ES341 GIS Tutorial – Creating Map Output in ArcGIS

-Step 1 – Download the tutorial data set. This is different than your Price Text, and we will use a separate data set for class work from time to time called the "GIS Tutorial" Data.

-Go to the class web site / bulletin board

-Download the self-extracting compressed zip file "GIS_Tutorial.xxe" – rt. Click – save link as – browse to your ES341 H:\folder – save file

-Using windows explorer or "My Computer", rename the file extension to "GIS_Tutorial.exe"; **NOTE: Make sure you use the quotes to force the file extension in Windows!!**

-Double click on the GIS_Tutorial.exe file – click OK on licensing message – click "unzip" on the self-extraction dialogue box

-You should now have an extracted subfolder in your H:\ES341 space entitled "GIS_Tutorial" with numerous files and subfolders.

-Your are now ready to work on the "GIS Tutorial Exercises" that will be handed out by the instructor throughout the term. Keep this folder alive, we will come back to the data in here throughout the term, as needed.

-Step 2 – Complete the attached "Tutorial 3 – GIS Outputs"

OBJECTIVES

Use interactive GIS
Produce print layouts
Create a custom map template and map series
Create a custom map template for multiple maps
Add reports to layouts
Export layouts as files
Generate other outputs

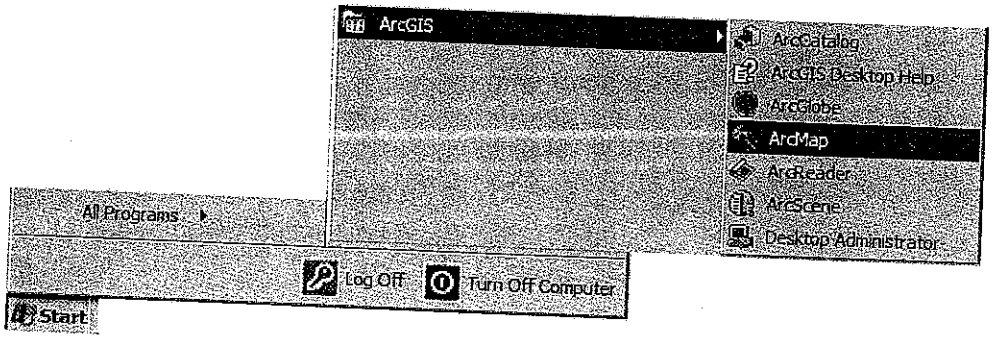
GIS Tutorial 3

GIS Outputs

GIS can produce many forms of output, from interactive desktop projects similar to maps in tutorials 1 and 2, to printed maps for distribution, to image files for placement in presentations or on Web sites. Final map compositions created in ArcMap are constructed in Layout mode. While in this mode, users see their current map on a virtual page (the layout) and can add map elements to it such as a title, map legend, north arrow, or scale bar. In addition, it is possible to add graphs or tabular reports to layouts. Layouts can be designed in various sizes, from regular letter-sized paper to very large sheets used in plotters.

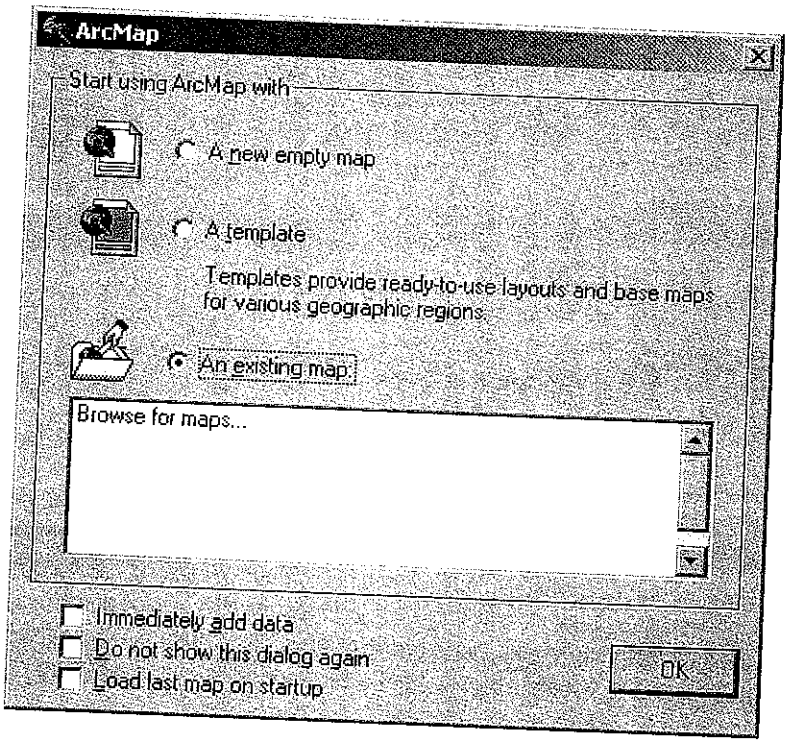
Launch ArcMap

1 From the Windows taskbar, click Start, All Programs, ArcGIS, ArcMap.



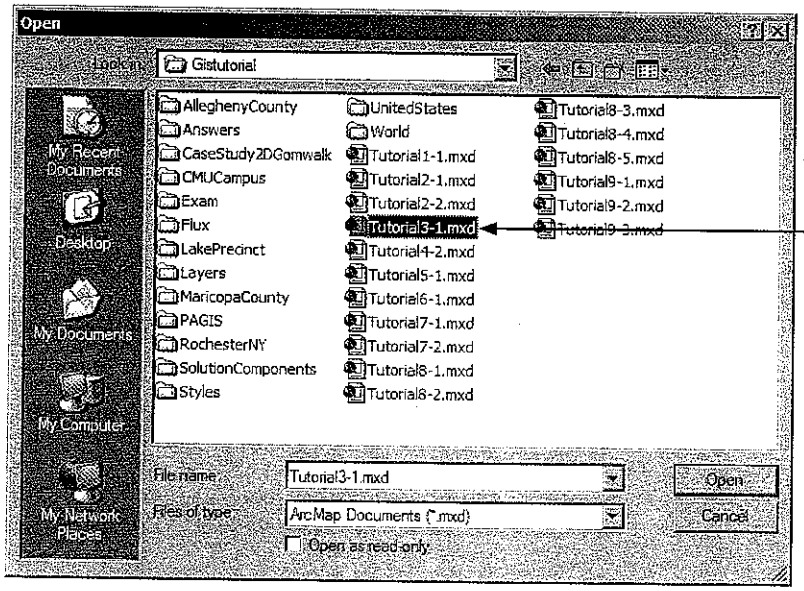
2 Click the An existing map radio button in the ArcMap dialog box.

3 Click OK.

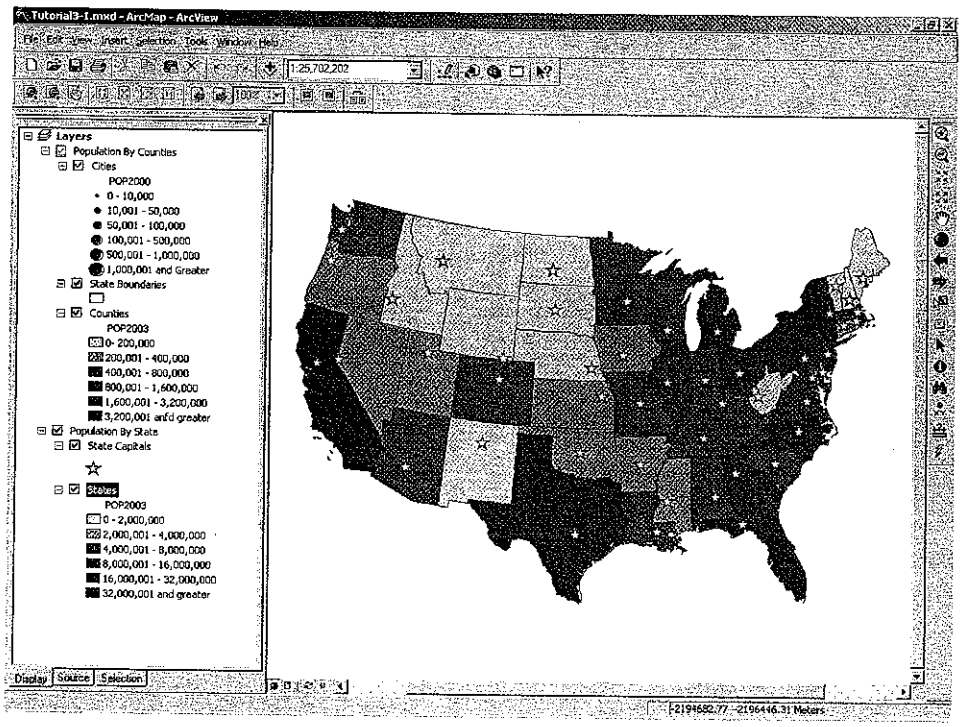


Open an existing map

1 **Browse to the drive on which the Gistutorial folder has been installed (e.g., C:\Gistutorial), select Tutorial3-1.mxd, and click the Open button.**



Tutorial3-1.mxd opens in ArcMap showing a map of the United States with state capitals displayed.



Use interactive GIS

The map document you just opened builds on work that you did in tutorials 1 and 2. It provides the ability to scan the entire area of interest, the continental United States; to get information on state e-government Web sites; and to pick an area to zoom into for more detailed information. Feature labels and MapTips provide additional information. Applying GIS in this way is quite powerful and popular. A good example is crime mapping by municipal police departments. The area-wide scan uses choropleth maps of crime counts by area to provide general information on neighborhoods where crimes are increasing or decreasing. The analyst can then drill down to small areas to see detailed information on individual crime points.

YOUR TURN

Start by using the Hyperlink tool (the lightning bolt on the Tools toolbar) to access some state e-government Web sites by clicking state capitals. Try any state along the west or south coast of the United States.

Zoom into an area about the size of a state to see the threshold scales at work. Try the MapTips over any city or county. Bookmarks are available to help you move around and get back to the continental United States.

Produce print layouts

Often, it is desirable to produce a paper copy or file copy of a map for distribution. ArcMap has a Layout View for this purpose and several built-in templates for producing layouts.

Choose a built-in layout template

1 **Click View, Bookmarks, Continental U.S.**

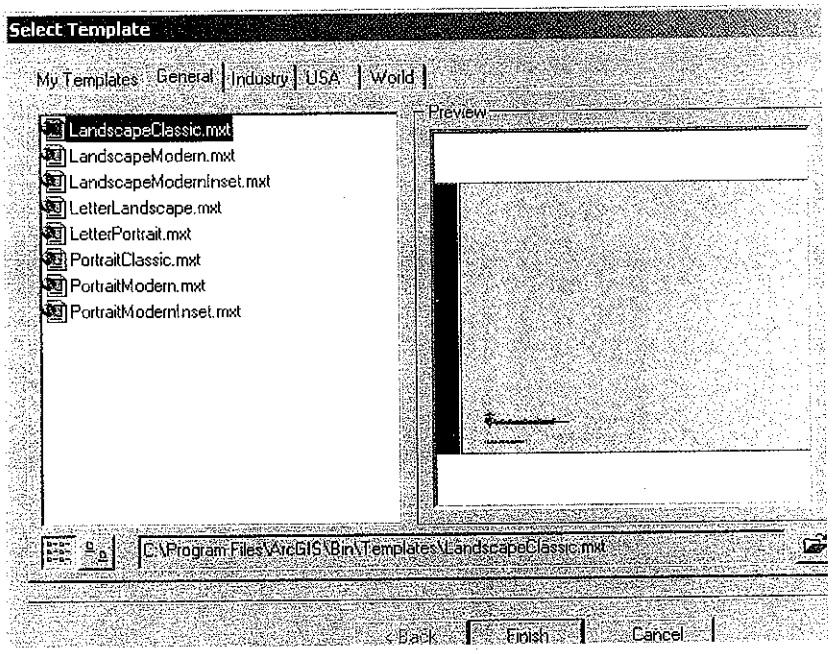
2 **Click View, Layout View.**

3 **Click View, Toolbars and make sure that Layout is selected.**

4 **Click the Change Layout button.**

5 **Click the General tab, LandscapeClassic.mxt.**

The .mxt extension is the file type for map layout templates.



6 **Click Finish.**

Set up and customize the template page

1 Right-click the top border of the layout, outside any rectangles containing map elements, and click Page and Print Setup.

2 In the Map Page Size panel, click the Standard Sizes drop-down list and click Letter.

3 Click the Landscape Orientation option in the Map Page size frame and again in the Paper frame, click the Scale Map Elements proportionally to changes in the Page size check box, and click OK.

4 On the left side of the map in the brown area, double-click the title place holder (< Double-click to enter map title >) and type U.S. Population and Cities.

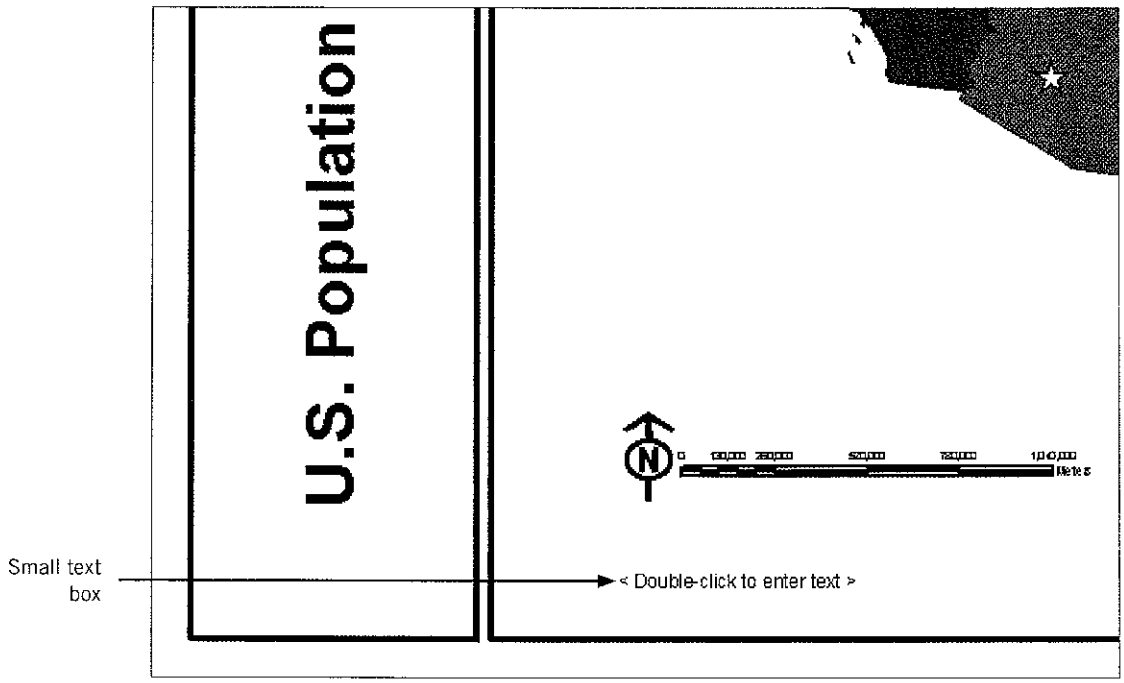
5 Click the Change Symbol button, change the color from white to black, click OK, then click OK again.

6 Double-click inside the brown left panel of the layout, outside the rectangles containing the legend and map title.

7 In the Properties window, change the Fill Color from brown to white and click OK.

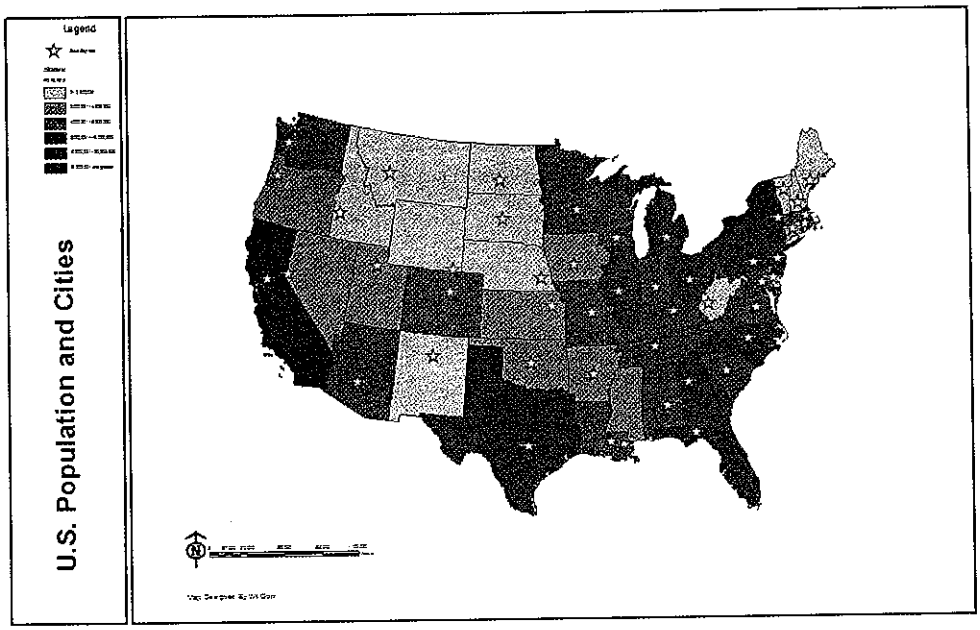
8 Right-click the light blue background surrounding the map, click Properties, click the Frame tab, change the Background Color from light blue to white, and click OK.

9 Double-click the small text placeholder in the lower left corner of the map, type Map Designed by "Your Name", and click OK.



10 Click File, Save As, browse to the \Gistutorial folder, name the map Tutorial3-2.mxd, and click Save.

The resulting layout has a new title, colors, and your name.



YOUR TURN

Return to Data View and turn off the Population By State group (but leave the Population By Counties group on). Your map will be blank.

Use a bookmark to zoom to one of the available cities (Los Angeles, for example).

Change back to Layout View and change the layout template to LetterLandscape.mxt.

Make modifications and additions as necessary. *Hint: If you double-click the map scale bar, you can change its units to miles and its style.*

Save the results as Tutorial3-3.mxd.

Create a custom map template and map series

Sometimes you'll want to produce a number of maps, each with the same design and layers, but with different attributes displayed. In this case, each map displays population of a different racial or ethnic group. To facilitate comparisons, you'll need to use the same numerical scale for each map.

Start a new map

1 **Click File, New, My Templates tab and double-click the Blank Document template.**

Starting with a blank document is the only way to create a custom template.

2 **Click View, Data View.**

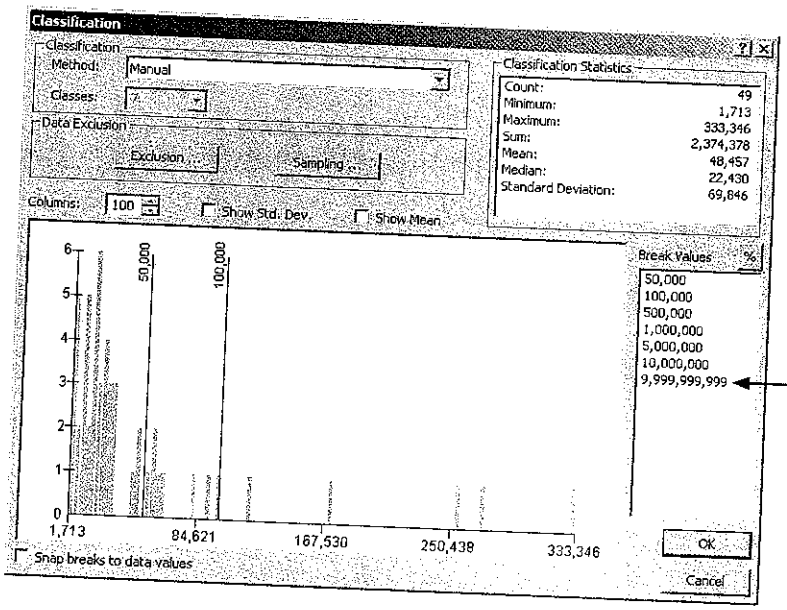
3 **Click the Add Data button,** **browse to the \Gistutorial\UnitedStates\ folder, and double-click States.shp.**

4 **Right-click the States layer in the table of contents and click Properties.**

5 **Click the General tab, and change the Layer Name to Population.**

6 **Click the Symbology tab, Quantities, Graduated Colors, a blue Color Ramp, and in the Fields panel click AMERI_ES as the Value.**

7 **Click Classify, change the number of Classes to 7, change the Method to Manual, and type the following Break Values starting at the bottom of the list: 9999999999, 10000000, 5000000, 1000000, 500000, 100000, 50000.**



Start here and work up

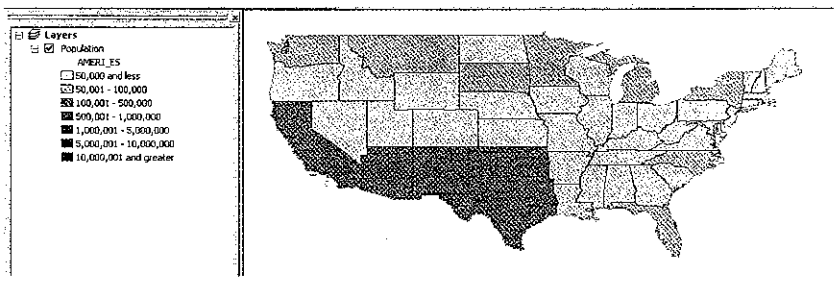
Complete the new map project

1 Click OK to return to the Symbology tab of the Layer Properties window.

2 Click the gray Label heading to the right of the Range heading, click Format Labels, Show thousands separators, and OK.

3 In the Label column, change the first label to 50,000 and less and change the last label to 10,000,001 and greater.

4 Click OK.



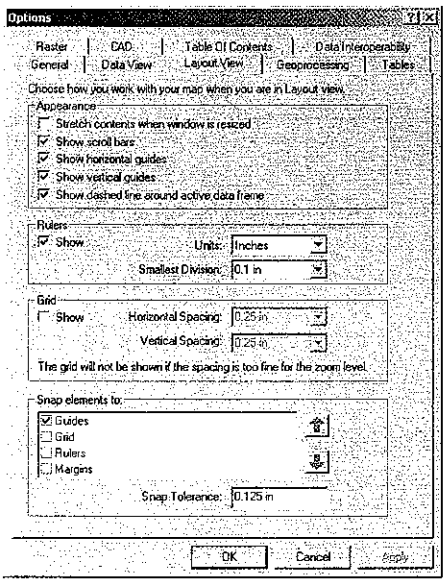
5 Right-click the Population layer in the table of contents, click Save As Layer File, browse to the \Gistutorial\Layers folder, type PopulationStatesNativeAmericans.lyr, and click Save.

Set up the layout view

1 Click View, Layout View.

2 Click Tools, Options, and the Layout View tab.

3 Make selections as shown below.



4 Click OK.

Set up guidelines in the layout view

In the next steps, you will use the vertical and horizontal rulers to set guides for positioning map elements on the layout page.

1 **Click at 8.5 inches on the top horizontal ruler to create a vertical blue guide line at that location.**

If you place your guide at the wrong place, right-click its arrow, click Clear Guide, and start again.

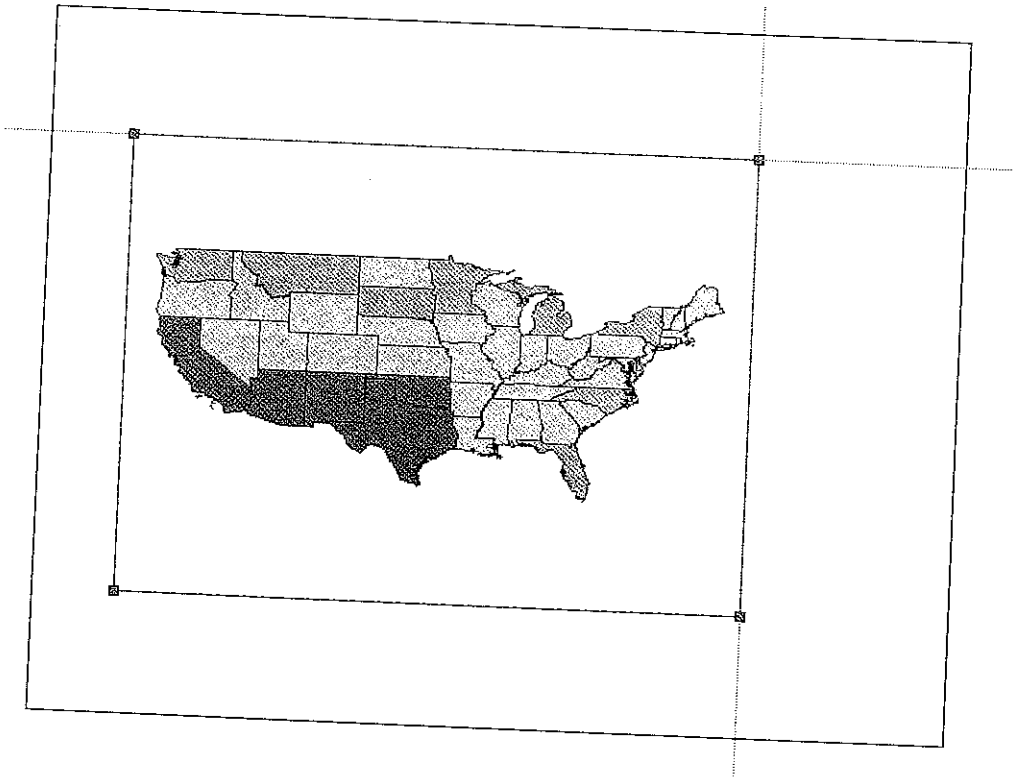
2 **Do the same at 7 inches on the left vertical ruler.**

3 **Right-click the map and click Properties, the Size and Position tab.**

4 **Click the Preserve Aspect Ratio check box, type 7.5 in the Size Width field, press the Tab key, and click OK.**

5 **Click, hold, and drag the map so that its upper right corner is at the intersection of the two guides, and release.**

The grab handle will snap precisely to the intersection of the guides when you release.



Add elements

1 Click Insert, Title.

2 Click outside the resulting title, then double-click the title, type Native American Population (2001) in the text box, click OK, and center the title above your map.

3 Click the horizontal ruler at 10.5 inches to create a new vertical guide.

4 Click Insert, Legend, click Next four times, and click Finish.

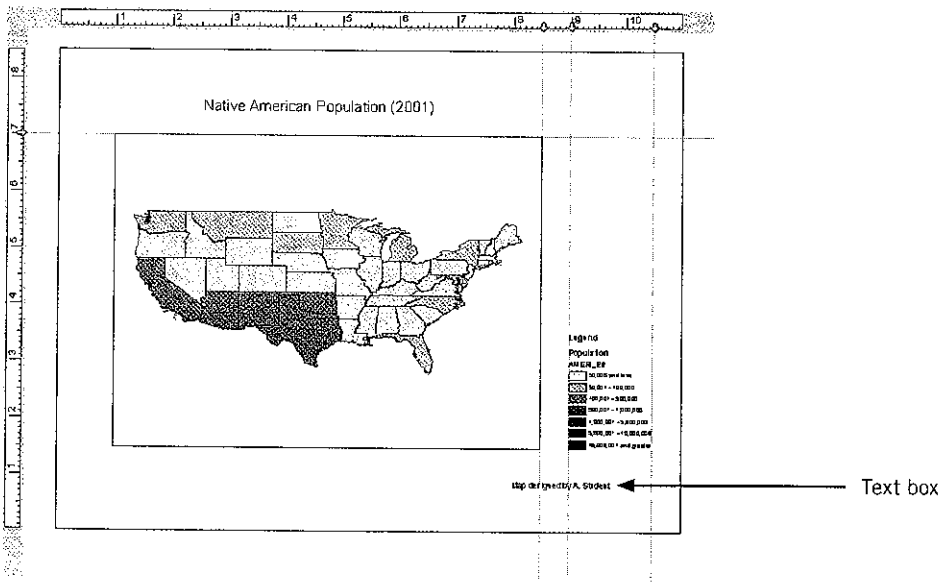
5 Click, hold, and drag the legend so that its right side snaps to the 10.5-inch guide.

6 Click the horizontal ruler at 9 inches to create a new vertical ruler.

7 Click the top left grab handle of the legend and drag to the right and down to make the legend smaller and so that it snaps to the 9-inch guide.

8 Click Insert, Text, then click outside the resulting small text box, click it again, and drag it away from the map to the lower-right corner of the layout.

9 Double-click the text box and type Map designed by "Your Name".



10 Click File, Save As, make sure the file type is ArcMap Document, name the map Tutorial3-NativeAmericans.mxd, and click Save.

11 Click File, Save As, browse to the \Gistutorial folder, change the Save As Type to ArcMap Template, name the template Tutorial3-Template, and click Save.

Note: Once you save the layout as a template, your selection for ArcMap Document will no longer be available in the Save As dialog box.

Use the custom template for a new map

1 Click File, New.

2 In the New window, click the Browse button, browse to the \Gistutorial folder, and double-click Tutorial3-Template.mxt.

3 Click View, Data View.

4 Right-click the Population layer in the table of contents, click Properties, the Symbology tab, and the Import button.

5 In the Import Symbology dialog box, click the Browse button, browse to the \Gistutorial\Layers folder, double-click PopulationStatesNativeAmericans.lyr, and click OK.

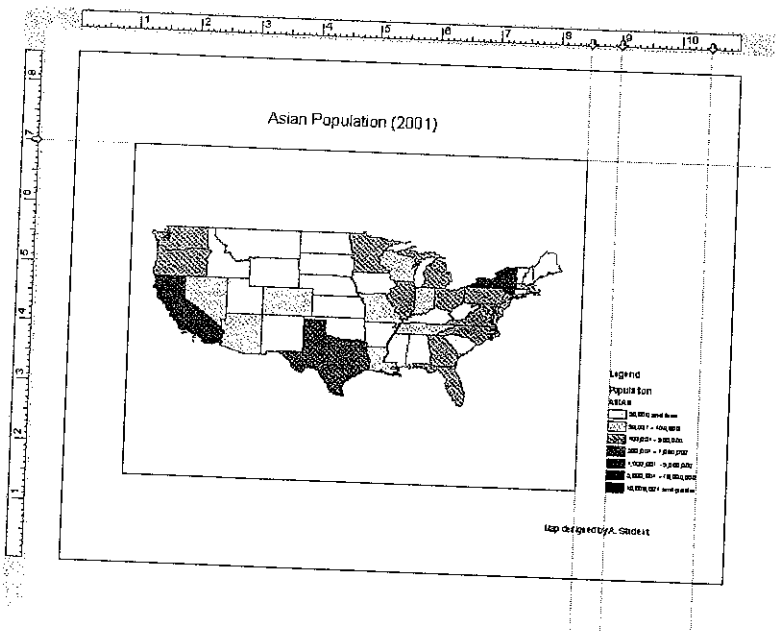
6 In the Import Symbology Matching Dialog, click the Value Field drop-down arrow, click ASIAN, and click OK.

7 In the Layer Properties window, change the color ramp to a green color ramp and click OK.

8 Right-click the Population layer in the table of contents, click Save As Layer File, browse to the \Gistutorial\Layer folder, key in PopulationStatesAsians.lyr, and click Save.

9 Click View, Layout View.

10 Double-click the map title, change Native American to Asian and click OK.



11 Click File, Save As, browse to the \Gistutorial folder, name the file Tutorial3-Asians.mxd, and click Save.

YOUR TURN

Complete the map series by making maps for at least one of the following: Blacks, Whites, or Hispanics.

Name the maps Tutorial3-Blacks.mxd, Tutorial3-Whites.mxd, and Tutorial3-Hispanics.mxd.

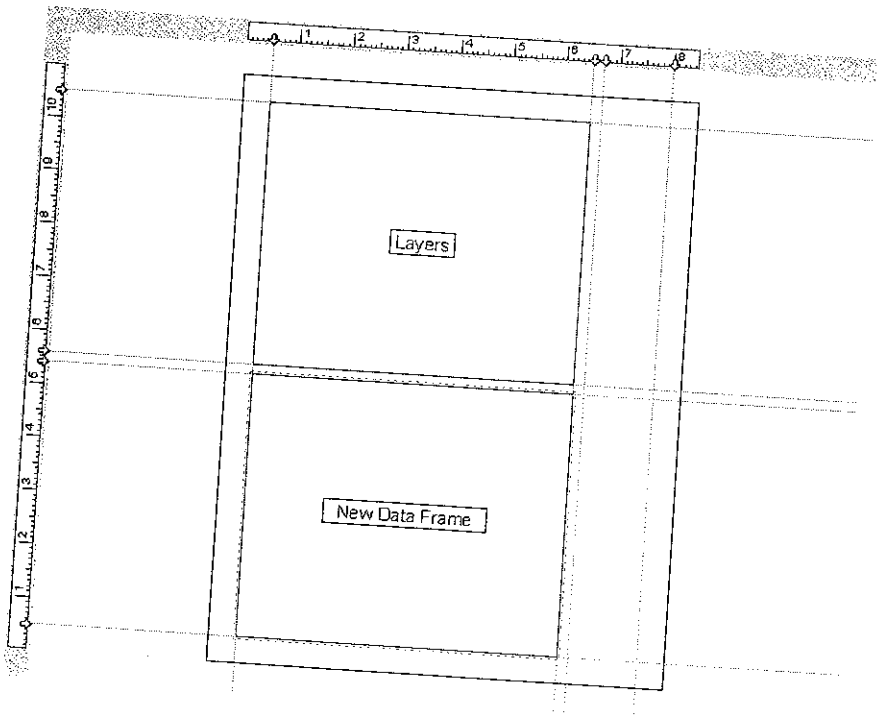
Save layer files for each Population layer.

Create a custom map template for multiple maps

To facilitate comparisons, it is a good idea to place two or more maps on the same layout. Our population maps by racial/ethnic groups are ideal for this because they all share the same break points, making comparisons easy.

Create a new map

1. Click File, New, then, in the My Templates tab, click Blank Document, and click OK.
2. If necessary, click View, Layout View.
3. Right-click the border of the layout, click Page and Print Setup, change the standard page size to Letter, click both Portrait radio buttons in the Page and Paper frames, and click OK.
4. Right-click the vertical ruler, click Clear All Guides, and do the same to the horizontal ruler.
5. Click the horizontal ruler at the 0.5-, 6.5-, and 8.0-inch marks.
6. Click the vertical ruler at the 0.5-, 5.4-, 5.6-, and 10.5-inch marks.
7. Click and drag the layers frame so that its upper left corner snaps to the intersection of 10.5-inch horizontal guide and 0.5-inch vertical guide.
8. Click and drag the lower right grab handle of the data frame to snap it at the 5.6-inch horizontal guide and 6.5-inch vertical guide.
9. Click Insert, Data Frame and drag/modify the new data frame to fit in the guides below the original frame.



Add elements

1 In the table of contents, right-click the Layers data frame, click Add Data, browse to the \Gistutorial\Layers folder, and double-click PopulationStatesNativeAmericans.lyr.

2 In the table of contents, right-click the New Data Frame, click Add Data, and double-click PopulationStatesAsians.lyr.

3 Click Insert, Legend.

4 Click Next four times, and then Finish.

5 Drag the legend so that it snaps on the lower right to the 8-inch vertical guide and 0.5-inch horizontal guide intersection, then resize it to fit the available space.

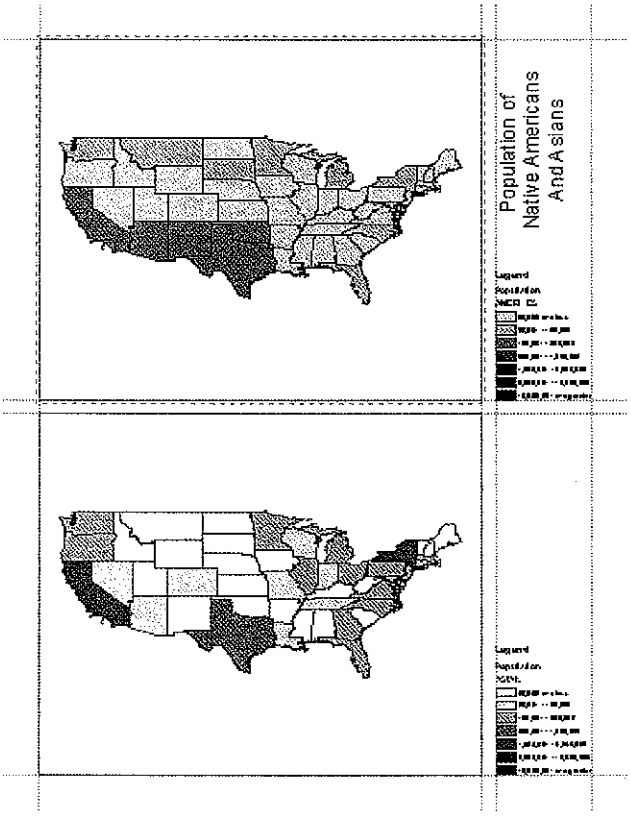
6 Right-click the Layers layer, click activate, and repeat steps 3–5 so that the second legend's lower right is at the intersection of the 8-inch vertical and 5.6-inch horizontal guides.

7 Click Insert, Title, click outside the Title frame, and then double-click the Title frame.

8 In the Properties window, type Population, press the Enter key, type of Native Americans, press the Enter key, type And Asians, change the angle to 90, click the Change Symbol button, change the Size to 20, and click OK twice.

9 Position the Title frame on the top right of the layout.

10 Click File, Save As, name the map Tutorial3-NativeAmericansAndAsians and click Save.



Add reports to a layout

ArcMap has a built-in capability to make tabular reports. These can be added to layouts to provide detailed information.

Open an existing map

1 **Click File, Open, browse to the \Gistutorial folder, and double-click Tutorial3-NativeAmericans.mxd.**

If you do not have this file in the \Gistutorial folder, browse to \Gistutorial\SolutionComponents\Tutorial3\ and you will find a copy there.

2 **Click File, Save As, and type Tutorial3-NativeAmericansReport.mxd for the File Name, then click Save.**

3 **Click View, Data View.**

Make a selection of records

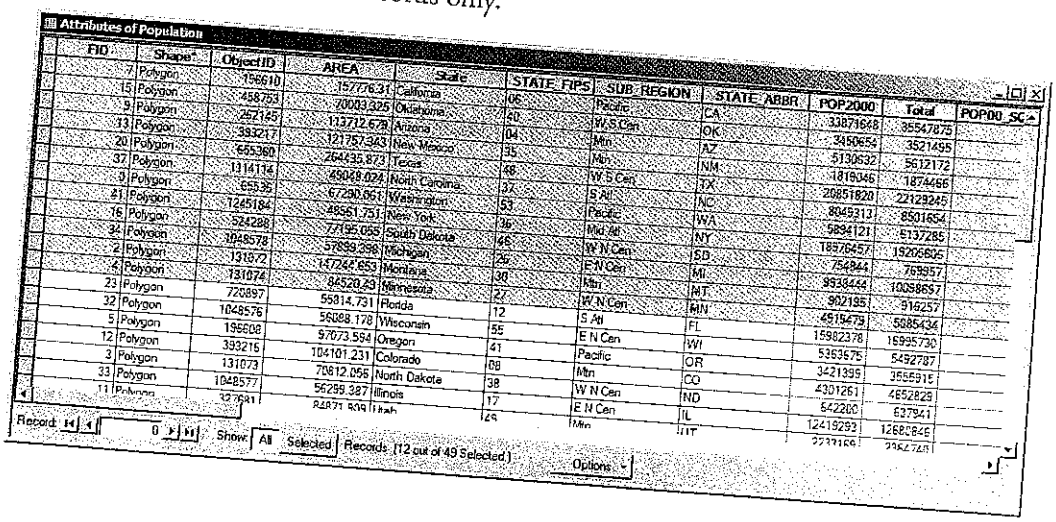
1 **Right-click the Population layer in the table of contents and click Open Attribute Table.**

2 **Scroll to the right in the Attributes of Population to find the AMERI_ES column, right-click the AMERI_ES column heading, and click Sort Descending.**

3 **Scroll left in the table until you see the STATE_NAME column.**

4 **If necessary, make the table large enough so you can see the first twelve state records. Click the row selector for the top row, then hold and drag down to select the top twelve rows in the table (California through Minnesota).**

You will generate a report for the selected records only.



Attributes of Population

FID	Shape*	ObjectID	AREA	State	STATE_FIPS	SUB_REGION	STATE_ABBR	POP2000	Total	POP00_SC
7	Polygon	156610	157776.31	California	06	Pacific	CA	33871648	35547875	
15	Polygon	458753	70003.325	Oklahoma	40	W S Cen	OK	3450654	3521495	
9	Polygon	262145	113712.679	Arizona	04	Mtn	AZ	5130632	5612172	
13	Polygon	393217	121757.343	New Mexico	35	Mtn	NM	1819046	1874466	
20	Polygon	655360	264435.873	Texas	48	W S Cen	TX	20851820	22129245	
37	Polygon	1114114	49048.024	North Carolina	37	S Atl	NC	8049313	8501654	
0	Polygon	65535	67290.061	Washington	53	Pacific	WA	5894121	6137285	
21	Polygon	1245184	48561.751	New York	36	Mid Atl	NY	18976457	19205605	
16	Polygon	524288	77195.058	South Dakota	46	W N Cen	SD	754844	769957	
34	Polygon	1048578	57859.398	Michigan	26	E N Cen	MI	9938444	10088857	
2	Polygon	131072	147244.653	Montana	30	Mtn	MT	902195	919257	
4	Polygon	131074	84520.43	Minnesota	27	W N Cen	MN	4919479	5085434	
23	Polygon	720897	59814.731	Florida	12	S Atl	FL	15982378	16995730	
32	Polygon	1048576	56088.178	Wisconsin	55	E N Cen	WI	5363675	5492787	
5	Polygon	196608	97073.594	Oregon	41	Pacific	OR	3421399	3655915	
12	Polygon	393216	104101.231	Colorado	08	Mtn	CO	4301261	4652829	
3	Polygon	131073	70812.056	North Dakota	38	W N Cen	ND	642200	637941	
33	Polygon	1048577	56299.387	Illinois	17	E N Cen	IL	12419293	12880846	
11	Polygon	[illegible]	[illegible]	Utah	49	Mtn	UT	[illegible]	[illegible]	

Record: 0 Show: All Selected Records (12 out of 49 Selected) Options...

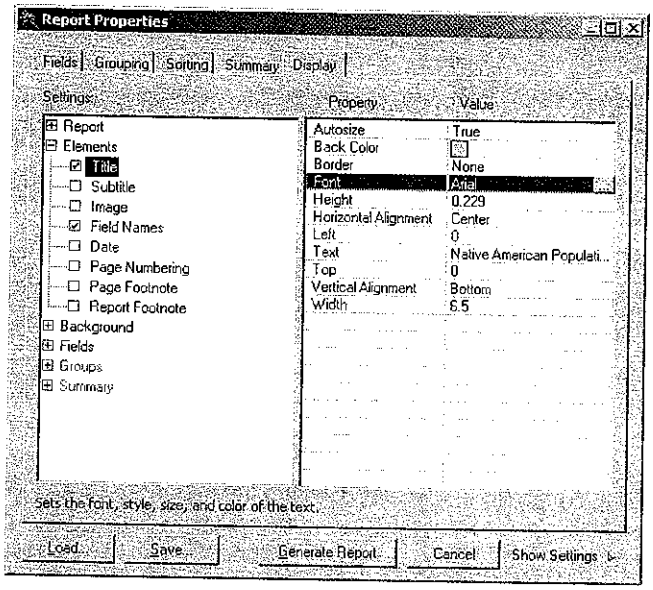
butes of Population window.

Start the report

1 Click View, Layout View.

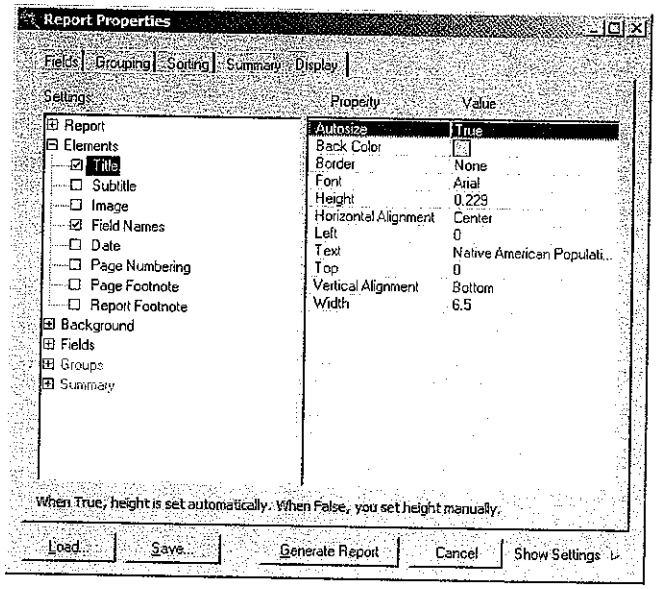
2 Click Tools, Reports, Create Report.

3 In the Report Properties dialog box, in the Available Fields box, double-click STATE_NAME, AMERI_ES, and POP2003.



4 Click the Sorting tab and change None in the AMERI_ES row to Descending.

5 Click the Display tab, check the box to the left of the Title item, change the Text property from Report Title to Native American Population in the Top 12 States, change the Font to Arial by clicking the box and selecting the font from the resulting pop-up window, and then click OK.



Finish the report

1 Click the plus sign (+) to the left of the Fields item to expand it.

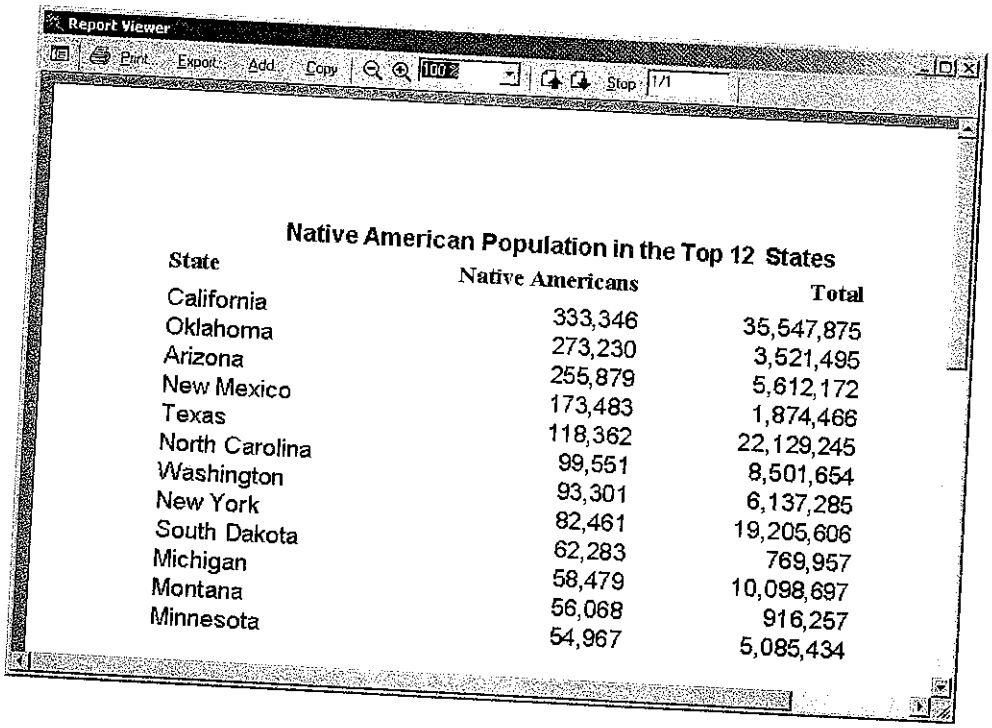
2 Click the STATE_NAME field and change its text to State, click the AMERI_ES field and change its text to Native Americans, and click the POP2003 field and change its text to Total.

3 Change the fonts of these fields to Arial.

4 Click the AMERI_ES field, Number Format, the builder button, the Show Thousands Separators check box, and OK.

5 Repeat step 4 for POP2003.

6 Click the Generate Report button.



Native American Population in the Top 12 States

State	Native Americans	Total
California	333,346	35,547,875
Oklahoma	273,230	3,521,495
Arizona	255,879	5,612,172
New Mexico	173,483	1,874,466
Texas	118,362	22,129,245
North Carolina	99,551	8,501,654
Washington	93,301	6,137,285
New York	82,461	19,205,606
South Dakota	62,283	769,957
Michigan	58,479	10,098,697
Montana	56,068	916,257
Minnesota	54,967	5,085,434

7 In the Report Viewer window, click Export, browse to the \Gistutorial folder, select Rich Text Format (*.rtf) from the Save as type drop-down list, name the report NativeAmericans, click Save, and close the Report Viewer.

8 In the Report Properties window, click Save, browse to the Gistutorial folder, type NativeAmericans as the File Name, and click Save, Close.

This saves the report specification as an RDF (report), which allows you to modify it and generate a new report output. It can be loaded in the Report Properties window.

Add the report to a layout

1 In the Layout View, click Insert then Object.

2 In the Insert Object dialog box, click the Create from File radio button, browse to the \Gistutorial folder, and double-click NativeAmericans.rtf (the rich text format report output).

3 Click OK in the Insert Object window.

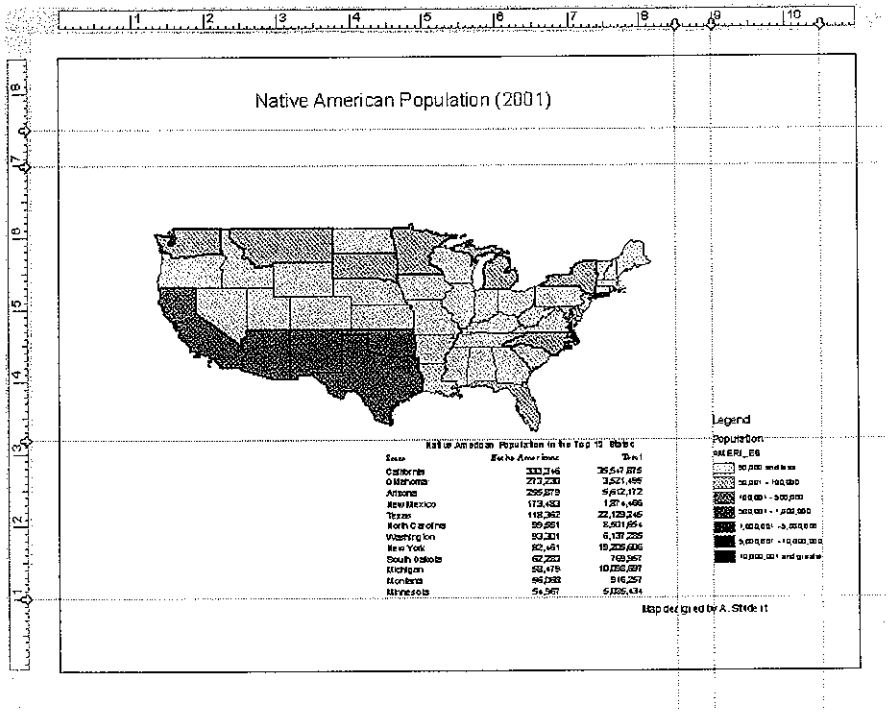
The report is now on the layout, but needs to be resized and moved.

4 Click anywhere on the map to activate its frame, right-click the frame, click Properties, click the Frame tab, change the border color to no color, and click OK.

5 Click the vertical ruler on the left at 7.5 inches to create a horizontal guide, and click and drag the map frame up to this guide.

6 Click the vertical ruler at 1-inch and 3.2-inch locations to create horizontal guides and click and drag the report frame down so that its lower right corner is at the 1-inch horizontal, 8.5-inch vertical guide intersection.

7 Move and resize the report using the guidelines.

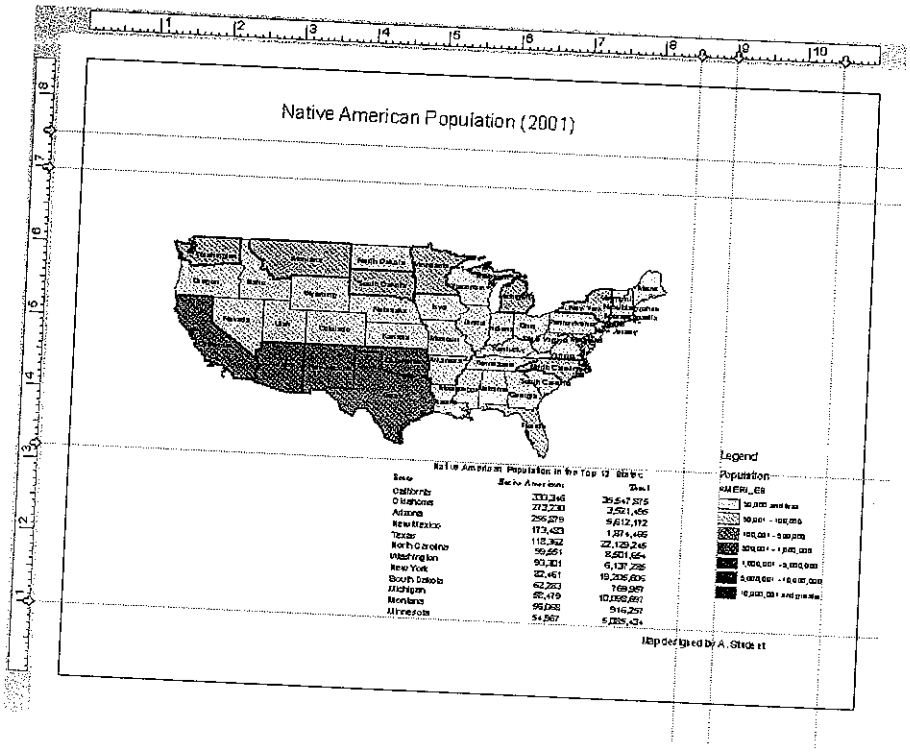


Add final touches to the layout

1 Right-click the Population layer in the table of contents and click Properties.

2 Click the Labels tab, check the box next to Label features in this layer, and click OK.

3 Click File, Save.



YOUR TURN

Create a report for another racial or ethnic group corresponding to a layout that you created earlier, and add it to the layout.

Save your layout using Save As and adding "Report" to the end of the .mxd file name.

Add graphs to a layout

The graphs available from ArcMap are easy to use, but have limitations. In this section you will build an ArcMap graph and then build the same graph in Microsoft Excel, both for use on an ArcMap layout. The Excel graph gives you more control over the graph design, but it takes several more steps than the ArcMap graph.

Open an existing map

1 **Click File, Open, browse to the \Gistutorial folder, and double-click Tutorial3-NativeAmericans.mxd.**

2 **Click View, Data View.**

Select records for graphing

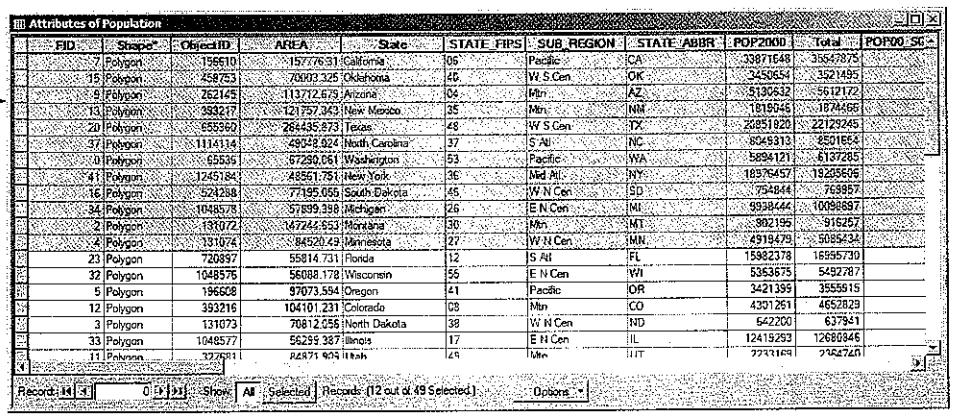
1 **Right-click the Population layer in the table of contents and click Open Attribute Table.**

2 **In the Attributes of Population window, scroll to the right until you can see the AMERI_ES column.**

3 **Right-click the AMERI_ES column heading and click Sort Descending.**

4 **Scroll back to the left, to the beginning of the table, click the first row's record selector, hold and drag down to include Minnesota, then release to select the first twelve rows.**

Record selector



FID	Shape*	ObjectID	AREA	State	STATE_FIPS	SUB_REGION	STATE_ABBR	POP2000	Total	POP00_SQ
7	Polygon	156610	157776.31	California	06	Pacific	CA	33871648	35642875	
15	Polygon	459753	70003.325	Oklahoma	40	W S Cen	OK	3450654	3521495	
9	Polygon	262145	113712.679	Arizona	04	Mtn	AZ	5130632	5612172	
13	Polygon	393217	121757.343	New Mexico	35	Mtn	NM	1819046	1874466	
20	Polygon	655360	264435.873	Texas	48	W S Cen	TX	20851820	22129245	
37	Polygon	1114114	49048.924	North Carolina	37	S Atl	NC	8049313	8501664	
0	Polygon	65535	67280.061	Washington	53	Pacific	WA	5894121	6137285	
41	Polygon	1245184	48561.751	New York	36	Mid Atl	NY	18976457	19295606	
16	Polygon	524288	77195.056	South Dakota	46	W N Cen	SD	754844	763957	
34	Polygon	1048578	57899.398	Michigan	26	E N Cen	MI	9938444	10088897	
2	Polygon	131072	147244.653	Montana	30	Mtn	MT	902195	916257	
4	Polygon	131074	84520.49	Minnesota	27	W N Cen	MN	4919479	5085434	
23	Polygon	720897	55814.731	Florida	12	S Atl	FL	15982378	16995739	
32	Polygon	1048576	56088.178	Wisconsin	55	E N Cen	WI	5363675	5492787	
5	Polygon	196608	97073.554	Oregon	41	Pacific	OR	3421399	3555915	
12	Polygon	393216	104101.231	Colorado	08	Mtn	CO	4301261	4652829	
3	Polygon	131073	70812.056	North Dakota	38	W N Cen	ND	642200	637931	
33	Polygon	1048577	56299.387	Illinois	17	E N Cen	IL	12419293	12880846	
11	Polygon	327681	82871.905	Utah	49	Mtn	UT	[illegible]	[illegible]	

5 **Close the table and click View, Layout View.**

The graph that you will create next will use just the records that you selected.

Create a graph in ArcMap

1 Click Tools, Graphs, Create.

2 In the Create Graph wizard, select AMERI_ES for the Value field and STATE_ABBR for the XLabel field. Click Next.

3 Click on the Show only selected features/records on the graph radio button and click off the Graph legend check box.

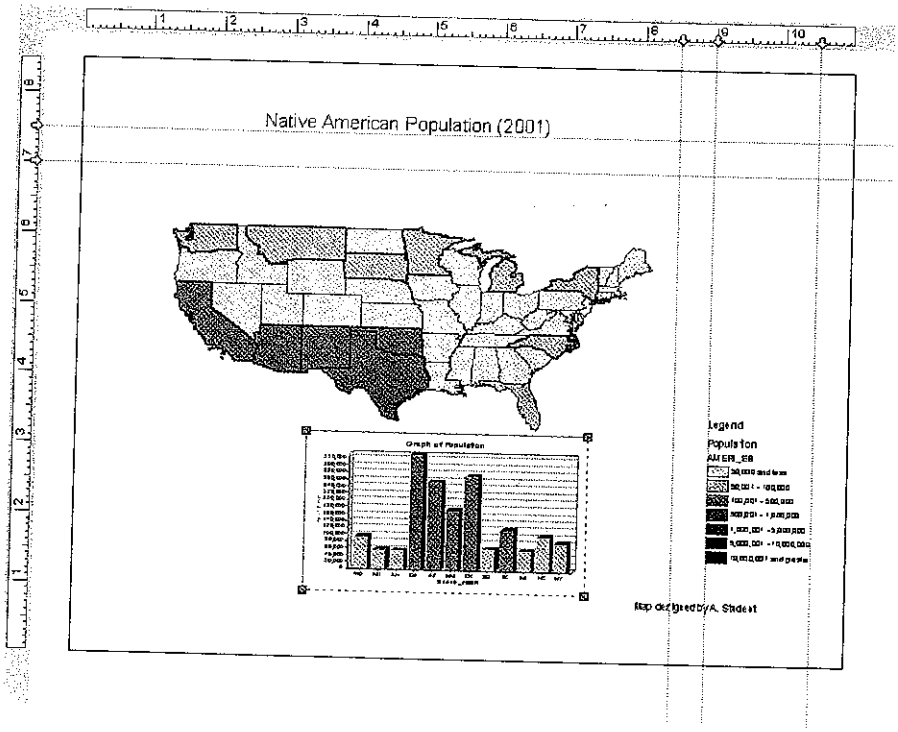
4 Type Native American Population in the Title field, click the Graph in 3D View check box, and click Finish.

5 Click anywhere on the map to activate its frame, right-click the frame, click Properties, change the Border Color to No Color, and click OK.

6 Click the vertical ruler at 7.5 inches to create a new guide, and drag the map frame up so that its top snaps to the new guide.

7 Right-click the graph, click Add to Layout, and close the graph window.

8 Resize and position the graph object.



The result is an attractive graph, but it would be better if you could control the sorting of the bars, for example in descending order.

Export data

1 Click View, Data View.

2 Right-click the Population layer in the table of contents and click Open Attribute Table.

The top twelve states should still be selected, although they will not appear as a contiguous group of records.

3 In the lower right corner of the Attributes of Population window, click the Options button, then click Export, browse to the \Gistutorial folder, change the name of the output file from Export_Output.dbf to NativeAmericanPopulation.dbf, click Save, click OK, and click No when asked to add it to your map.

4 Close the Attributes of Population table.

Import data into Microsoft Excel

1 Start Microsoft Excel (you can minimize ArcMap, but do not close your project), click File, Open, browse to your \Gistutorial folder, change the Files of Type to dBase Files (*.dbf), and double-click NativeAmericanPopulation.dbf.

2 Click column headings and use Edit, Delete to delete all but STATE_NAME and AMERI_ES columns.

3 Change the column headings from STATE_NAME to State and AMERI_ES to Population.

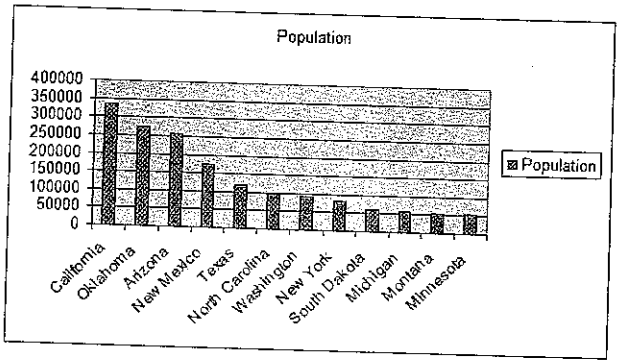
4 Select all cells in the table and click Data, Sort, click the Descending radio button for Population, and click OK.

	A	B
1	State	Population
2	California	333346
3	Oklahoma	273230
4	Arizona	255879
5	New Mexico	173483
6	Texas	118362
7	North Carolina	99551
8	Washington	93301
9	New York	82461
10	South Dakota	62283
11	Michigan	58479
12	Montana	56068
13	Minnesota	54967

Create a graph in Microsoft Excel

1 With the table still selected, click the Chart Wizard button in Excel.

2 In the Chart Wizard, click Next until finished.

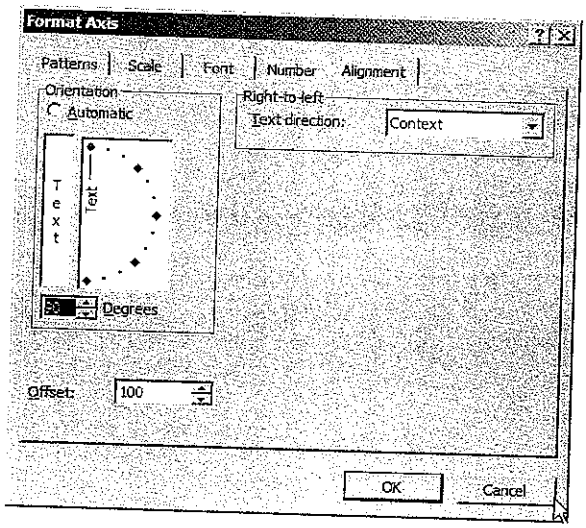


3 Click the frame of the Population legend to the right of the graph and press Delete on your keyboard.

4 Resize the graph so that it is about 3 inches wide and 2 inches tall.

5 Double-click the horizontal axis.

6 In the resulting Format Axis window, click the Alignment tab. Then click and hold the red dot at the end of the Text line and rotate up to vertical.



7 Click the Scale tab, enter values of 1 for the first three text boxes, and click OK.

8 Double-click the vertical axis of the graph, click the Scale tab, change the Major Unit to 100000, and click OK.

Add the Microsoft Excel graph to the layout

1 In Excel, click the boundary of the graph to activate its frame.

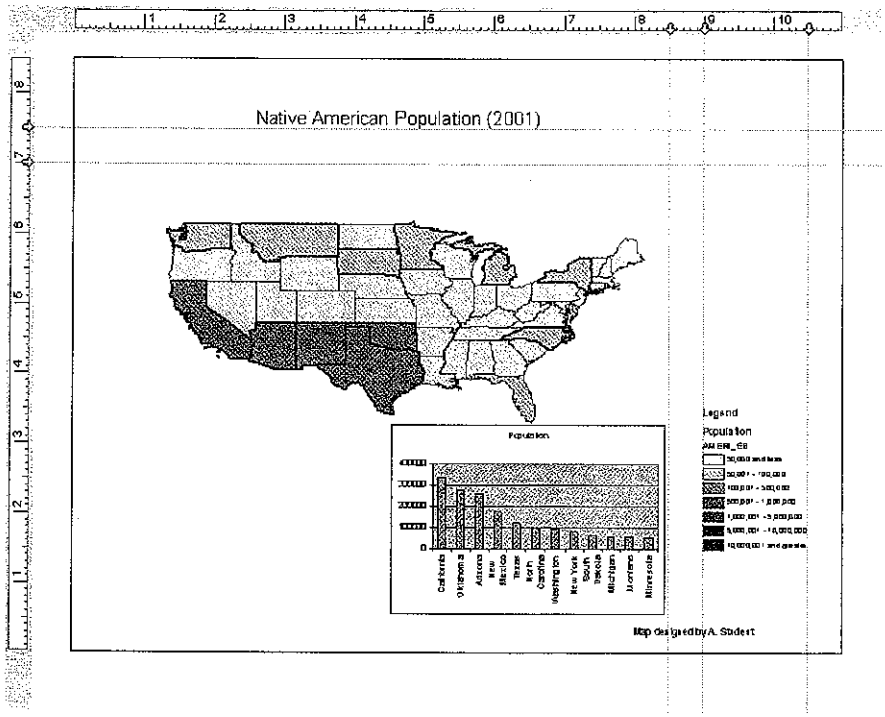
2 Click Edit, Copy.

3 Close Excel (save as an Excel workbook if you like).

4 Switch to ArcMap, which should still be open, and click View, Layout View.

5 Click the Population graph to activate its frame and press Delete on your keyboard.

6 Click Edit, Paste and relocate/resize your Excel graph.



7 Click File, Save As, key in Tutorial3-Graph.mxd as the File Name, and click Save.

Export layouts as files

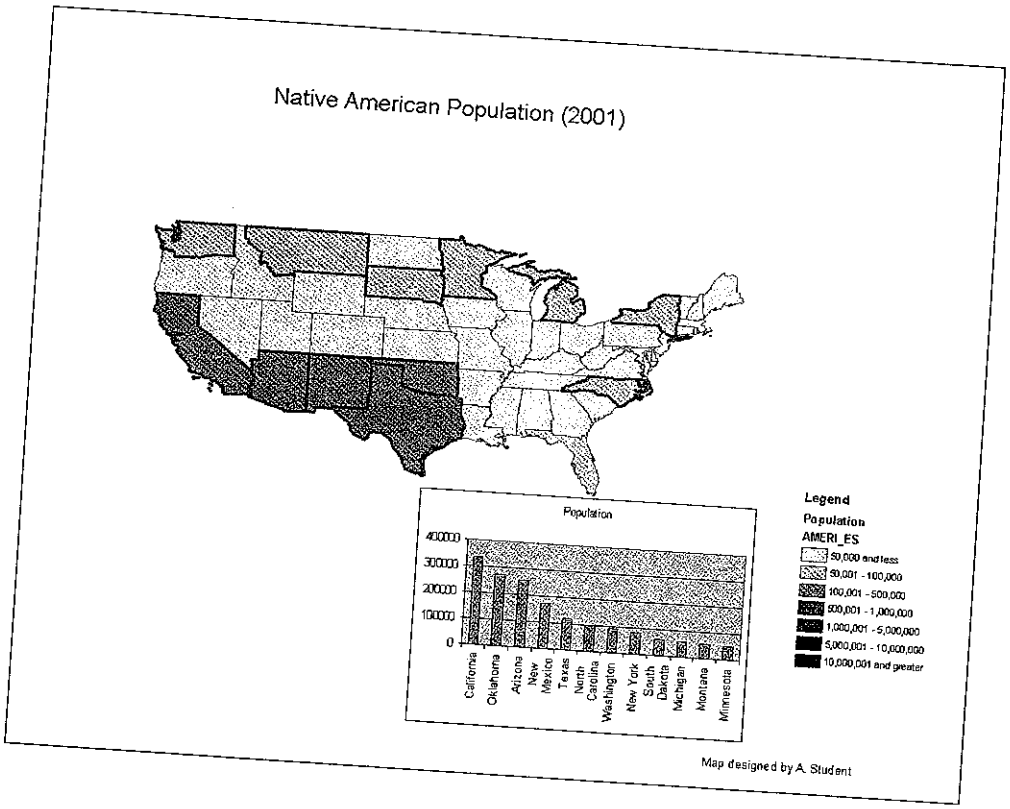
It is often desirable to include maps in Microsoft Word documents or Microsoft PowerPoint presentations, or on Web sites. ArcMap allows you to export layouts in a variety of file formats.

1 **In Layout View of Tutorial3-Graph.mxd, click File, Export Map.**

2 **In the Export Map window, click the Save as type drop-down arrow and click JPEG (*.jpg).**

3 **Browse to the \Gistutorial folder and click Save.**

You now have a very nice JPEG file, displayed below, that you can import as a picture into a variety of software packages or upload to a Web site.



4 **Save and close ArcMap.**

Other outputs

We have covered several outputs of GIS in this tutorial, including interactive GIS, print layouts, and file exports of layouts. There are many more GIS outputs, and while not covered in this chapter, we will list a few more here for your information.

1. Spatial data processing—GIS provides unique outputs that no other kind of software can produce because it incorporates world coordinate systems and related algorithms. A major GIS output is a point on a map that represents a street address. Points are generated from street addresses (like 4800 Forbes Ave., Pittsburgh, PA 15213) through a unique GIS process called address matching. It is then possible to use another spatial data processing step, spatial overlay, to assign area identifiers (like county, census tract, and so on) to such points. We will cover geocoding, address matching, and spatial overlay in later chapters.

2. Web-based, interactive GIS—the ArcIMS package from ESRI—is an easy way to provide most of the functionality of tutorials 1 and 2 on the Web. You can try out sample Web sites at *www.esri.com/software/internetmaps/index.html*. This is not a difficult package to learn, given your current GIS knowledge, but ArcIMS is limited to organizations that can afford the package and have staff who can implement and maintain it.

3. Free GIS package for map display and querying—ArcExplorer—is a simple, free GIS package that includes functionality similar to tutorials 1 and 2. See *www.esri.com/software/arcexplorer/index.html*.

Assignment 3-1

Layout comparing males, females, and young population in Orange County, California

Sometimes you will want to compare two or more maps in layout view to visualize information about multiple attributes and analyze those attributes. In this problem, you will create a map layout with two maps with population percentages for youths and the elderly in Orange County, California.

Start with the following:

- **C:\Gistutorial\UnitedStates\California\OrangeCountyTracts.shp**—census tract polygon boundaries for Orange County, California, Census 2000.

Create a comparison map of census data

Create a new map document called C:\Gistutorial\Answers\Assignment3\Assignment3-1.mxd that includes an 11×8.5-inch portrait layout with two data frames: one with the percentage of 2000 population who are 5 to 17 years old and the second with percentage 65 or older. Use the same numerical scale for both maps. Include a graphic scale bar in miles.

Hints

- Use the Layer Properties, Symbology tab to show a population as a percentage of the total population for the year 2000 (use POP2000 field to normalize the data).
- Use your judgment as to the color, sizes, titles, and other map elements to add or modify.

Export the map as a JPEG file called C:\Gistutorial\Answers\Assignment3\Assignment3-1.jpg.

Assignment 3-2

Walking map of historic districts in downtown Pittsburgh

Many city planning departments are using GIS as a tool to create maps for their cities. These maps can be used in planning documents, tourist attraction documents, or Web sites for visitors in a city. Visit Pittsburgh's Department of City Planning Web site to see examples of maps *(www.city.pittsburgh.pa.us/cp)*. Click "Walking Tours" to see maps and photos of Pittsburgh's historic sites. In this exercise, you will create maps that the planning department can use to promote historic areas. In the layout, you will create an overall view of the historic sites in the Central Business District as well as a zoomed map for one area.

Start with the following:

- **C:\Gistutorial\PAGIS\CentralBusinessDistrict\CBDOutline.shp**—polygon feature of Pittsburgh's Central Business District neighborhood outline.
- **C:\Gistutorial\PAGIS\CentralBusinessDistrict\CBDBLDG.shp**—polygon features of Pittsburgh's Central Business District buildings.
- **C:\Gistutorial\PAGIS\CentralBusinessDistrict\CBDStreets.shp**—line features of Central Business District streets.
- **C:\Gistutorial\PAGIS\Histsite.shp**—polygon features of historic areas in Pittsburgh's Central Business District. This layer shows historic district polygons for the entire city of Pittsburgh. You will focus only on those historic areas within the Central Business District neighborhood.
- **C:\Gistutorial\PAGIS\Histpnts.shp**—point features of historic sites in Pittsburgh's Central Business District. This layer shows points for the entire city of Pittsburgh. You will focus only on those historic points within the Central Business District neighborhood.

Create a large-scale map

Create a new map called C:\Gistutorial\Answers\Assignment3\Assignment3-2.mxd with an 8.5×11-inch layout containing two data frame maps—one scaled at 1:14,000 showing all of the historic districts in the Central Business District, and one scaled at 1:2,400 showing one of the historic districts (you choose the focus) in detail. See hints for how to set a fixed scale in a layout.

Keep in mind basic mapping principles such as colors, ground features, and so forth, covered in previous chapters. Choose labels and other map elements that you think are appropriate for each map as well as the overall layout. Include a photograph of a building that you download from the City of Pittsburgh Web page and save to the C:\Gistutorial\Answers\Assignment3 folder.

Draw the Historic Sites polygons as a transparent layer (see hints) so you can see the buildings under the sites and the Central Business District as a thick outline.

Export your map as a PDF file called C:\Gistutorial\Answers\Assignment3\Assignment3-2.pdf.

Assignments

Drawing a layer transparently

- Click the View menu, point to Toolbars, and click Effects.
- Click the Layer drop-down arrow and click the layer you want to adjust.
- Click the Adjust Transparency button.
- Drag the slider bar to adjust the transparency.

Setting a Fixed Scale in a Layout Data frame

- Click the black pointer tool and select a data frame in a layout.
- Right-click the data frame and click Properties.
- Click the Data Frame tab.
- Click the Fixed Scale radio tab and enter your new scale here.

What to turn in

If you are working in a classroom setting with an instructor, you may be required to submit the exercises you created in tutorial 3. Below are the files you are required to turn in. Be sure to use a compression program such as PKZIP or WinZip to include all three files as one .zip document for review and grading. Include your name and assignment number in the .zip document (YourNameAssn3.zip).

ArcMap documents

C:\Gistutorial\Answers\Assignment3\Assignment3-1.mxd
C:\Gistutorial\Answers\Assignment3\Assignment3-2.mxd

Exported maps

C:\Gistutorial\Answers\Assignment3\Assignment3-1.jpg
C:\Gistutorial\Answers\Assignment3\Assignment3-2.pdf

Downloaded image of a building

C:\Gistutorial\Answers\Assignment3\XX.XX