GST 103: Data Acquisition & Management Lab Series

Lab 3: Database Schema Implementation

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Introduction

This lab is part of a series of lab exercises designed through a grant initiative by the National Information, Security & Geospatial Technologies Consortium (NISGTC), funded by the United States Department of Labor in partnership with the Department of Education under the Trade Adjustment Assistance Community College and Career Training Grant Program (TAACCCT).

Data consistency and integrity is a large issue when it comes to data capture or data entry. Using subtypes and domains allows us to keep the data entry consistent. Domains are created on the geodatabase level, using codes to store values. Subtypes are used when we can characterize the data.

Your instructor may require that you provide screen captures, exported files and database designs (as directed in the lab). Please check with your instructor for the requirements specific to your class.

This lab includes the following tasks:

1. Implementing Subtypes and Domains
2. Using the Subtypes and Domains in Digitizing
3. Building a Relationship Class

Objective: Implementing a Database Structure

In this lab we will set up a database structure that employs subtypes and domains that can then be used for digitizing. We will also look at how to build a relationship class between data files.

Lab Settings

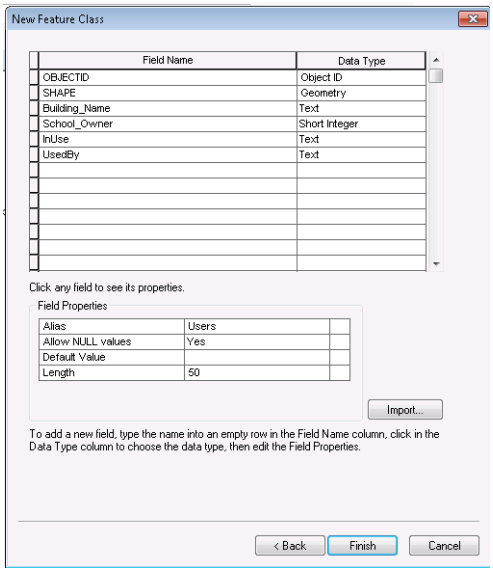
Required Virtual Machines and Applications

Windows Machine User Account	Train
Windows Machine User Password	Train1ng$

1 Implementing Subtypes and Domains

This task will illustrate how to implement subtypes on shapefiles and domains on a geodatabase to ensure the data integrity and consistency. It is important that the data we capture be accurately added into the database.

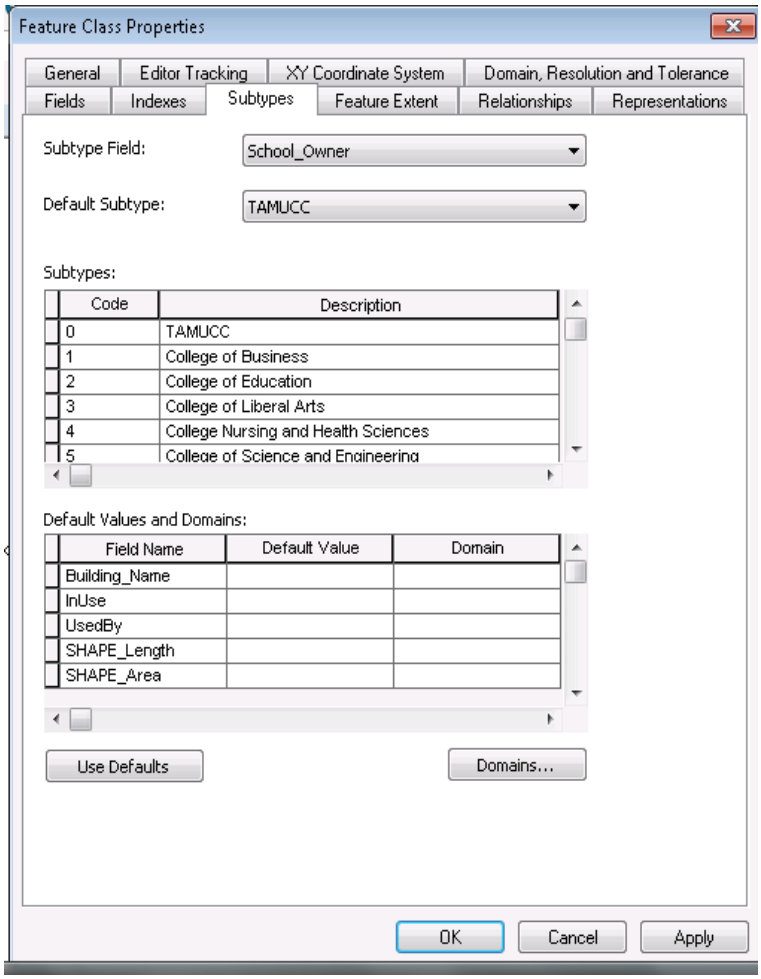
1. Log into the computer, using the information provided in the Lab Settings section.
2. Click **Start->all Programs->ArcGIS->ArcCatalog 10.1** this will open ArcCatalog.
3. Make sure you have a folder connection to your *D:\GST 103\Lab 3* folder.
4. Create a new file geodatabase in your *Lab 3* folder and name it **`MyDatabase`**.
5. **Right-click** on the geodatabase and select **Import->XML Workspace Document**. The wizard will pop up. Set the radio button to **Data**. Next, browse for the University.xml file in the *Lab 3* folder. This XML folder contains the structure of the database and the raster datasets.
6. Once the data has been imported, we will create two feature datasets and feature classes within those datasets. Feature datasets are a container for the feature classes and will store any data as long as it is in the same coordinate system. **Right-click** on the geodatabase and select **New -> Feature Dataset.** Name the feature dataset **`Buildings`**. Set the Coordinate System of the feature dataset to NAD_*1983_StatePlane_Texas_South_FIPS_4205_Feet*. We have no vertical coordinate system. Click **Next**, and the XY tolerances are good enough for our use. Click **Finish**.
7. **Right-click** on the Buildings dataset and select **New->Feature Class**. Name it **`School_Buildings`** with an Alias of **`Buildings`**. Make sure it is set to a polygon feature. **Click Next**. We have no database configuration keyword. **Click Next.** Now we have to enter the field names and data types. Reference the screenshot below to fill out your table. Once you have entered the name, **press Tab** and select the data type. School_Owner is a short integer data type, as we will be using a subtype to code those values. **Click Finish** to create the feature class.



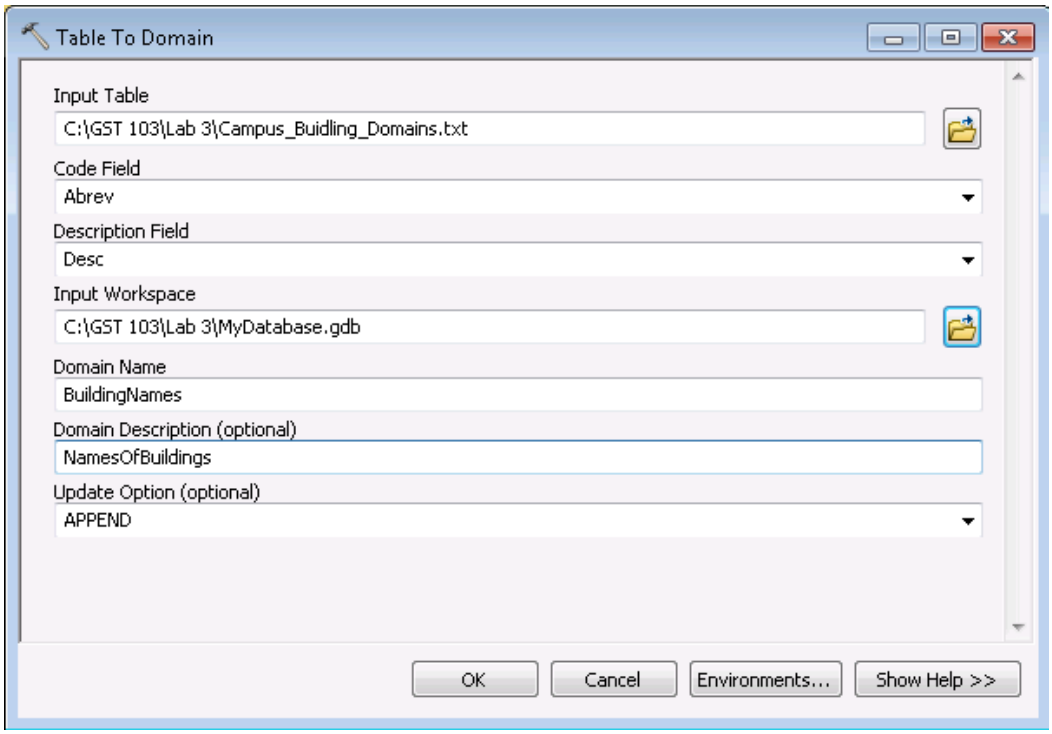
8. To create a subtype, **right-click** on your new feature class, click **Properties,** and go to the **Subtypes** tab. Subtypes only work on fields that have a short integer data type. In the Subtype field dropdown select ***School_Owner***. This is the school that owns the building such as the College of Business or Liberal Arts. Enter the values shown below into the Subtypes table. Set the default subtype to **TAMUCC**.

Code	Description
0	TAMUCC
1	College of Business
2	College of Education
3	College of Liberal Arts
4	College of Nursing and Health Sciences
5	College of Science and Engineering

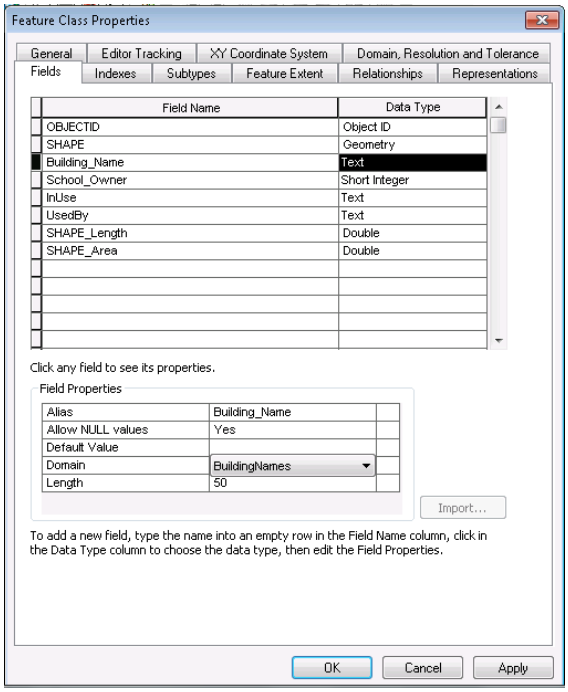
9. It should look like the screenshot below when you are finished. Establishing these subtypes allows us to create features easily and to store the data more efficiently in the database. Click **Apply** and **OK**.



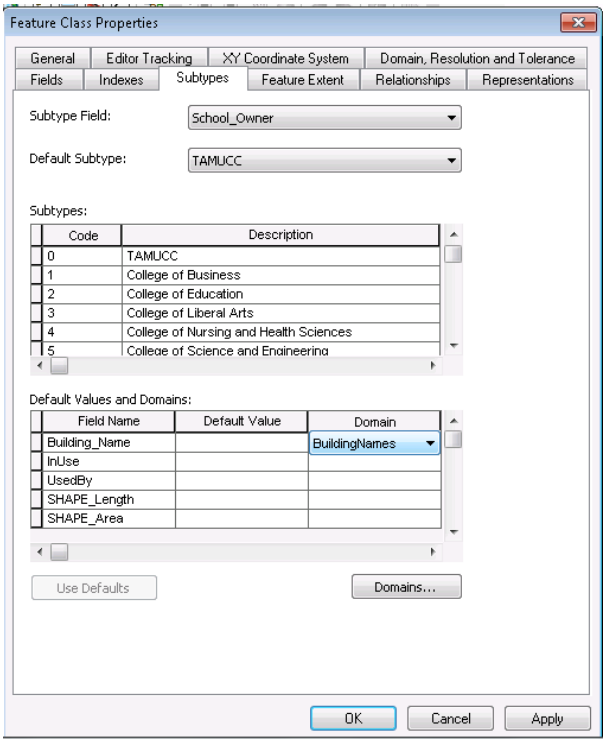
10. Next, we will set up the domains. Since domains are created at the database level, we have to define them on the geodatabase. **Right-click** on the geodatabase, open **Properties**, and go to the **Domains** tab. We can either retype all the values in here from the Campus Buildings Domains text file or we can use ArcGIS tools to import it into the table. We will import the table.
11. Go to the search bar and **search** for **`Table to Domain`**, a Data Management tool (**Data Management->Domains->Table To Domain**). This takes the data from the space delimited text file and automatically writes it to the domain table in the geodatabase. Open the tool and set the parameters as shown in the screenshot below. The Input Table will be ***Campus_Buidlings_Domains.txt***. The Code Field should be ***Abrev*** and the Description field should be ***Desc***. The Input Workspace is the geodatabase. Name the domain **`BuildingNames`**, and in the domain description, type **`Names of Buildings`** and then **click OK.** Go to the geodatabase Properties and look at the Domain tab and notice the domains are now listed.



12. The domain list is populated but now we need to ensure the domain is linked to the field and ensure it has the right names. Right-click on the ***School_Buildings*** feature class to open **Properties**, and go to the **Fields** tab. Click on the empty cell to the left of the *Building_Name* field. In the Field properties table, click the empty cell to the right of Domain and select *BuildingNames* from the dropdown menu (see screenshot below).



13. Then, go to the Subtypes tab. First, select TAMUCC from the Subtypes table and on the bottom table select the BuildingNames domain from the dropdown for *Building_Name* (see screenshots below). **Click Apply**. You have successfully set up a domain for the TAMUCC subtype. Next, select College of Business from the subtypes table and select BuildingNames domain again from the dropdown for Building_Name. Click **Apply**. Repeat this process for each of the subtypes. When you are finished you should be able to click on any of the subtypes and the bottom table should show BuildingName as the domain for that subtype. Now click **OK**.



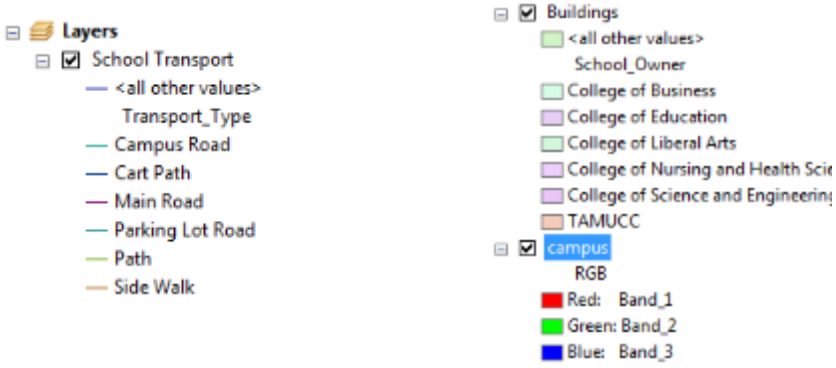
14. Create a new feature dataset in your database called **`Infrastructure`** and set the coordinate system to **NAD_1983_StatePlane_Texas_South_FIPS_4205_Feet**. Accept the default tolerances. Use the information below, follow the steps outlined above and create a feature class named School_Transport with a subtype on the feature class (remember that whichever field you are going use as your subtype will have a short integer data type). Set the default subtype to *Campus Road* after entering in the following subtypes.

Code	Description
0	Main Road
1	Campus Road
2	Sidewalk
3	Path
4	Cart Path
5	Parking Lot Road

2 Using the Subtypes and Domains in Digitizing

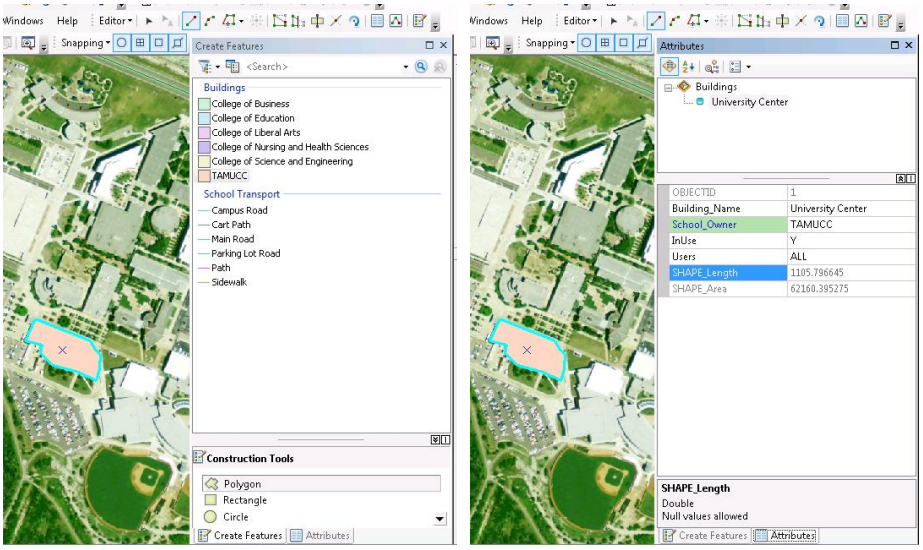
1. Open ArcMap and enable the Editor toolbar and the Snapping toolbar. The Editor toolbar will allow us to draw lines and polygons on the satellite image. The Snapping toolbar will ensure that our lines and polygons are closed. The Snapping toolbar is shown below. Click the Snapping dropdown and select Use Snapping to enable it. The circle represents point snapping, the grid represents end snapping to snap to the end of points and lines, the square is vertex snapping allowing us to snap to corners and the square with a line behind it is line snapping. Click all these options to ensure that we can use them all (options are selected when outlined by a square). Before digitizing a layer, be sure to set the snapping tolerance.

2. Add the ***Campus*** image and the ***School_Buildings*** and ***School_Transport*** shapefiles to the Table Of Contents. The *School_Buildings* and *School_Transport* layers should show up as follows. This indicates that our subtypes were defined properly in the design phase.

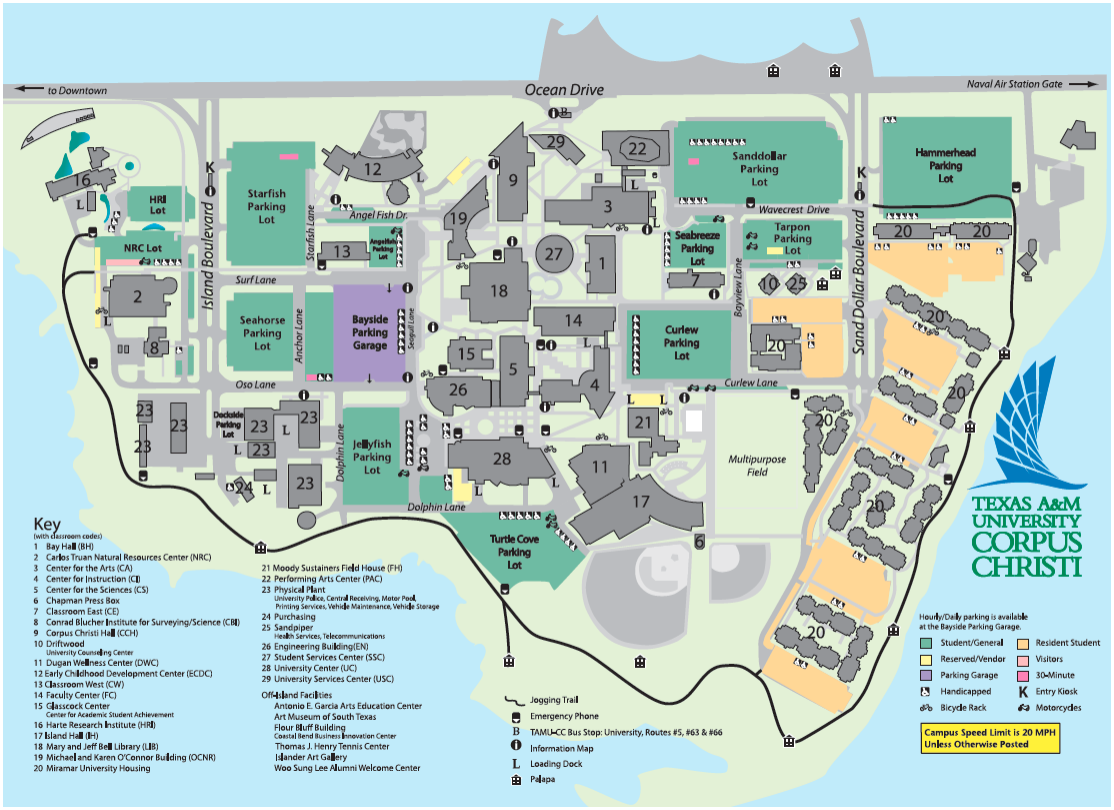


3. Start an editing session by clicking on the **Editor** dropdown on the Editor toolbar and select **Start Editing** (you may need to dismiss a spatial reference warning by clicking **Continue**). You are now in an editing session. Click on the **Create Features** button  . This will open the Create Features window. This window allows us to select the feature we want to edit using the subtype. To digitize point and click to collect a point. Using the Create feature toolbar the workflow is as follows:
    a. First, we must select the template TAMUCC. At the bottom of the Create Features window, we select the Polygon construction tool. Digitize the University Center building by clicking a point on each corner of the building and then double-clicking the last corner to end the sketch (see screenshot below).

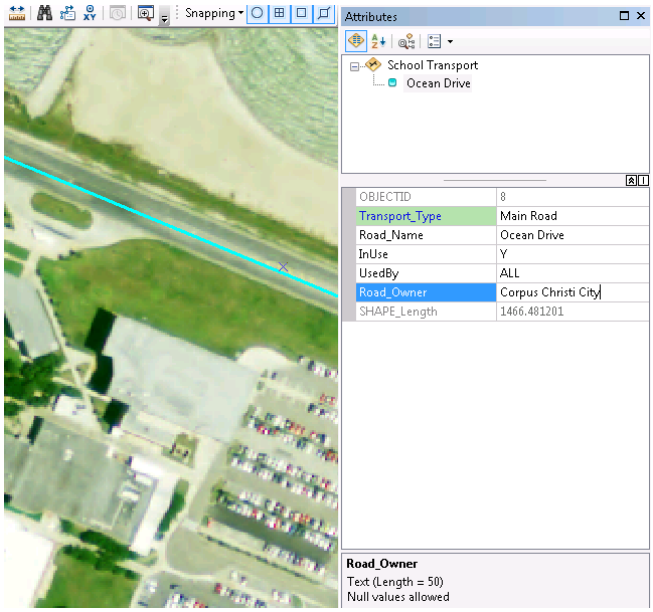
b. Once the feature has been captured, we have to edit the attributes. Click on the **Attributes** button  at the bottom of the Create Features window or in the Editor toolbar to open the Attributes window. Click on the Building_Name <Null> and notice a dropdown. Select **University Center** from the dropdown. For the InUse field, enter **Y** and for the UsedBy field, enter **ALL**.



c. Consult the map of TAMUCC campus (below) to digitize 5 buildings on the map.



4. We follow the same process for line features. We select the template *Main Road.* Our construction tool should be set to *Line*. Digitize the road next to the water. The road's name is `Ocean Drive.` Be sure to enter the name in the attributes.

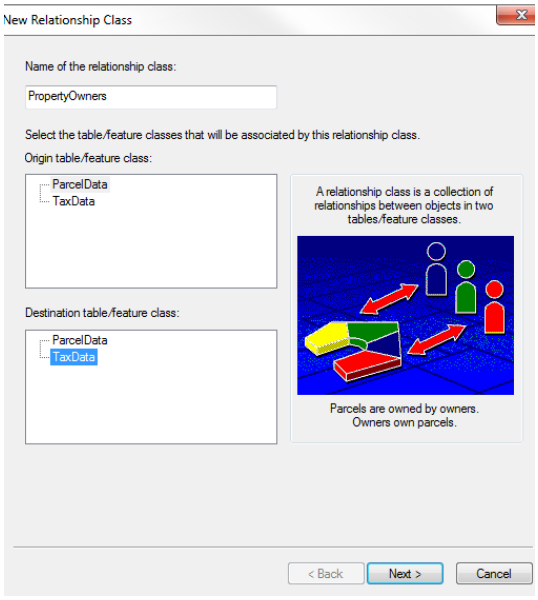


5. Consult the TAMUCC campus map (shown in Step 3.c) to digitize the major roads and paths on campus. Be sure to digitize at least one road/path from each type (i.e. Cart path, sidewalk).
6. When you are done editing, click the **Editor** dropdown and **Save Edits**. If you exit during an editing session, nothing will be saved and you will need to do everything again. Stop your edits by clicking on the Editor dropdown and selecting **Stop Editing**. You are no longer in edit mode.
7. Close ArcMap.

3 Building a Relationship Class

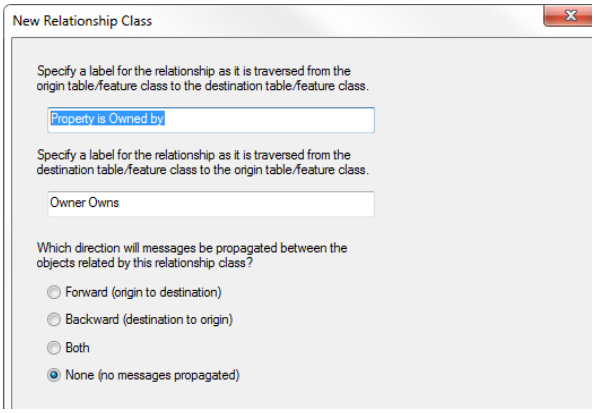
A *relationship class* is a class that facilitates a relationship between shapefiles and tables. A relational table may allow modification of records, depending on the relationship type. In a simple peer-to-peer relationship, records are not deleted by default but a composite relationship will delete and alter the state of tables as changes are made.

1. Open ArcCatalog.
2. Create a new file geodatabase and import ***TaxData*** and ***ParcelData*** tables into the geodatabase.
3. As soon as the data is in the database, look at the data and determine which fields are common to both tables. These will be the key fields we will use to join the tables.
4. Right-click on the geodatabase and select **New->Relationship Class**. A wizard will pop up.
5. In the wizard, name the relationship class `PropertyOwners`. Select the Parcels as the Origin feature class and the **TaxData** for the Destination table. Click **Next**.

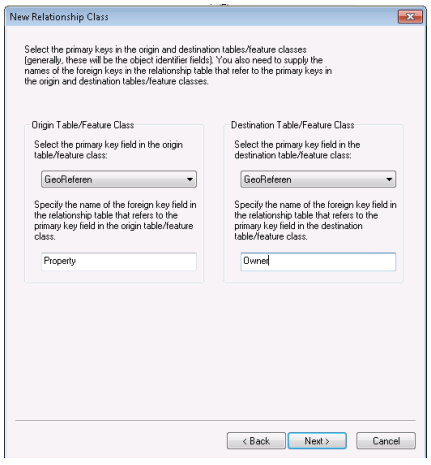


6. Select a simple peer-to-peer relationship.

7. For the next screen, we will enter the relationship description between the table and the feature class. For the first textbox enter a label for the relationship between the origin table and the destination as, **`Property is Owned by`** and for the second text box enter a label for the relationship between the destination table and the origin; enter **`Owner owns`** (as shown in the screenshot below). We will not be sending messages from one table to another, so select the radio button, **None**.



8. Set the cardinality of the relationship to **many-to-many *(M-N)*** as many people may own one property. Click **Next**.
9. We want to add attributes to the relationship so click **Yes** then **Next**. Name the field **Ownership_Percentage** and set it to a **float** value as we are not working with round numbers. In the next window, we will define the primary and foreign keys to use. The keys we select will be fields that both tables have in common in order to create a relationship based on those values.
10. The primary key for both tables is the ***GeoReference*** field. For the origin to destination, the foreign key is ***Property*** and for the destination to origin it is ***Owner*** (see screenshot below). Click **Next**.



11. The next page is a summary. Click **Finish**. The relationship class should be created.

Conclusion

In this lab, we have learned about ensuring data integrity and keeping the data clean and consistent. We explored digitizing, using subtypes and domains to streamline the process. We have also learned about the use of relationship classes when we need to use feature classes and tables.

Discussion Questions

1. What is the difference between a subtype and a domain?

2. Why might we need to streamline the digitizing process?

3. Provide any example of how relationship classes might be implemented in an industry.