances*, or rows, so that there is some data in the table:

tblAdvisor : Table

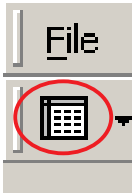
AdvisorID	LName	FName	Department
1	Dickey	Martin	Computer Science and Engineering
2	Whiteaker	Grace	Information School

A number appears once you put your cursor in the LName column and start typing "Dickey". This is the **primary key** for each row and it is generated by Access so that every row is unique and at no time will a null value be allowed in the AdvisorID column. AutoNumber is not always required when establishing a primary key in Access. It is simply a convenient way to assign one if an existing attribute does not exist that is known to be unique and not null.

C. After you add the data, switch to design view of the table by clicking the design icon in the upper left corner of the database screen:

What is the view of the table? It is the view you first saw when creating the attributes of the entity.

Switch back to Datasheet View by clicking the appropriate icon now in the left corner of the database screen



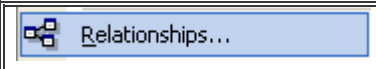
D. Close the table.

You do not have to save tables when you enter data in the datasheet view. It is automatically saved for you. **IF** you change the way the table "looks" (the display/format), then you need to save it in order to preserve the look you have created.

5. Establishing Relationships

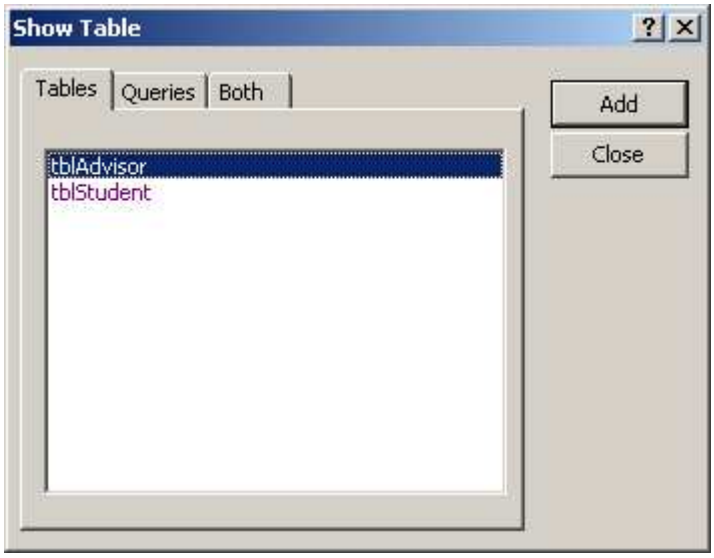
In order to enforce referential integrity among tables, and to be able to create forms based on information from more than one table you should establish relationships between your tables. They might be **one-to-one** or **one-to-many**. In order to ensure data integrity, allow Access to enforce the relationships as you create queries and forms.

A. Go to the Relationships window:



- Right click while on the database window OR
- Go to **Tools> Relationships** OR
- Find the icon on the Tool Bar

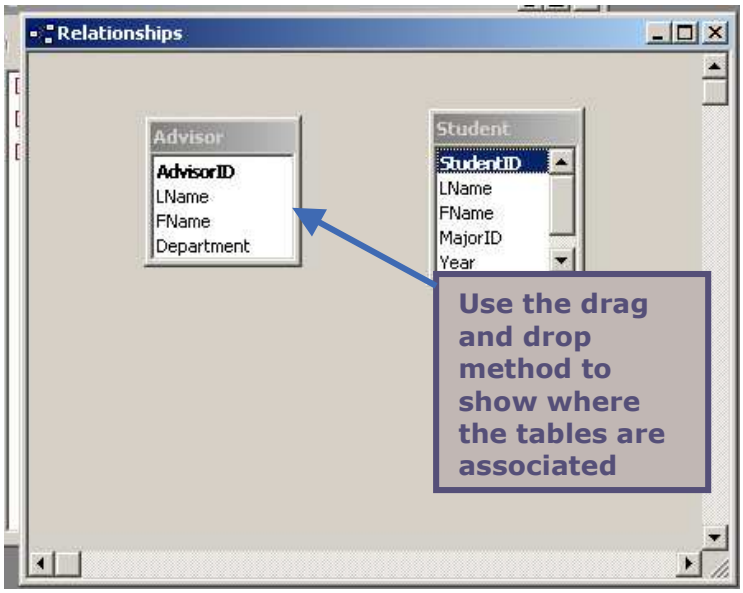
The Show Table window box should come up:



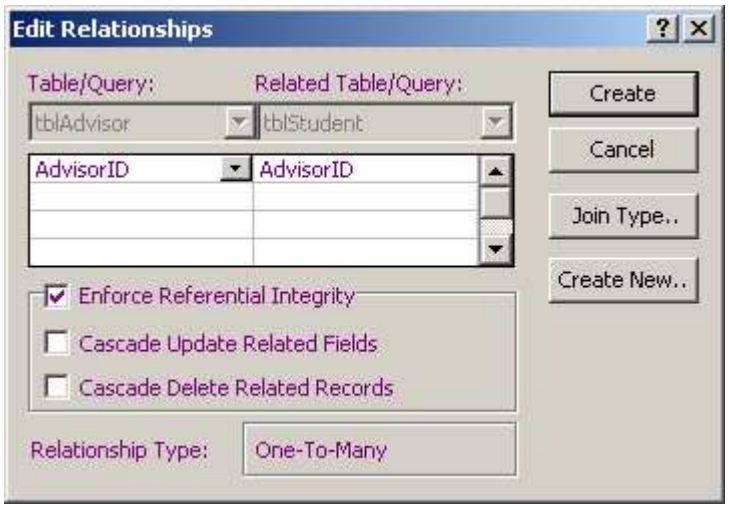
B. Add each table to the Relationship form by selecting it and clicking Add. Do not add each table more than one time. **IF** the Show Table window does not appear when you open the Relationship form, right click to find it.

C. Close the Show Table window.

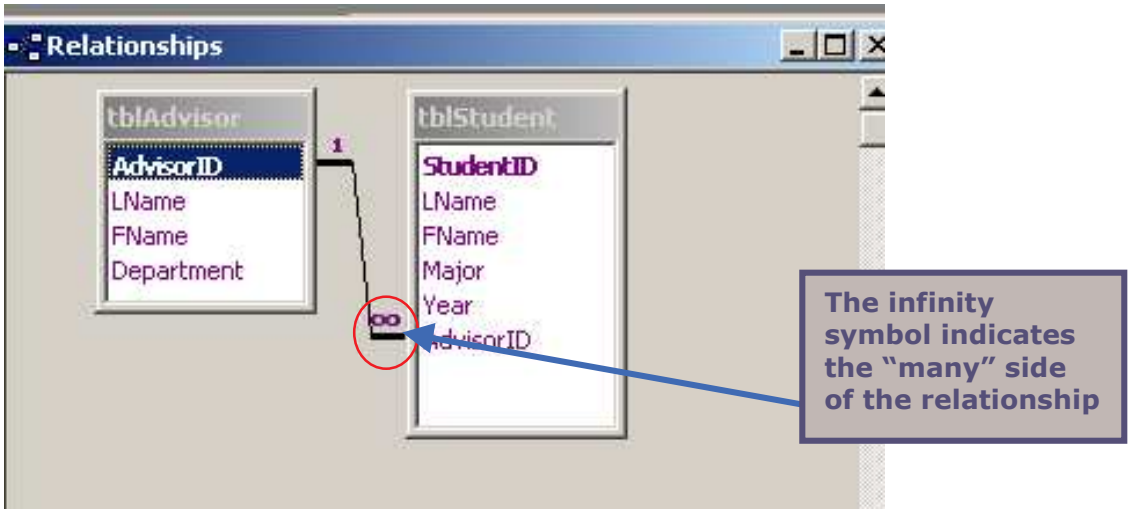
D. Drag the attributes holding the keys that correspond to each other from one table to the next. Once you have placed them, an Edit Relationships window comes up.



E. Check the **Enforce Referential Integrity** window and **Create** the relationship:



When you have created all the proper relationships, your window should look like this:



F. Save and close the Relationships Window.

G. Open up the **Student** table. Add 4 records of student information for yourself and 3 friends. Assign them each an advisor and place the ID number that corresponds with the advisor in the correct column:

StudentID	LName	FName	Major	AdvisorID
1	Crowley	Caro	INFO	2
2	Jordan	Michael	INFO	1
12	Jennings	Waylan	CSO	2
13	Ima	Tester	INFO	4
(AutoNumber)				(AutoNumber)

Record: 1 of 4

In order to maintain data integrity, do not try to assign an Advisor ID that does not correspond to an actual advisor. Because you have established relationships between these two tables that enforce referential data integrity, you will not be allowed to do so.

H. You now have two entities in your database. They are populated with instances (rows of data). Take a look at each of your tables. What attribute (besides the foreign key attribute) in each of our tables could have been separated out, a new table created, and a key number put in its place to reduce data redundancy (the number of times we had to type in the same information)?

Normalization

Normalization is the process of efficiently organizing data in a database. Two main goals of the normalization process are to eliminate redundant data (for example, storing the same data in more than one table) and ensure data dependencies make sense (only storing data about a single entity in a table). This process has many levels involved in it. Let's look at one of the most basic: revising a table structure when it has more than one entity described in it.

Let's start to normalize one of the two tables you created today. This process is usually done before creating table structures, but we are going through it on a database that has already been created so that you get an idea of how it is done.

Currently your database consists of two tables. The Student table includes in it textual information about another potential entity. This means there is the possibility that values in some of the columns may be filled with redundant information.

Can you identify the column that holds semantic (textual, meaningful) information about a separate "thing" in the student table?

6. Breaking One Table Into Two

A. Add a table called Major to hold the list of majors that a student can declare.

For our database, a student will only be allowed to declare one major.

This will maintain a **one – to - many** relationship between the Student and Major entities.

B. Create a table called **tblMajor** with the following attributes:
MajorID as the Primary Key (use autonumber)
MajorName as a text attribute
School_Dept as a text attribute

Refer to step 3 to create this table if needed.

C. Save the table as **tblMajor** and close it.

To use the data in tblMajor how will we associate it with the tblStudent? To do this requires removing one attribute and adding another attribute to the Student table.

- What attribute should be removed from the Student table?
- What attribute will we put in its place?
- Are there additional themes represented in the Advisor table that should be removed? (You are not required to remove them, just identify them)

D. Open the tblStudent table in Design view. Do this by clicking once on the Student table object and then click the **Design** icon above,

Domain Integrity:
There is a rule in database design that any attributes that are part of a relationship between 2 tables must have the same data type. This is called "maintaining domain integrity".

By creating a new table for Majors with a primary key that is a number data type, we can no longer use the attribute Major in tblStudent as the foreign key field because it is a text data type.

The data type of any attribute holding foreign key information from the Major table will have to match. Since you already have a couple rows of data in that column, it will be easier to delete the attribute and then create another field called MajorID, this time with a number data type.

E. Delete the field Major. When asked if you want to *"permanently Delete the selected fields…."*, click Yes. Now the old attribute Major and all the corresponding data in your table have been removed.

F. Insert a new row right above the field AdvisorID.

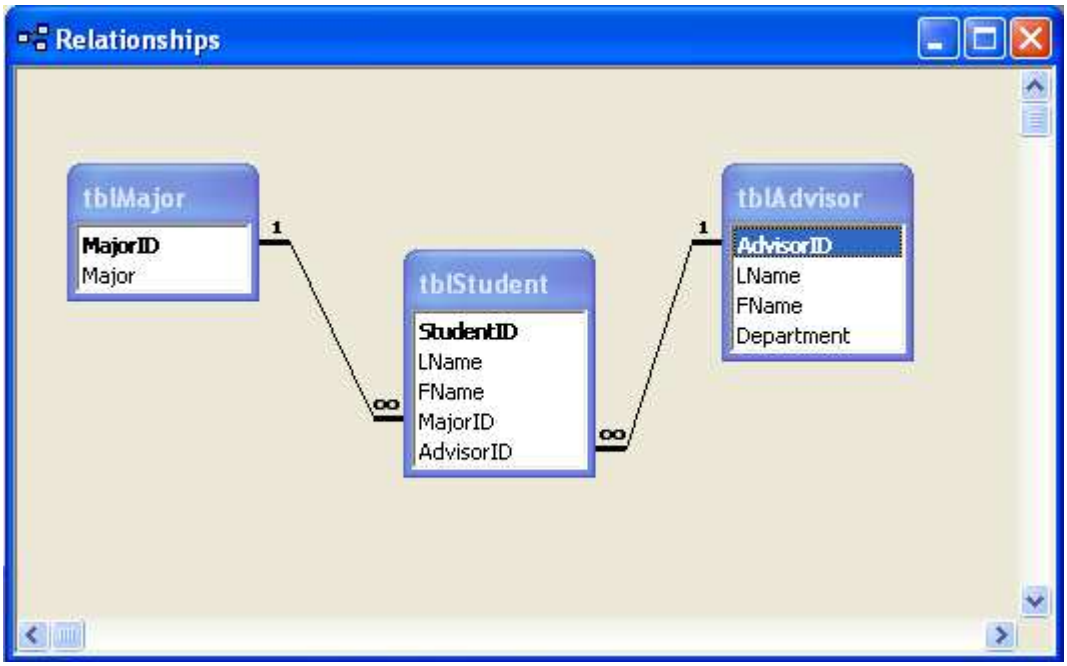
G. Add a new field (attribute) to the table Student where you inserted the row.

H. Name it **MajorID** and make the data type a **number**. Why are you doing this???? Because this field will hold the key number of the related record in tblMajor. Since the primary key for tblMajor is a number, the field set up in tblStudent must also be a number data type to maintain domain integrity.

This attribute will hold the key numbers that corresponds with particular instances of the Major entity. It is placed in the Student table as a way to indicate the major that the student has declared. (The attribute AdvisorID is used in the same manner.)

I. Save and close the table. There are now 3 table structures created to hold instances of the entities Student, Advisor and Major.

J. Add the Major Table to your relationship window. Associate the Major table with the Student table based on the **MajorID**. Create the relationship and enforce referential integrity.



K. Close the database completely and transfer your database to Dante. You will use it again in the next lab.

ALERT!! If your database is open when you upload, you may end up loading an empty file. (Depends on the version of Access and the Operating System)