GIS I: Organizing Principles
Leveraging the *What* of Geographic Data Exercise

*** Files needed for exercise: *NY_Tract_2012_prj.shp* and *NY_Trt_ACS2012.dbf*

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Goals: The goals for this exercise are to join a New York state Census Tract shapefile to a dbf table containing tract level population data from the 2012 American Community Survey (ACS) 5 Year Estimates, and export the combined table to a new .shp file for display.

Skills: After completing this exercise, you will be able to execute a basic table join in ArcMap, export data as a shapefile, select features by attributes, create selection queries, change your selections, and access descriptive statistics for data in ArcMap.

Setting Up Your Project

1. Open ArcMap. Choose to start a new **Blank Map**.
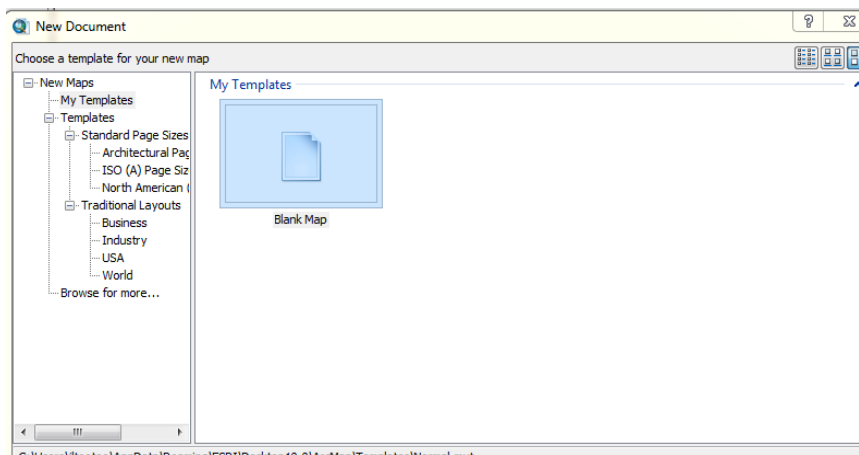
2. Click the **Add Data** button ⬇.

3. If you have not already connected to your folder, click on the **Connect to Folder** button 🗁.

4. Browse to the data folder for this exercise: Leveraging_the_What_Exercise_Data and connect to it. We now have a permanent connection to that folder.

5. Double click on the Leveraging_the_What_Exercise_Data folder to open it.

6. Add the *NY_Tract_2012_prj.shp* and the NY_Trt_ACS2012.dbf files to your project. You can select both by holding down the **Shift** key. They will appear in your Table of Contents (TOC):
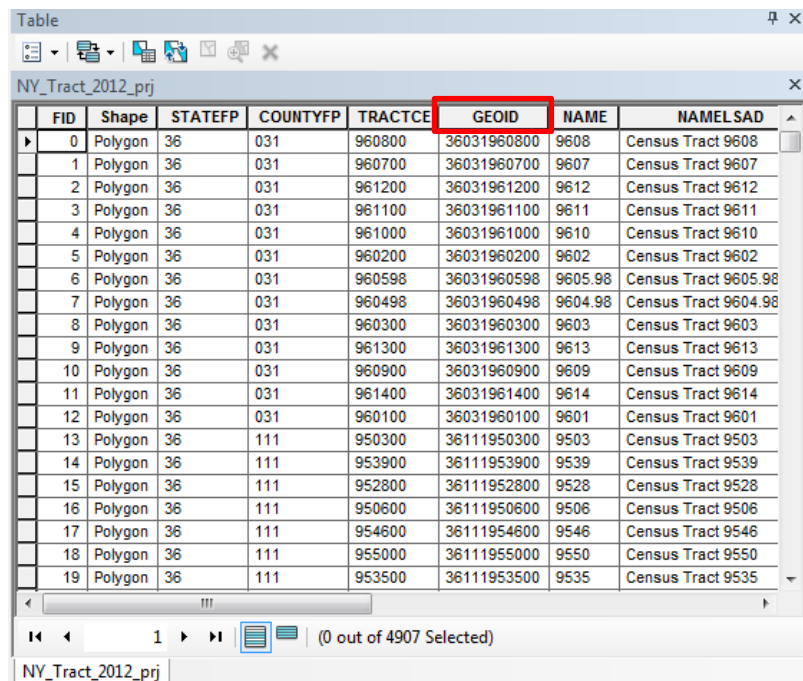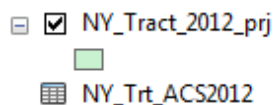
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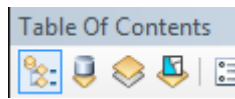
7. Take a look at the tabs in your TOC. How does what you see in your TOC change as you toggle between the tabs: **List by Drawing Order**, **List by Source**, or **List by Visibility**? Return to the **List by Source** tab.

**Understanding Tables and Preparing for a Table Join**

1. You will append data to the tract shapefile *NY_Tract_2012_prj.shp* attribute table – *this is the target table*.
2. Take a look at the fields in your tract shapefile attribute table. To view the attribute table, right click on the shapefile in the Table of Contents and select **Open Attribute Table**.
3. This table is associated with your tract shapefile with attribute names (attribute fields) as columns and rows as records of individual tracts. At the bottom of the table the number of records is shown.
4. The first join will be based on the **GEOID** attribute field; this field represents the tract identifier code. Is this field unique to each tract?

Table

NY_Tract_2012_prj

FID	Shape	STATEFP	COUNTYFP	TRACTCE	GEOID	NAME	NAMELSAD
0	Polygon	36	031	960800	36031960800	9608	Census Tract 9608
1	Polygon	36	031	960700	36031960700	9607	Census Tract 9607
2	Polygon	36	031	961200	36031961200	9612	Census Tract 9612
3	Polygon	36	031	961100	36031961100	9611	Census Tract 9611
4	Polygon	36	031	961000	36031961000	9610	Census Tract 9610
5	Polygon	36	031	960200	36031960200	9602	Census Tract 9602
6	Polygon	36	031	960598	36031960598	9605.98	Census Tract 9605.98
7	Polygon	36	031	960498	36031960498	9604.98	Census Tract 9604.98
8	Polygon	36	031	960300	36031960300	9603	Census Tract 9603
9	Polygon	36	031	961300	36031961300	9613	Census Tract 9613
10	Polygon	36	031	960900	36031960900	9609	Census Tract 9609
11	Polygon	36	031	961400	36031961400	9614	Census Tract 9614
12	Polygon	36	031	960100	36031960100	9601	Census Tract 9601
13	Polygon	36	111	950300	36111950300	9503	Census Tract 9503
14	Polygon	36	111	953900	36111953900	9539	Census Tract 9539
15	Polygon	36	111	952800	36111952800	9528	Census Tract 9528
16	Polygon	36	111	950600	36111950600	9506	Census Tract 9506
17	Polygon	36	111	954600	36111954600	9546	Census Tract 9546
18	Polygon	36	111	955000	36111955000	9550	Census Tract 9550
19	Polygon	36	111	953500	36111953500	9535	Census Tract 9535

1 ▶ ▶| (0 out of 4907 Selected)

NY_Tract_2012_prj

5. Once you have confirmed this field is in fact unique and does represent tract, you should also determine what type of data field it is. To find this information right click on the shapefile in your TOC and select **Properties**. This will open the layer properties. Select the **Fields** tab and click the **GEOID** field. What type of field is it?
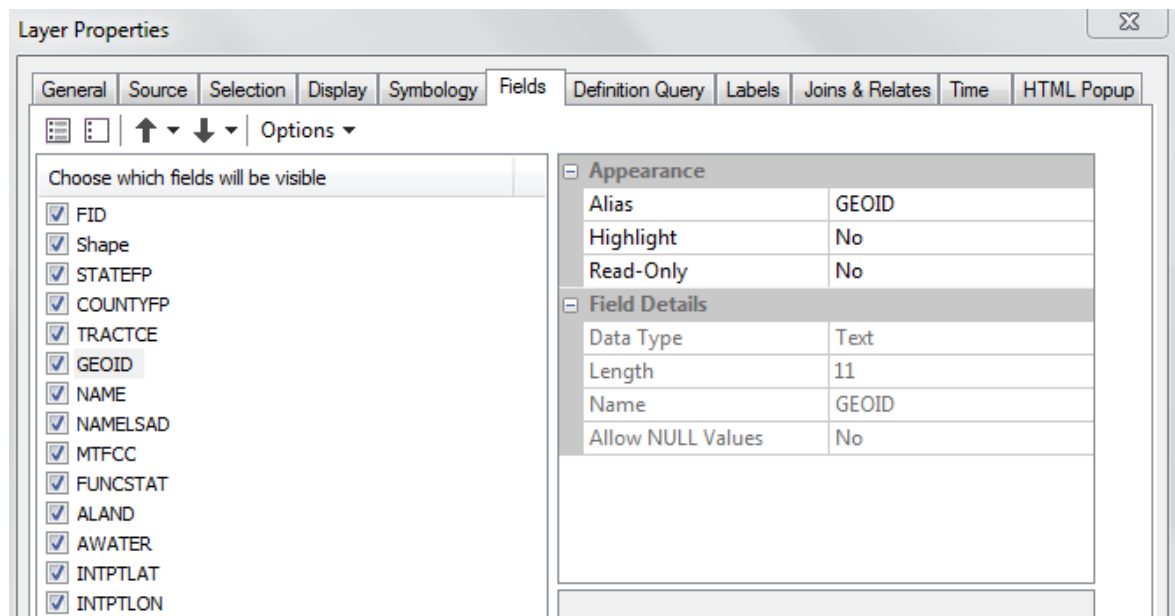
Do you know what a GEOID code is? This field represents an eleven-digit code which uniquely identifies a US Census Tract. The first two digits are the state code, the next three the county code, and the final six the tract identifier: together they ID a single US Census tract.

6. Now that you know more about your target table, take a look at the table you will append to the tract shapefile (*NY_Trt_ACS2012.dbf*) - *this is the* ***join*** *table*. Open this table and examine it; the common field that you will use to join this table to your shapefile is: **GEOID**. Confirm that it is the same data type as the field in the tract shapefile.

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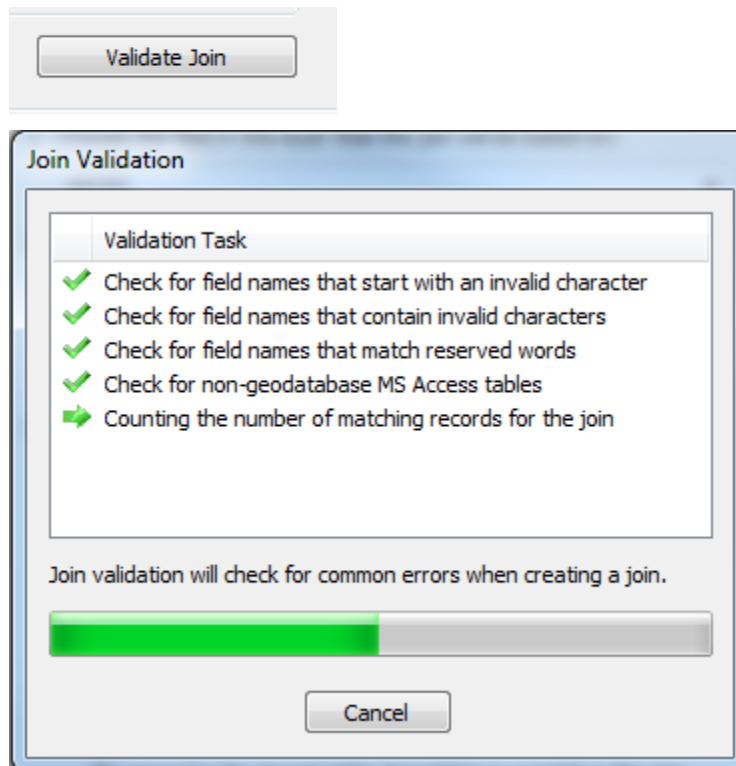

Performing a Table Join

1. In examining your two tables you may have noticed that there are the same number of records in both your target and join tables, this means that your join is a *one to one join*.

2. You have confirmed that the field you are basing your join on is a *common field* to both the target table (*NY_Tract_2012_prj.shp* "**GEOID10**")**,** and the join table *(NY_Trt_ACS2012.dbf* "**GEOID**"). In this case the two fields have the same name in each table, they also importantly have the same meaning and are of the same data type, so you are ready to join.

3. Right click on the *NY_Tract_2012_prj.shp* in the table of contents; select the **Joins and Relates**; choose **Join**. This will open the Join Data dialogue.
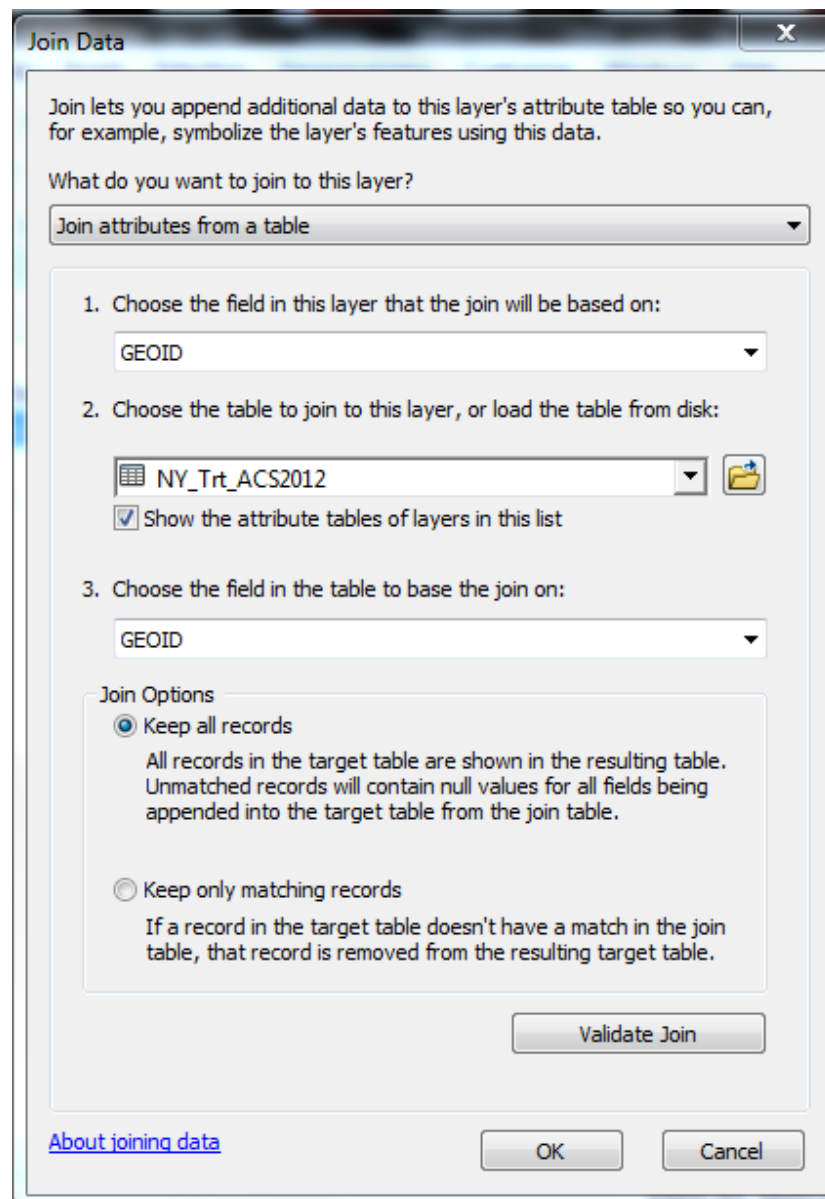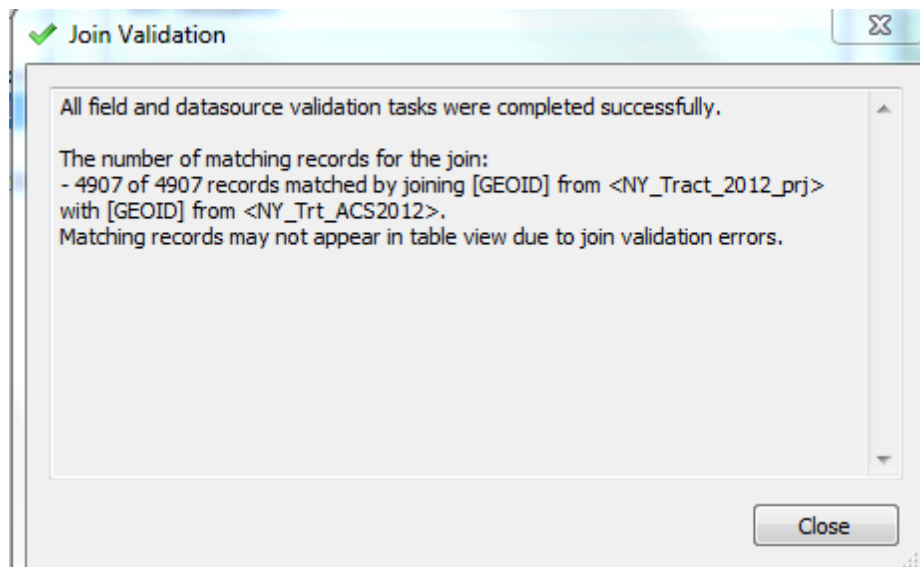
4. You are immediately confronted with a question: **What do you want to join to this layer?** In the drop down box, select **Join attributes from a table**.

5. Next you will choose the join field in your target table that the join will be based on: **GEOID**.

6. Select the *NY_Trt_ACS2012.dbf* table as the table to join to your target.

7. Finally, choose the field in the join table to base the join on: **GEOID**.

8. Before you click okay, take a look at some of the help: **About Joining Data.**

9. Click **Validate Join**. This will check for some common issues that can foul up a table join.

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Validate Join

Join Validation

Validation Task
✔ Check for field names that start with an invalid character
✔ Check for field names that contain invalid characters
✔ Check for field names that match reserved words
✔ Check for non-geodatabase MS Access tables
➡ Counting the number of matching records for the join

Join validation will check for common errors when creating a join.

Cancel

You may get a message about indexing the join, select yes…

If you see the message below, it is a positive sign.

✔ **Join Validation**

All field and datasource validation tasks were completed successfully.

The number of matching records for the join:
- 4907 of 4907 records matched by joining [GEOID] from <NY_Tract_2012_prj>
with [GEOID] from <NY_Trt_ACS2012>.
Matching records may not appear in table view due to join validation errors.
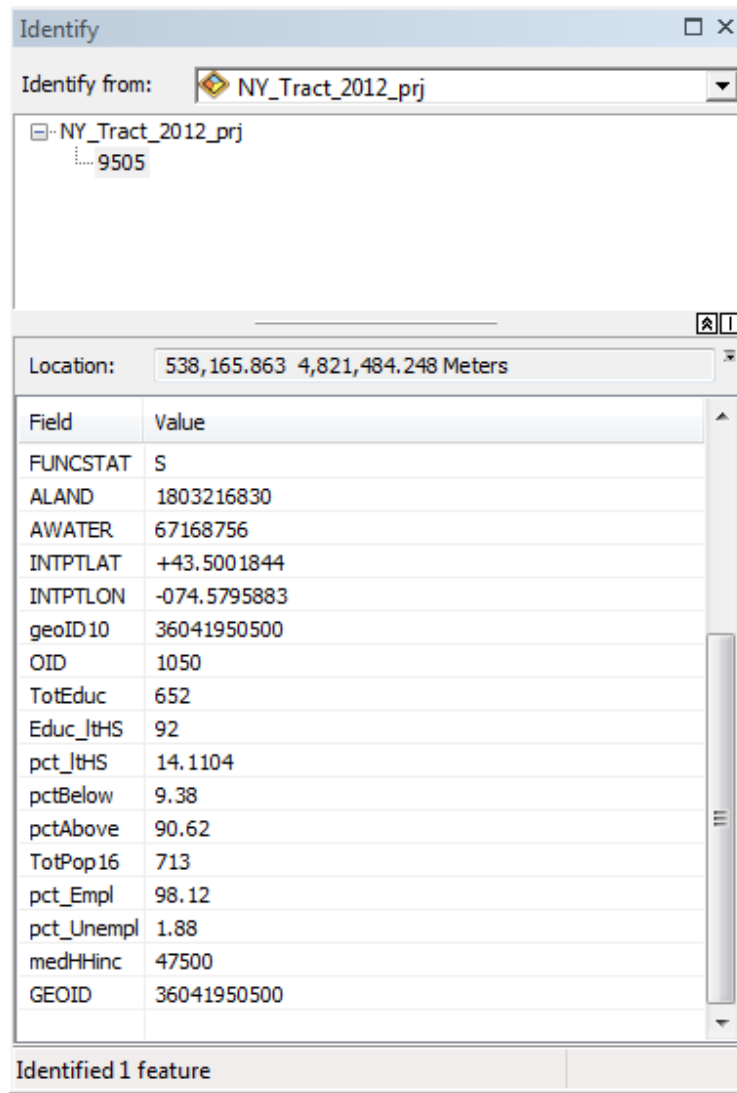
Close

10. Click **Close** and then **OK** to complete the join.

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Examining the Result of a Table Join

1. Use the Identify tool to click on a feature on your map, and explore the attributes of your shapefile. What new fields have been added through the join?

Identify	□ ×

Identify from: ◇ NY_Tract_2012_prj ▼

☐ NY_Tract_2012_prj
　　… 9505

Location:　538,165.863　4,821,484.248 Meters

Field	Value
FUNCSTAT	S
ALAND	1803216830
AWATER	67168756
INTPTLAT	+43.5001844
INTPTLON	-074.5795883
geoID10	36041950500
OID	1050
TotEduc	652
Educ_ltHS	92
pct_ltHS	14.1104
pctBelow	9.38
pctAbove	90.62
TotPop16	713
pct_Empl	98.12
pct_Unempl	1.88
medHHinc	47500
GEOID	36041950500

Identified 1 feature

2. Right click on your target (*NY_Tract_2012_prj.shp*) in the TOC and open the attribute table.
   a. Does the table look different?
   b. The **INTPTLON** field is the last field of your target table *NY_Tract_2012_prj.shp.*
      Every field to the right has been added from the join table *NY_Trt_ACS2012.dbf*

   Close your table. Open the layer **Properties** by right clicking on the *NY_Tract_2012_prj.shp* in your TOC, then choose the **Joins & Relates** tab. This is the place to take a look at all of the information related to your join(s).

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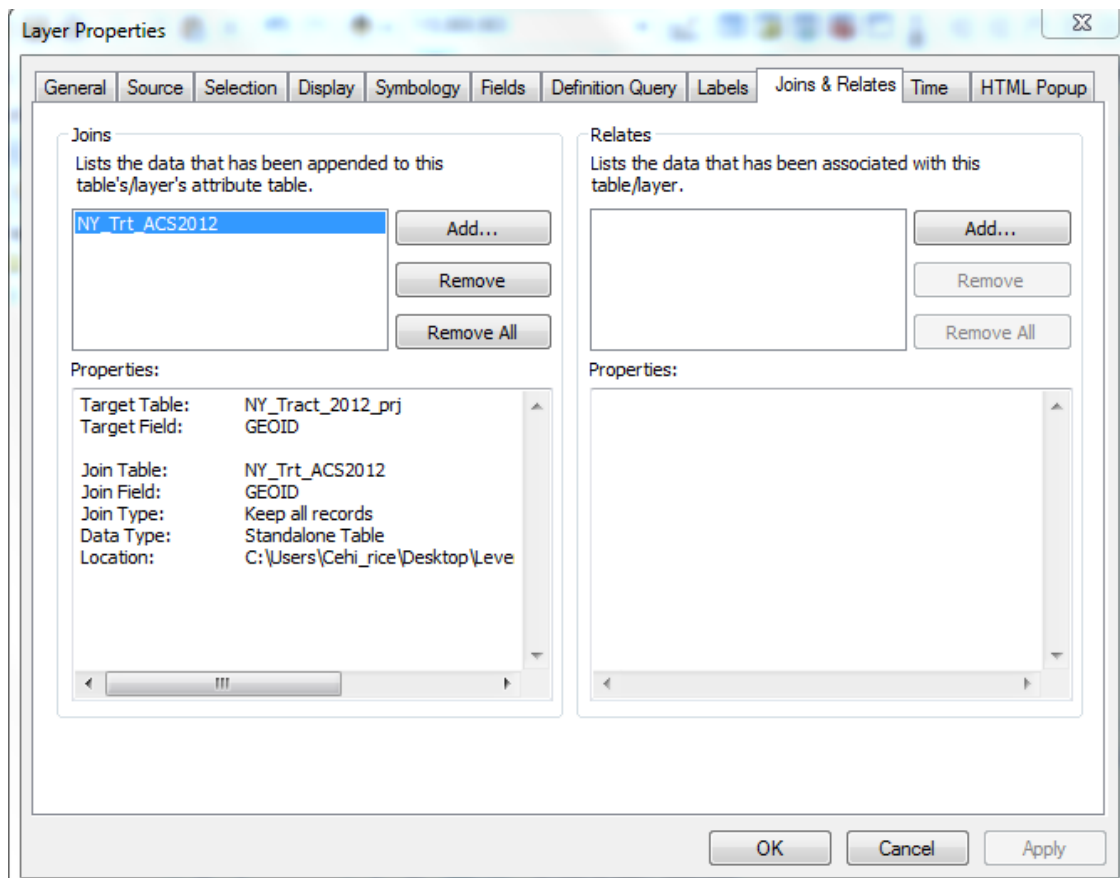

3. After you take a look at the join information, click on the **Fields** tab. All fields from both tables (target/join) should be present.

4. A successful table join is very useful. You can select, display, or calculate fields based on the appended data in the target table.

5. It is important to remember that in a join the data are dynamically linked: what does this mean?

   a. Nothing is written on disk - the join exists in your project only.

   b. Edits to the underlying tables will appear in appended fields.

   c. Fields in your target table can be edited, but the data in the appended fields **cannot** be directly edited.

6. You will now export your joined data (target + join) to a new feature as a shapefile. The table associated with this feature will include all of the data from the two original tables, and will be written on disk - so you will need to name and save it.

7. Open the layer **Properties** by right clicking on the *NY_Tract_2012_prj.shp* in your TOC and then choose the **Fields** tab. Before you export your joined data you can select the fields that

you want to be present in your new feature class. Click **Turn all fields off** and choose the following five fields by checking the boxes (you will need to scroll down to get to the last three fields):

- GEOID
- TotalPop16
- pctltHS
- pctUnempl
- medHHinc
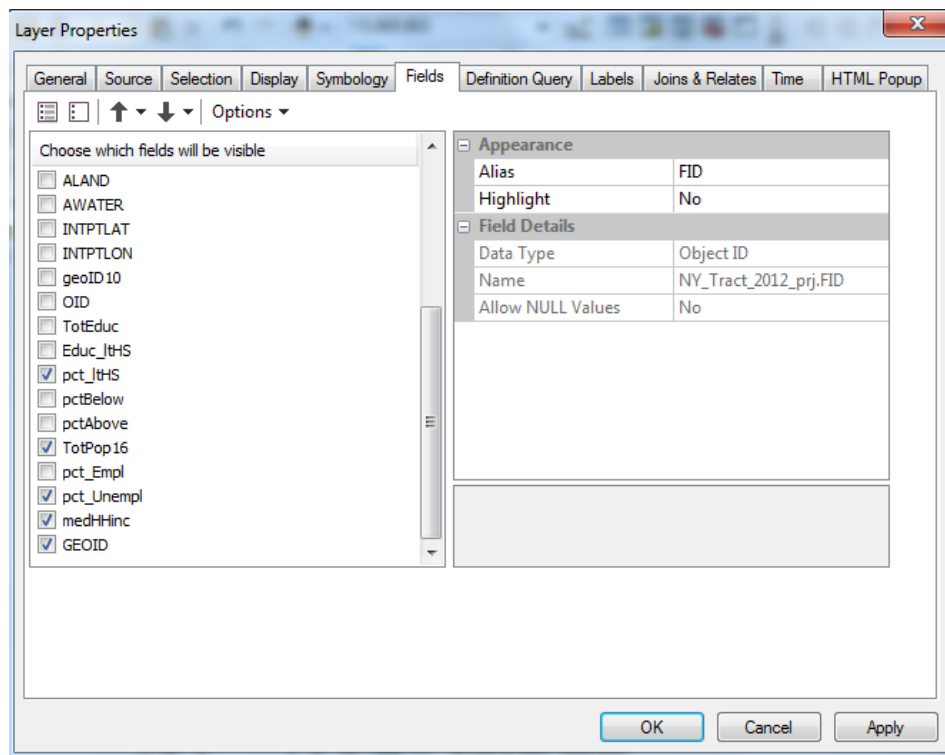
NOTE: these standard ACS and Census variables and others provided over the course of the training are defined here in the Census_FieldMap.xlsx file which is posted in the GIS I training materials folder on Box.

8. Click **OK** and take a look at your attribute table. The five fields you selected should be the only fields you see in the table.

9. Close your table and right click on *NY_Tract_2012_prj.shp* in your TOC one last time. Choose **Data > Export Data** to open the export data option. You are exporting **All features** and want to use the same coordinate system as **this layer's source data**. When you
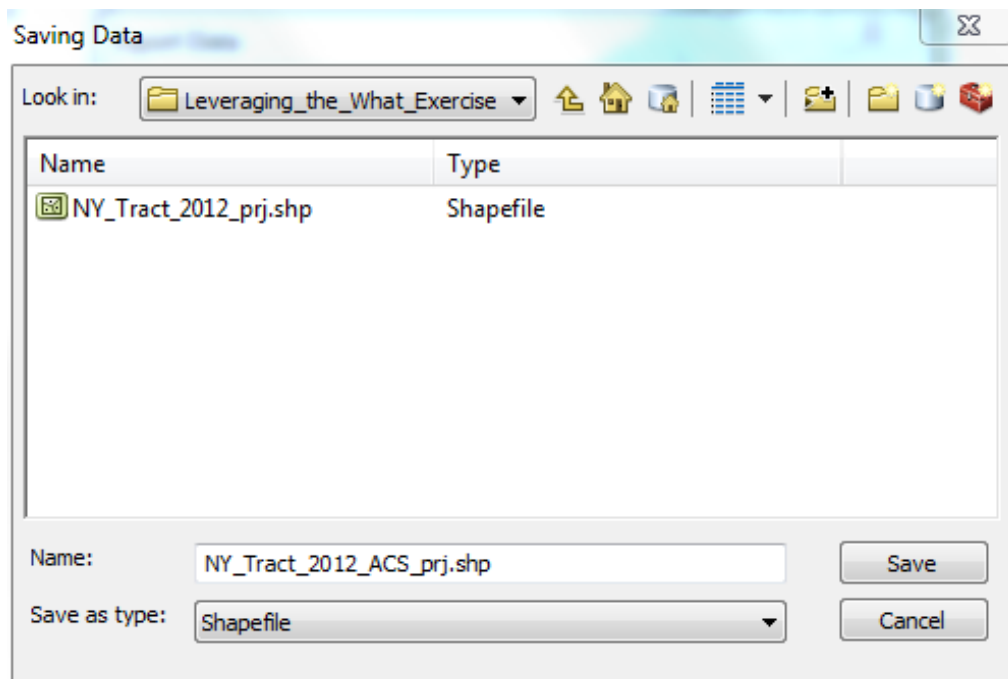
selected fields of interest in step 7, you made sure that you will only be exporting the fields

we want.
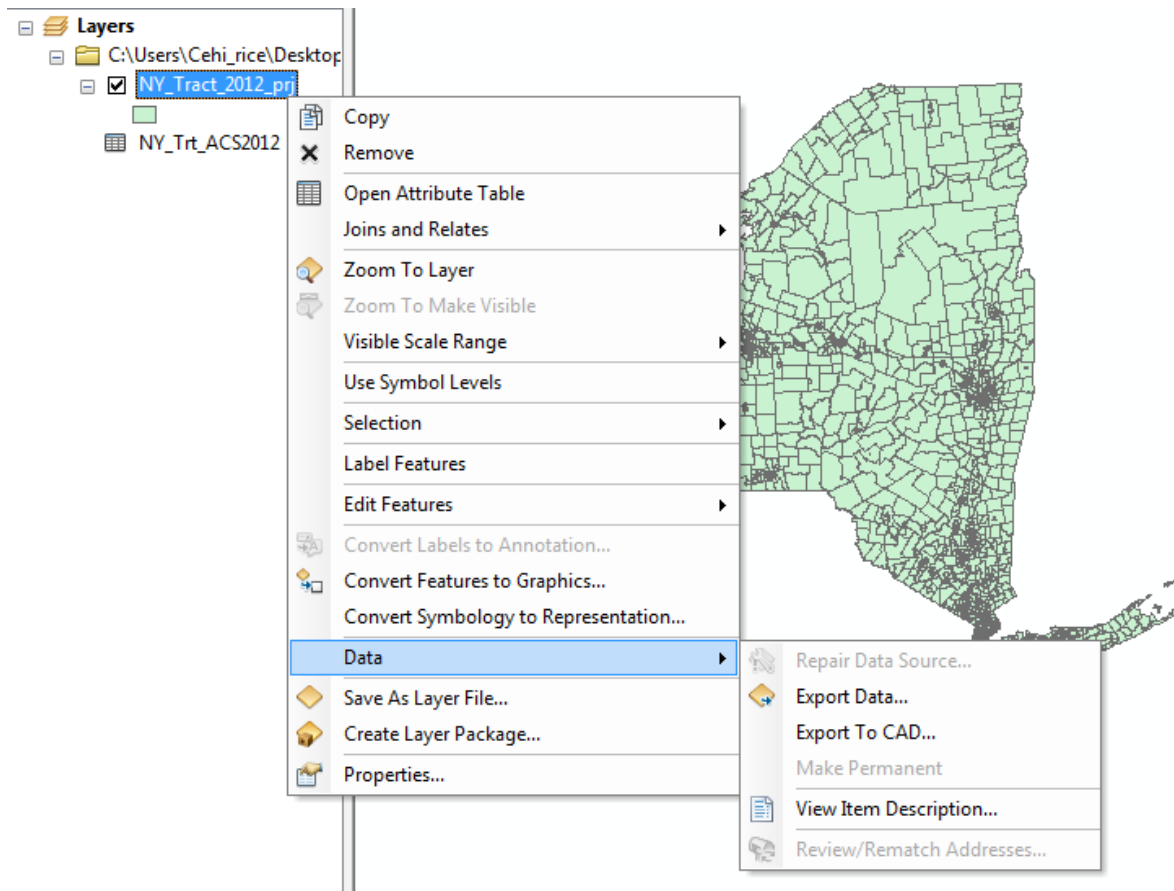
10. Click the folder browse button and name the file *NY_Tract_2012_ACS_prj.shp* and save it in
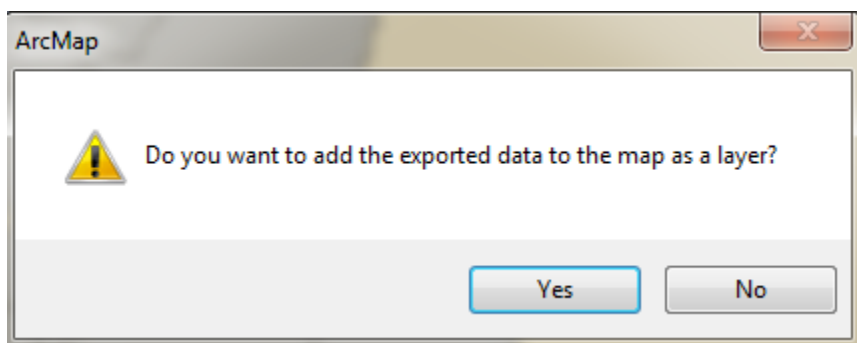
your exercise data folder.
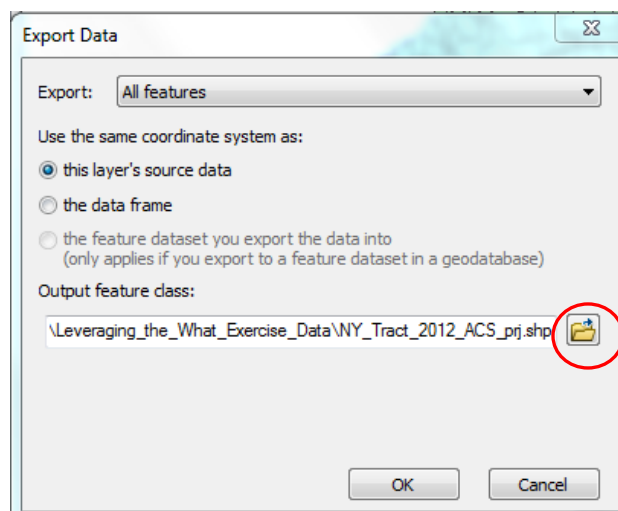
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Before clicking Save make sure you save as type: shapefile.

11. When you are prompted to add the data as a layer, click **Yes**.

12. Now that you have added the exported data as a new layer, take a look at the attribute table. Only the fields you selected should be present in the resultant shapefile. Leave your project open, or save it; you will use it in the next portion of this exercise.
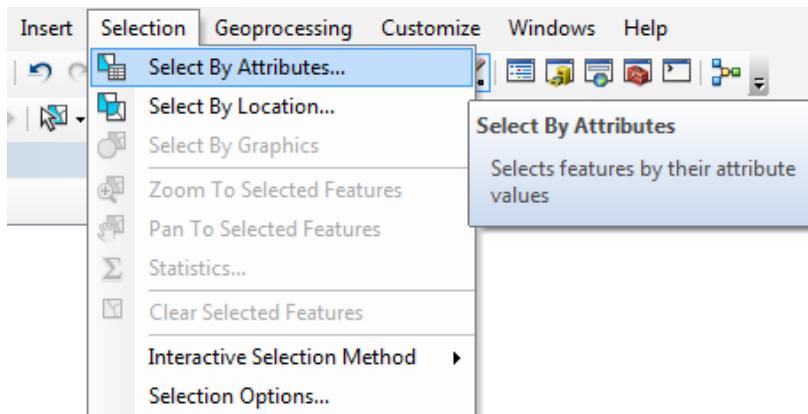
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Working with Selections

1. Click on the **Selection** tab in the Menu Bar. You can control the options for your selections in this menu and you can build your attribute selections. You will now make a selection based on your join.
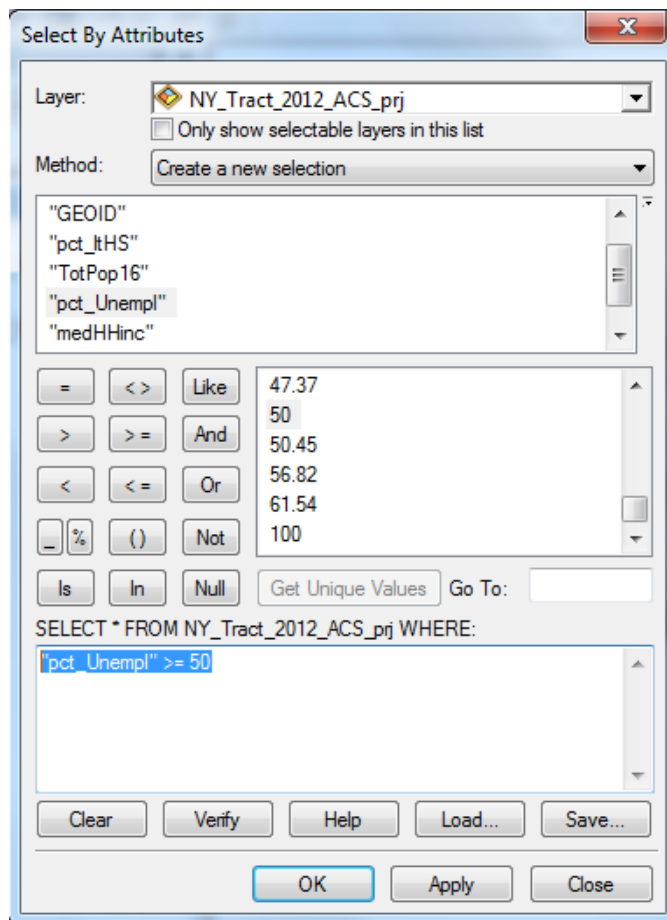

2. Choose **Select by Attributes.**

3. In the dropdown select the *NY_Tract_2012_ACS_prj.shp* shapefile as your layer and select **Create a new selection** as your method. Build the following statement by double-clicking the field *"pct_Unempl"* , clicking the >= button, then typing 50:

$$\text{"pct\_Unempl" >= 50}$$

This query will select those tracts that have 50% or more % unemployment. Click **OK**.

4. Take a look at the tracts that are selected on the map.

5. You are now going to take a look at some descriptive statistics for your selected records.

   Right click on the "TotalPop16" field and select **Statistics**.

6. Here you can access summary statistics for any meaningful attributes within your selection.
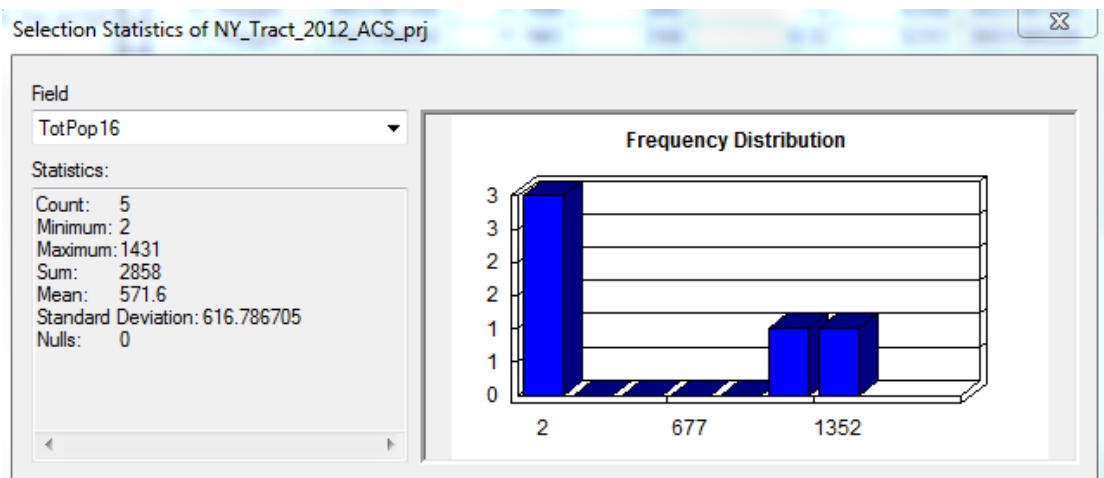
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7. What is the total population (16 yrs and older) for tracts with 50% or more unemployment? Looks like 2,858 according to the ACS. Close the Selection Statistics window.

8. Right click on your *NY_Tract_2012_prj* shapefile in the TOC and choose **Selection**.
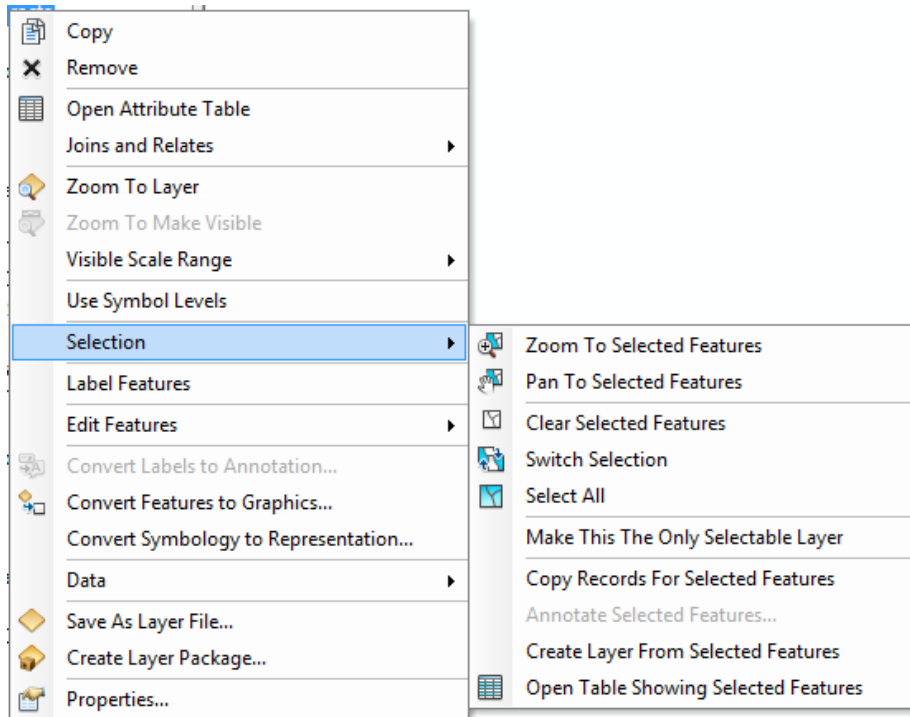
In this menu you can:

- Zoom to selected features;
- Clear selected features;
- Copy selected;
- Switch selection and;
- Create a layer from selected features.

9. Choose **Switch Selection.** This will select all of the tracts that have less than 50% unemployment.

10. Take a look at the Statistics for TotalPop16 with your new Selection.