

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

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.

Q New Document		8 23
Choose a template for your new m	ap	
New Maps My Templates Templates Standard Page Sizes Architectural Pag TSO (A) Page Size North American (Traditional Layouts Business Industry USA World Browse for more	My Templates	

- 2. Click the Add Data button
- 3. If you have not already connected to your folder, click on the **Connect to Folder** button $\stackrel{[1]}{=}$.
- 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):
 - NY_Tract_2012_prj

INY_Trt_ACS2012



- Table Of Contents
- 7. Take a look at the tabs in your TOC. Solution is the tabs in your TOC. Take a look at the tabs 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?

	pij						
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 9605.9
7	Polygon	36	031	960498	36031960498	9604.98	Census Tract 9604.9
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
	•		2		1		•

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?



Layer Properties						23
General Source Selection Display Symbology Fields	[Definition Query	Labels	Joins & Relates	Time	HTML Popup
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Choose which fields will be visible		Appearance				
FID		Alias		GEOID		
Shape		Highlight		No		
STATEFP		Read-Only		No		
COUNTYFP	Ξ	Field Details				
TRACTCE		Data Type		Text		
GEOID		Length		11		
NAME		Name		GEOID		
NAMELSAD		Allow NULL V	alues	No		
MIFCC						

*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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ļ	pctBelow	pctAbove	TOTPOP16	pct_Empi	pct_unempi	medHHinc	GEOID *
	27.91	72.09	1562	84.67	15.33	35476	36001000100
ļ	41.39	58.61	3654	88.69	11.31	25756	36001000200
ļ	29.46	70.54	4693	88.24	11.76	33571	36001000300
ļ	6.39	93.61	2303	91.19	8.81	71902	36001000401
ļ	21.61	78.39	4228	94.14	5.86	60298	36001000403
ĺ	0	100	4902	77.3	22.7	19125	36001000404
ļ	44.9	55.1	2929	83.27	16.73	19345	36001000501
l	24.53	75.47	3565	83.31	16.69	39814	36001000502
l	49.94	50.06	3227	82.36	17.64	19273	36001000600
	34.43	65.57	2881	80.29	19.71	31375	36001000700
	46.32	53.68	1434	77.17	22.83	24142	36001000800
I	45.59	54.41	1083	70.23	29.77	12146	36001001100
]	14.89	85.11	2938	91.52	8.48	34637	36001001400
ſ	37.16	62.84	4147	98.38	1.62	30350	36001001500
1	30.62	69.38	3445	91.68	8.32	44024	36001001600
1	11.18	88.82	3885	92.83	7.17	64832	36001001700
Ī	8.5	91.5	6170	95.06	4.94	70682	36001001801
1	13.47	86.53	3880	90.78	9.22	49779	36001001802
1	14.2	85.8	2405	96.34	3.66	64500	36001001901
1	3.52	96.48	2294	96.39	3.61	72428	36001001902
Ĵ							

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*.
- 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.
- 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.



oin Da	ta	X
Join le for ex	ts you append additional data to this layer's attribute table so you can, ample, symbolize the layer's features using this data.	,
What	do you want to join to this layer?	
Join a	attributes from a table	•
1.	Choose the field in this layer that the join will be based on:	
-		
	deoid	
2.	Choose the table to join to this layer, or load the table from disk:	
	🖽 NY_Trt_ACS2012 🔄 🖻	
	Show the attribute tables of layers in this list	
3.	Choose the field in the table to base the join on: GEOID	
- C	Join Options	
	 Keep all records 	
	All records in the target table are shown in the resulting table. Unmatched records will contain null values for all fields being appended into the target table from the join table.	
	Keep only matching records	
	If a record in the target table doesn't have a match in the join table, that record is removed from the resulting target table.	
	Validate Join	
About	joining data OK Cancel	

- 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.



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	23
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.</ny_trt_acs2012></ny_tract_2012_prj>	
	Ŧ
Clos	se

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



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	
		<u> </u>
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_ItHS	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 f	eature	

- 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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Lists the data that table's/layer's attr	t has been appende ibute table.	ed to this		Lists the data that h table/layer.	as been associated with	ı this
NY_Trt_ACS2012		Add	i			Add
		Remo	ve All			Remove All
Properties:				Properties:		
Target Table: Target Field:	NY_Tract_2012 GEOID	_prj	*			*
Join Table: Join Field: Join Type: Data Type: Location:	NY_Trt_ACS201 GEOID Keep all records Standalone Tab C:\Users\Cehi_r	2 e ice\Desktop\	Leve			
•	11			•		

- 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

Layer Properties	•	· ± =	×
General Source Selection Display Symbology F Image:	ields	Definition Query Labels	Joins & Relates Time HTML Popup
Choose which fields will be visible ALAND AWATER INTFTLAT INTFTLON geoID 10 OID TotEduc Educ_ItHS V pct_ItHS pctBelow pctAbove TotPop 16 pct_Empl V pct_Unempl V medHHinc V GEOID		Appearance Alias Highlight Data Type Name Allow NULL Values	FID No Object ID NY_Tract_2012_prj.FID No
			OK Cancel Apply

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



we want. 🗉 🥩 Layers 🖃 🚞 C:\Users\Cehi_rice\Desktop NY_Tract_2012_prj ð Сору NY_Trt_ACS2012 × Remove Open Attribute Table Joins and Relates ۲ Zoom To Layer 🖏 Zoom To Make Visible Visible Scale Range Þ Use Symbol Levels Selection ۲ Label Features Edit Features ۲ 🖏 Convert Labels to Annotation... 😪 Convert Features to Graphics... all the second Convert Symbology to Representation... Data F Repair Data Source... 1 Export Data... Save As Layer File... 🞓 Create Layer Package... Export To CAD ... Make Permanent r Properties... View Item Description... Review/Rematch Addresses...

selected fields of interest in step 7, you made sure that you will only be exporting the fields

10. Click the folder browse button and name the file *NY_Tract_2012_ACS_prj.shp* and save it in your exercise data folder.

xport Da	a 🛛
Export:	All features 🗸
Use the s	ame coordinate system as:
) this la	yer's source data
🔘 the da	ata frame
only (ature dataset you export the data into applies if you export to a feature dataset in a geodatabase)
Output fe	ature dass:
\Levera	ging_the_What_Exercise_Data\NY_Tract_2012_ACS_prj.shp



Saving Data	Trans.					23
Look in: 🛅 L	.everaging_the_What_E>	xercise 🔻	è 🏠 🗔		¥ 🗳	11 🗳
Name		Туре				
₩ NY_Tract_2	012_prj.shp	Shapefile				
Name:	NY_Tract_2012_ACS_p	rj.shp			Sa	ve
Save as type:	Shapefile			•	Car	ncel

Before clicking Save make sure you save as type: shapefile.

Save as type:	Shapefile 🔻]
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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.



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.

	File	Edit	View	Bookmarks	Insert	Selection	Geoprocessing	Customize	Windows	Help			
2.	Choose Select by Attributes.												
	Insert	Sele	ection	Geoprocessing	Customi	ze Windows	Help						
		-	Select E	By Attributes		1 🗉 🧊 🕻	, 🔩 🖸 🖓						
	- IØ -		Select E	By Location		Select By At	Salast By Attributor						
			Select B	ct By Graphics		Selects feat	uros bu thoir attribut	to I					
			Zoom 1	To Selected Featu	res	values							
			Pan To	To Selected Features									
			Statistics										
			Clear Se	r Selected Features									
			Interactive Selection Method										
			Selectio	on Options									

 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:

"pct_Unempl" >= 50

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



Select By Attr	ibutes	x		
Layer:	Layer:			
Method:	Create a new selection	•		
"GEOID" "pct_ltHS" "TotPop16" "pct_Unemp "medHHinc	p!"	*		
= <>> > > = < < = _ % () Is In SELECT * FR 'pct_Unemp	Like 47.37 50 50.45 50.45 56.82 61.54 100 Null Get Unique Values Go To: NOM NY_Tract_2012_ACS_prj WHERE: ">= 50			
Clear	Verify Help Load Sa OK Apply Cla	ve		

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





- 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**.

	Copy Remove Open Attribute Table Joins and Relates Zoom To Layer	-				
2	Zoom To Make Visible Visible Scale Range					
	Use Symbol Levels					
	Selection	⊕ ¶	Zoom To Selected Features			
	Label Features	P	Pan To Selected Features			
	Edit Features	M	Clear Selected Features			
-	Convert Labels to Annotation	2	Switch Selection			
\$_	Convert Features to Graphics		Select All			
	Convert Symbology to Representation		Make This The Only Selectable Layer			
	Data 🕨		Copy Records For Selected Features			
\diamond	Save As Layer File		Annotate Selected Features Create Layer From Selected Features			
	Create Layer Package					
8	Properties		Open Table Showing Selected Features			

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.