

Exercise 5: Working with Tables in ArcGIS

Introduction:

This exercise will introduce you to some of the most common tasks done on tables, including formatting, editing, querying, using the field calculator and field statistics functions. In addition we will create a table join and a table relate and observe the differences between the two.

Procedures:

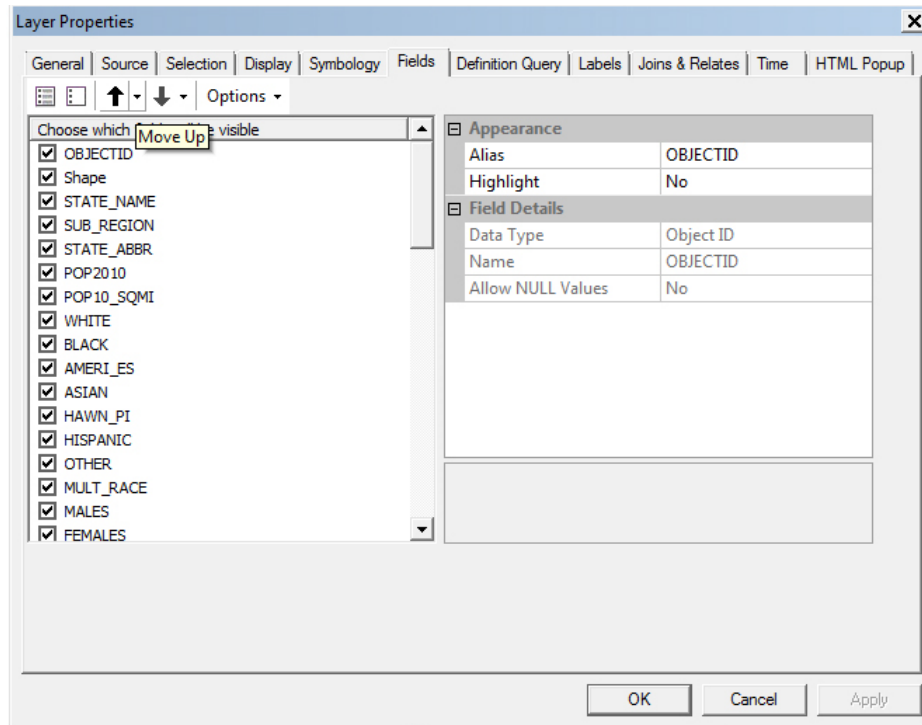
1. Download and unzip Ex_05 folder.
2. Open ArcCatalog and connect to the Ex_05 folder.
3. In the Catalog Tree, create a New Personal Geodatabase name Ex_05
4. Within the geodatabase, create a New Feature Dataset named US_States, and set the coordinate system to North America Albers Equal Area Conic, and accept the defaults for all other parameters.
5. Import *States.shp* and *Roads.shp* into your feature dataset using Feature Class (single) .

NOTE: You can drag and drop from the Catalog Tree to the dialog box.

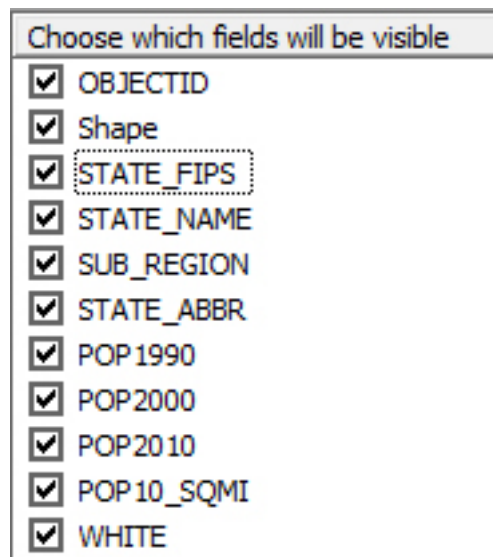
6. Import the two tables: *dist_by_state* and *congdist_115* into your Ex_05 database and close ArcCatalog.
7. Open ArcMap to a blank map and add the States and Roads features and your two tables to your project and zoom in to the continental US, and create a Bookmark. From the file menu select Bookmark > Create Bookmark and give it an appropriate name.
8. Uncheck the Roads feature in the TOC.
9. Set the current workspace and your scratch space to your geodatabase, and , if necessary, repair your data source. Right-click on any layer with a red exclamation mark and select Data > Repair Data Source, and browse to your Ex_05 folder.
10. Save your project and give it an appropriate name.
11. Right-click on the States layer and choose Properties > Labels .
 - a. Verify that the Label Field is STATE_NAME.
 - b. Note that you can change the text properties (font, size, etc.) if the labels are not legible.
 - c. Also Note, that in the upper left corner is a box "Label features in this layer". If we checked this box, the labels would be immediately visible. However there is another way of turning labels on and off.
 - d. Click OK.
 - e. Right-click on the States layer in the TOC and choose Label Features.

Changing the Appearance of a Table:

12. First we will change the order of the fields in the table.
 - a. Open the Properties dialog box of the States layer.
 - b. Click on the Fields tab. Notice that the population for 1990 and 2000 are near the bottom. Move FIPS, POP_1990 and POP_2000 to the top, by selecting the field and using the "Up" arrow.



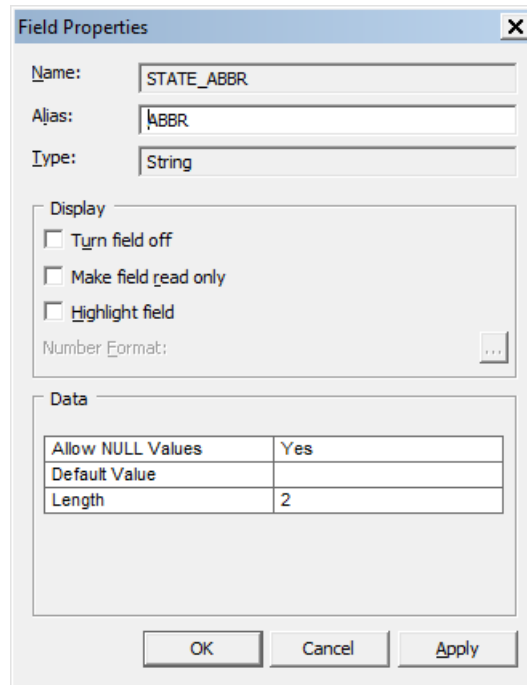
13. Then rearrange them as follows:



then click OK.

There are usually several ways of accomplishing a task in ArcMap. In the Properties dialog box you can “hide” fields by unchecking them, you can change the display name of a field by giving it an alias and you can change the number format, but we can also do those tasks from within a table.

13. Close the dialog box and open the States table.
14. Notice how the STATE_NAME field is much wider than the data contained in it. Narrow the fields to a more suitable width by clicking and dragging the right border of the field. You can also adjust the width of a field to the minimum required by double clicking on the right border.
15. Since the STATE_FIPS field is not very useful, so we will hide it. Right-click the field name and choose Turn Off from the context menu.
16. The STATE_ABBR field is also too wide for its data, but narrowing it will cut off the field name. Right-Click on the field name and select Properties, give it an alias (ABBR). Click OK.



17. Change the STATE_NAME field to NAME, and adjust the width.
18. Scroll over to the right of the table and look at the different fields of population data from the U.S. Census. It is difficult to match the values to the right state, because the state names scroll quickly out of sight.
 - a. Freeze the NAME column by right-clicking on the NAME field and choose Freeze/Unfreeze Column.
 - b. Now scroll again and see how much easier it is to interpret the data.

NOTE: An unfrozen column will not return to its original position. To move it back, you will have to remove the feature from the map document, then re-add it.

19. Next you will use the Sort function to obtain information about the states with the largest and smallest populations. Right-click on the POP2010 field name and choose Sort Descending (largest to smallest).

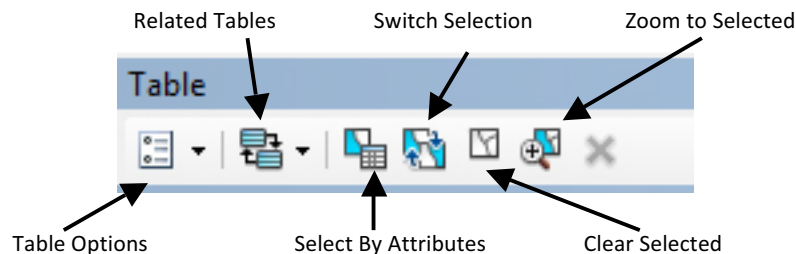
Q1. Which state has the largest population?

20. Now use the sort function on area.
21. Notice that the Shape_Area field has decimal values in it, which make it hard to compare the sizes of different states. To reformat the field so that no decimals are displayed:
 - a. Right-click on the field name and choose Properties from the context menu.
 - b. Click on the ellipses to the right of the word numeric.
 - c. Change the number of decimal places to 0.

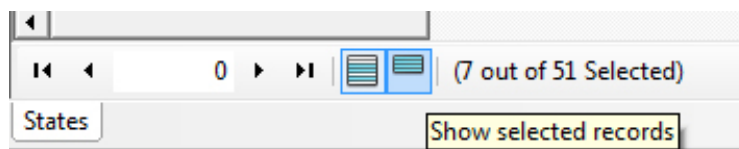
Q2. Which state is closest in area to Maine?

Using Attribute Queries on Tables (Select by Attributes)

There are two ways of creating an attribute query on a table: when the table is open and when it is not. If the table is not open, you use Selection > Select by Attributes from the menu bar, and then select the layer you are querying. If the table is open, that layer is selected and you use Select by Attributes from the option icon.



22. Next you will use the Select by Attributes function to select states with a 2010 population greater than 10 million.
 - a. With the attribute table still open, click the Table Options button drop down arrow and choose Select By Attributes.
 - b. Enter the Query [POP2010] >10000000. Click Apply.
 - c. Click on the Show Selected button to view only the selected records.



- d. Did you get the correct number selected? If not fix the query try again.

Each of the following queries will be made on the States table, and each will be to create a new selection. The answers to each of the queries will appear in parentheses at the end of the query. If you are not getting that result, make the necessary change and try again.

23. Try each of the following:

[SUB_REGION] = 'East North Central' AND [SUB_REGION] = 'East South Central' (0)

[SUB_REGION] = 'East North Central' OR [SUB_REGION] = 'East South Central' (9)

Think about this. The AND is looking for a single sub_region with two names: 'East North Central' and 'East South Central', no such sub_region exists. The OR is looking for two sub_regions: looking first for the sub_region named 'East North Central', then for the sub_region named 'East South Central'

[POP2010] <= [POP1990] (1 - only DC)

[POP2010] > [POP2000] AND [POP2000] > [POP1990], then switch the selection . (4 - Michigan, Rhode Island North Dakota and DC)

We can also use many of the numeric and string functions as part of a query.

Q3. Have any states doubled in population since 1990?

[POP2010] > 2 * [POP1990] (1 - Nevada)

Q4. Have any states grown by a million people since 1990?

[POP2010] > [POP1990] + 1000000 (16)

Q5. Alphabetically, how many states come before California?

[NAME] < 'California' (4 - Alaska, Alabama, Arizona and Arkansas)

The "Like" operator can be used with the wildcards "?" and "*", where the question mark replaces a single text character, and the asterisk replaces several text characters.

[ABBR] LIKE '?A' (8)

[NAME] LIKE 'M*' (8)

The NOT operator negates a result.

[SUB_REGION] = 'New England' AND NOT [STATE_NAME] = 'Maine ' (5)

Just as in mathematics, the parentheses can be used to change the order in which expressions are evaluated. Expressions in parentheses are evaluated first. The IN operator is used to create sub-queries which is beyond the scope of this exercise.

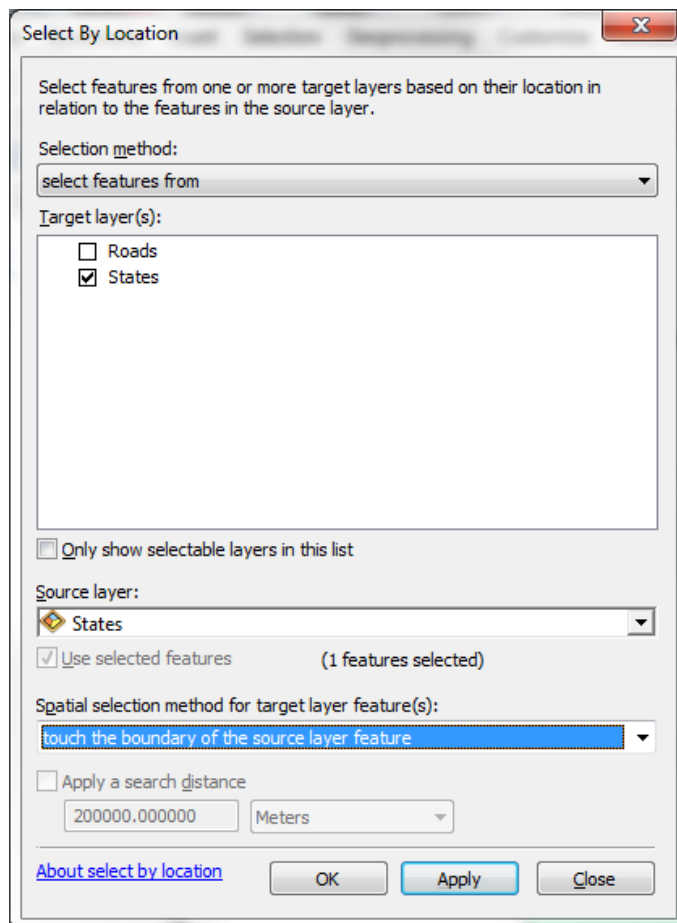
24. Clear the selected features and close the States attribute table.

Using Spatial Queries (Select by Location)

Since we have a geodatabase, we can ask spatial questions.

25. From the menu bar choose Selection > Select by Attributes and select Utah

- a. Table: States
 - b. Method: Create a new selection
 - c. Query: NAME = 'Utah'
26. From the menu bar choose Selection > Select by Location. We want to select the states that touch the boundary of Utah.
- a. We want to select "select features from"
 - b. Target layer(s): States
 - c. Source layer: States
 - d. Spatial selection method: "touch the boundary..."
 - e. Click OK.



You should now have all of the states surrounding Utah selected

27. Clear the selected features.
28. Draw on the Roads layer by checking it in the TOC.
29. Select by Attributes U.S. Route 1, which runs from Maine to Florida ([HWY_NUM] = '1'). We want to find out which states Route 1 passes through.
 - a. Target layer: States
 - b. Source layer: Roads (selected features should be checked).
 - c. Selection method: "are crossed by the outline of the source..."

30. Open the States attribute table.
- Q6. How many states were selected? (16)**
31. Clear the selected features but leave the States attribute table open.

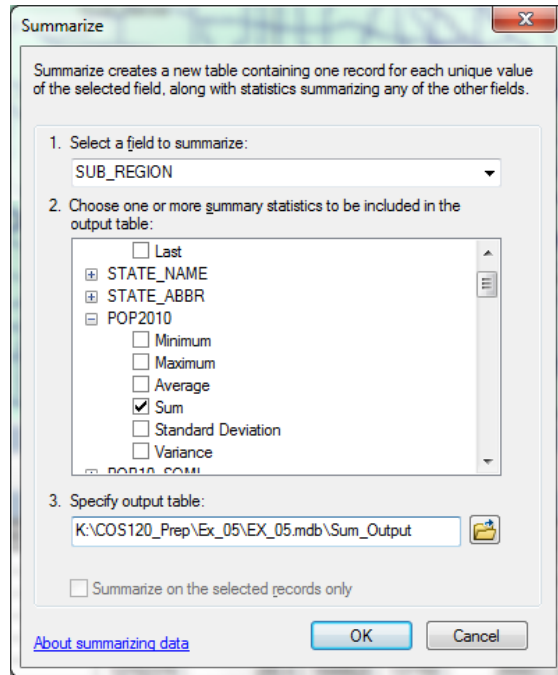
Calculating Statistics for Fields:

32. To calculate and view some population statistics for states:
 - a. Right-click on the POP2010 field name and choose Statistics from the context menu.
 - b. Spend some time looking at the results.
- Q7. What is the largest population?**
- Q8. What is the smallest population?**
- Q9. How many people live in all of the states?**
33. Use the drop-down list in the Statistics box to select the POP1990 field.
- Q10. Did the number of people in a state increase, decrease, or stay the same from 1990 to 2100?**
34. Close the Statistics box.
35. The Statistics command calculates using all of the records in a table, unless a subset of records has been selected, then only the selected set is used in the calculation.
 - a. Use the Select By Attributes option to select all states with a 2000 population greater than 5 million.
 - b. Now open the Statistics box again and note that the count is smaller.
 - c. Clear the selected features.

Summarizing Tables

We can use the Summarize feature to determine the number of states in each sub_region of the country and the population for each sub_region..

36. Right-click on the Sub_region field name and choose Summarize.
 - a. Expand POP2010 and choose Sum.
 - b. Save it in your geodatabase.
 - c. Click OK.
 - d. Say yes to adding it to the map.



37. Open the newly created table.

Q10. Which sub_region has the largest population?

Joining Tables and Relating Tables

To join a separate table to a theme attribute table, the relationship must be 1:1 (1 row of the theme attribute table matches one row in the table to be joined) or M:1 with many rows of the theme attribute table matching one row in the table to be joined.

One-to-One Join

Employee-id	Job	Employee-id	name
1	Digislave	1	Tom
2	Useless Supervisor	2	John

Join Employee-id to Employee-id

After join

Employee-id	Job	Name
1	Digislave	Tom
2	Useless Supervisor	John

A join does not permanently alter the table structure



Many-to-One Join

Polygon Id	Symbol
1	Qa
2	Qa
3	Pa
4	Qe

Symbol	Description
Qa	Quaternary Alluvium
Qe	Quaternary Eolian
Pa	Permian Abo

After Join on Symbol

Polygon ID	Symbol	Description
1	Qa	Quaternary Alluvium
2	Qa	Quaternary Alluvium
3	Pa	Permian Abo
4	Qe	Quaternary Eolian

38. Open the dist_by_state table.
 - a. Notice that it has 51 rows, the same number of rows as in the States table. This is a 1:1 relationship. In addition to the Object ID it has the state name, abbreviation and the number of congressional districts for that state.
 - b. Close the table
39. Right-click on the STATES layer and choose Joins and Relates->Join.
 - a. In the Join dialog box, enter Join Attributes from a Table in the dropdown box.
 - b. Choose ABBR as the field in the STATES to base the join on.
 - c. Choose dists_by_state as the table to join.
 - d. Choose ABBR again as the field in the source table to join on.
 - e. Select Keep all records.
 - f. Click OK to finish the join.
 - g. Click Validate the Join. Everything should check.
 - h. Click Yes to indexing the join field.
40. Open the US States table and scroll to the end to find the new fields that have been added as a result of the join.

NOTE: You could hide the repeated columns Object ID, NAME and ABBR, making the table easier to read.

41. Close the States table.

Relating Tables: If a join is not possible; i.e. the relationship is 1:M or M:M then a relate must be used. In a relate, information may be accessed from both tables, but they are not physically connected.

42. Open the CongDist table.
 - a. Notice that here there may be many rows for a given state so the relationship is 1:M. This table cannot be joined to the theme attribute table, so we will do a relate.
 - b. Close the table.

43. Right-click on States in the TOC and choose Joins and >Relate.
 - a. Use NAME in the States table.
 - b. Use STATE_NAME in the CongDist table
 - c. Use the default output name of Relate 1.
 - d. Click Ok.
44. Open the States table and the CongDist table. You can go back and forth between them by toggling the tabs in the lower left of the table.
45. From the States table, Select by Attributes, the state of Maine.
 - a. Toggle to the CongDist table.
 - b. View the selected records. You should see that Maine has 2 congressional districts.
46. Clear the selected features.
47. Remove the Relates and Joins by right-clicking on the US States layer and choosing Joins and Relates->Remove Join(s)->Remove All Joins.
48. Then remove all relates.

Analyzing Tabular Data

As a final exercise, you will explore the percentage of White people () by state.

49. Open the States attribute table.
 - a. From the Options button choose Add a new field called pct_White and select Float as its type.
 - b. Click OK.
50. Next you will calculate the percentage of White people compared to the total population of each state.
 - a. Right-click on the pct_White field and choose Field Calculator from the context menu and ignore the warning message..
 - b. Enter the following expression by selecting the appropriate symbols from the wizard

$$[\text{WHITE}] / [\text{POP2010}] * 100$$
 - c. Click OK.
51. Sort the pct_White in ascending order.

Q11. What state has the lowest percentage of white people?