

## **OBJECTIVES**

- Work with map layers
  - Zoom and pan
- Magnifier and Overview windows
  - Spatial bookmarks
- Measure distances
  - Identify features
- Select features on a map
  - Find features
- Work with feature attribute tables
  - Label features

## ***GIS Tutorial 1***

# **Introduction**

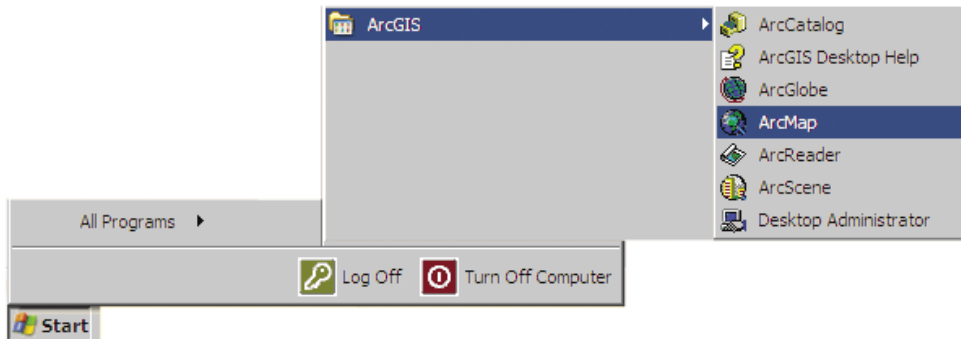
This first tutorial familiarizes you with some of the basic functionality of ArcMap and illustrates the fundamentals of GIS. You will work with map layers and underlying attribute data tables for U.S. states, cities, counties, and streets. All layers you will use are made up of geographic or spatial features consisting of points, lines, and polygons. Each geographic feature has a corresponding data record, and you will work with both features and their data records.

# Launch ArcMap

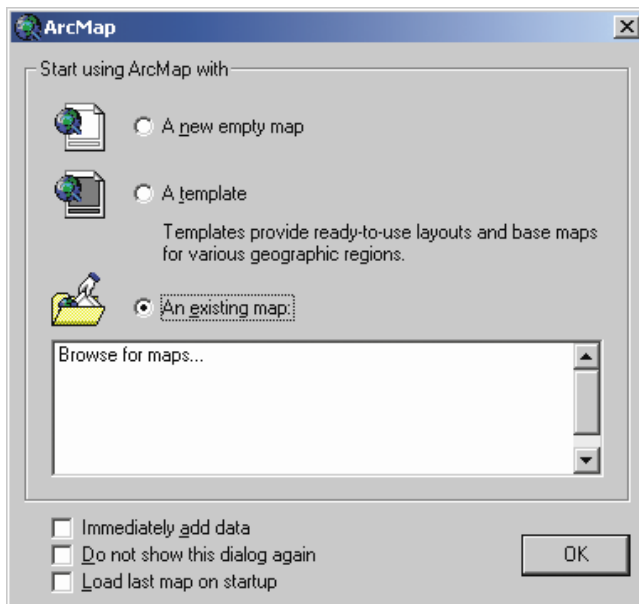
ArcMap is the primary mapping component of ArcGIS Desktop software from ESRI. ESRI offers three licensing levels of ArcGIS Desktop, each with increasing capabilities; namely, ArcView, ArcEditor, and ArcInfo. Together, ArcMap and two other components that you will use later in this workbook (ArcCatalog and ArcToolbox) make up ArcView, the world's most popular GIS software.

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

Depending on your operating system and how ArcGIS and ArcMap have been installed, you may have a different navigation menu.

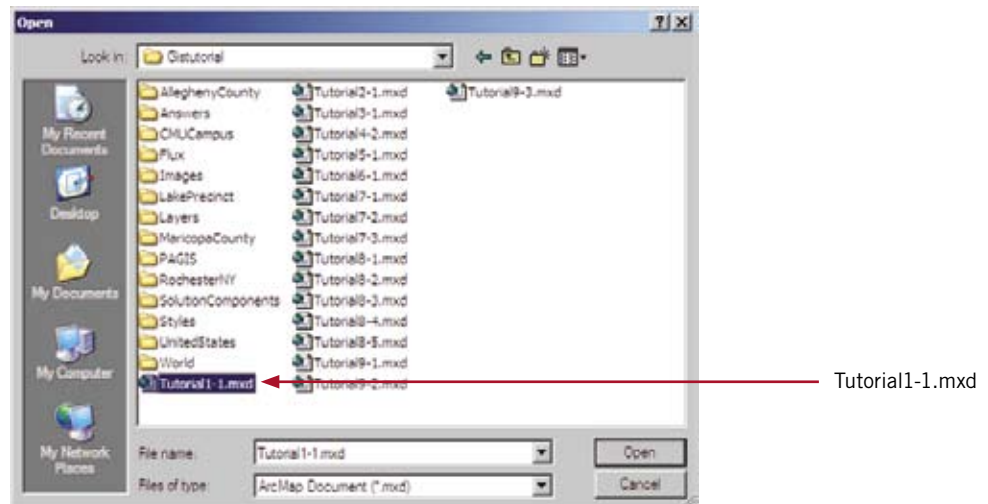


- 2 In the resulting ArcMap window, click the An existing map radio button and click OK.

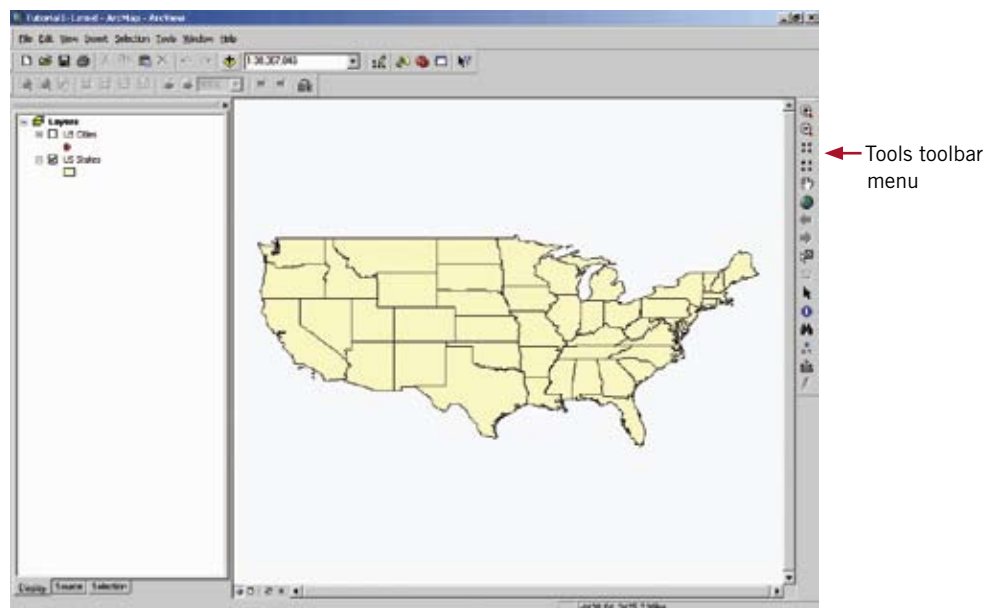


# Open an existing map

- 1 Browse to the drive on which the Gistutorial folder has been installed (e.g., C:\Gistutorial), click the **Tutorial1-1.mxd** (or Tutorial1-1) icon and click **Open**.



The Tutorial1-1.mxd map document opens in ArcMap showing a map consisting of the US States layer (boundaries of the lower forty-eight contiguous states). The US Cities layer (not yet turned on) is the subset of cities with population greater than 300,000. Note that your Tools menu, which is anchored on the right side of the screen below, may be free-floating on your screen or docked somewhere else on the interface. If you wish, you can anchor it by clicking in its top area, dragging it to a side of the map display window and releasing when you see a thin rectangle materialize. If you do not see the Tools menu at all, click View, Toolbars, Tools to make it visible.



# Map layers

Map layers are references to data sources such as point, line, and polygon shapefiles; geodatabase feature classes; raster images; and so forth, representing spatial features that can be displayed on a map.

## *Turn a layer on*

- 1 Click the small check box to the left of the US Cities layer in the table of contents to turn that layer on.

The table of contents is the panel on the left side of the view window. If the table of contents accidentally closes, click Window, Table of Contents to reopen it. A check mark appears if the layer is turned on. Nothing appears if it is turned off.

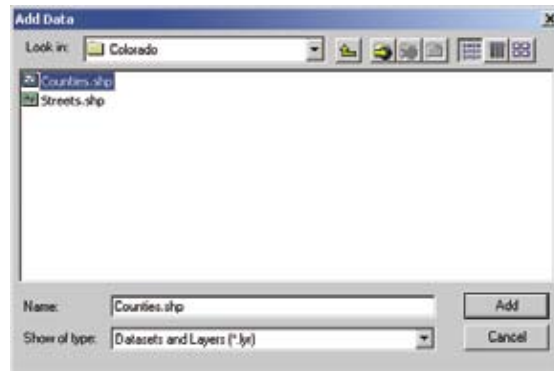


## *Turn a layer off*

- 1 Click the small check box to the left of the US Cities layer in the table of contents again to turn the layer off.
- 2 Click the check box again to turn the layer on.

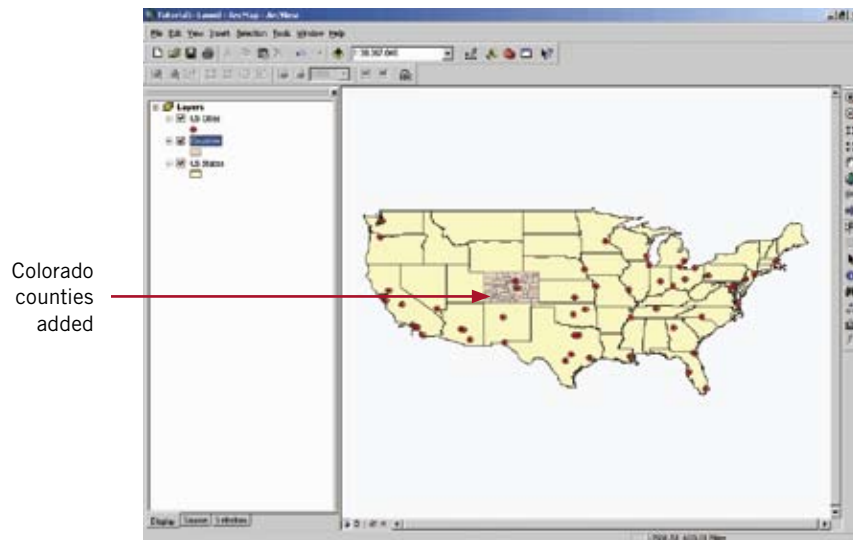
### Add a layer

- 1 Click the Add Data button. 
- 2 In the Add Data browser, browse to \Gistutorial\UnitedStates\Colorado.
- 3 Click **Counties.shp**.
- 4 Click Add.



- 5 In the Geographic Coordinate Systems Warning dialog box, click the Don't warn me again ever check box and click Close.

ArcMap randomly picks a color for the Colorado counties layer. The color can be changed later.



## YOUR TURN

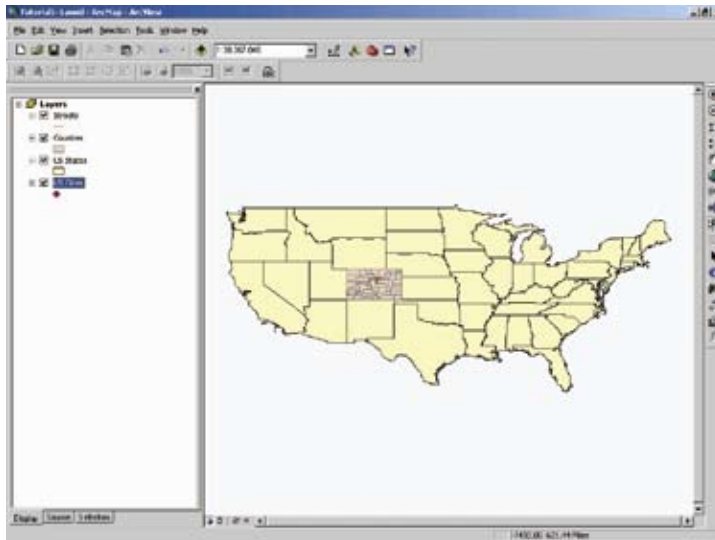
Use the Add Data button to add Streets.shp, also found in the \Gistutorial\UnitedStates\Colorado folder. These are street centerlines for Jefferson County, Colorado.

Note: You may not be able to see the streets because they occupy a small area of the map and are partially obscured by the top city point marker in Colorado.

### *Change a layer's display order*

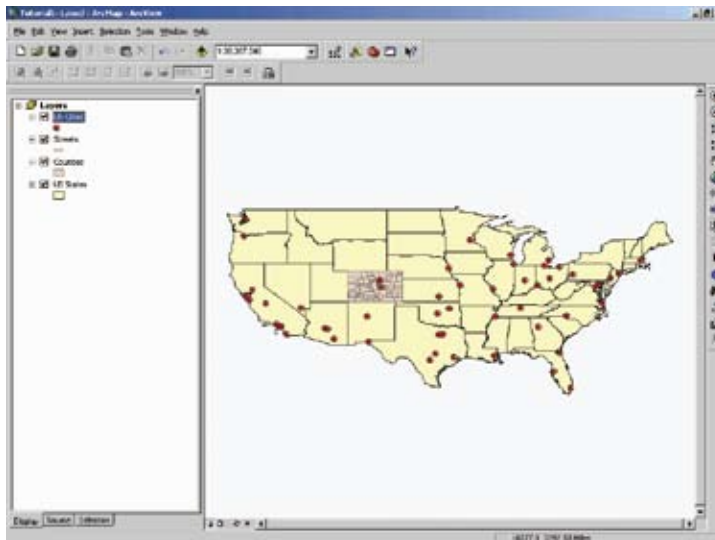
- 1 In the table of contents, click and hold down the left mouse button on the name of the US Cities layer.
- 2 Drag the US Cities layer down to the bottom of the table of contents.

ArcMap draws layers from the bottom up. Because the US Cities layer is now drawn first, its points are covered by the US States and Counties layers and cannot be seen.



- 3 Click and hold down the left mouse button on the US Cities layer.
- 4 Drag the US Cities layer back to the top of the table of contents.

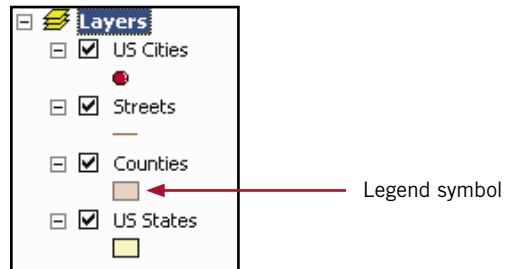
Because US Cities is now drawn last, its points can be seen again.



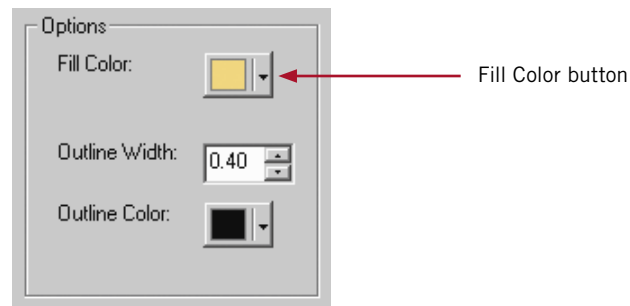
## Change a layer's color

- 1 Click the Counties layer's legend symbol.

The legend symbol is the rectangle below the layer name in the table of contents.



- 2 In the resulting Symbol Selector window, click the Fill Color button in the Options section.



- 3 Click the Tarragon Green tile in the Color Palette.

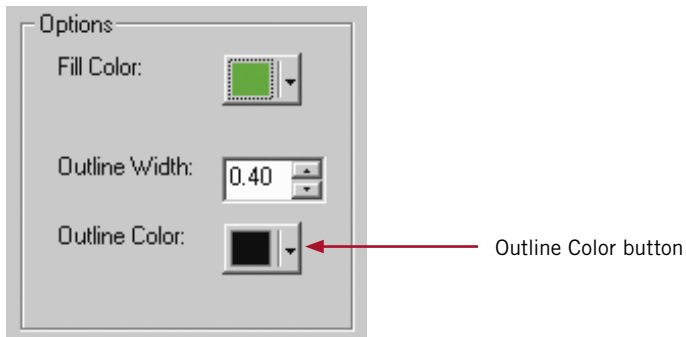


- 4 Click OK.

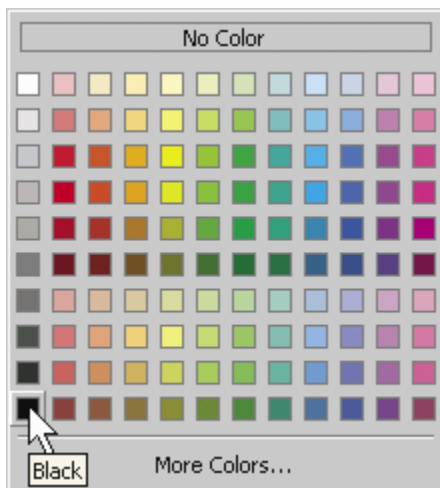
The layer's color changes to Tarragon Green on the map.

### *Change a layer's outline color*

- 1 Click the Counties layer's legend symbol.
- 2 Click the Outline Color button in the Options section of the Symbol Selector dialog box.



- 3 Click the Black tile in the Color Palette.



- 4 Click OK.

## ***YOUR TURN***

Repeat the steps outlined above, this time changing the colors of the other layers to your liking.




# Zoom and pan

Zooming and panning enlarges or reduces the display and shifts the display to reveal different areas of the map. The zoom and pan buttons are found on the Tools toolbar.



## ***Zoom In***

- 1 Click the Zoom In button. 
- 2 Click and hold down the mouse button on a point above and to the left of the state of Florida.
- 3 Drag the mouse below and to the right of the state of Florida and release the mouse button.



- 4 Click once on the map to zoom in.

The display recenters on the point you clicked. This is an alternative to dragging a rectangle for zooming in.

## ***Fixed Zoom In***

- 1 Click the Fixed Zoom In button. 

This zooms in a fixed distance on the center of the current zoomed display.

### ***Zoom Out***

- 1 Click the Zoom Out button.



- 2 Click once on the map to zoom out from the point you pick.

### ***Fixed Zoom Out***

- 1 Click the Fixed Zoom Out button.



This zooms out a fixed distance from the center of the current zoomed display.

### ***Pan***

Panning shifts the current display to the left, right, up, or down without changing the current scale.

- 1 Click the Pan button.



- 2 Move the cursor anywhere onto the map display.
- 3 Hold down the left mouse button and drag the mouse in any direction.
- 4 Release the mouse button.

### ***Full Extent***

- 1 Click the Full Extent button.



This zooms to a full display of all layers, regardless of whether they are turned on or turned off.

### ***Go Back to Previous Extent***

- 1 Click the Go Back to Previous Extent button.



This returns the map display to its previous extent.

- 2 Continue to click this button to step back through all of the views.

### ***Go to Next Extent***

- 1 Click the Go to Next Extent button.

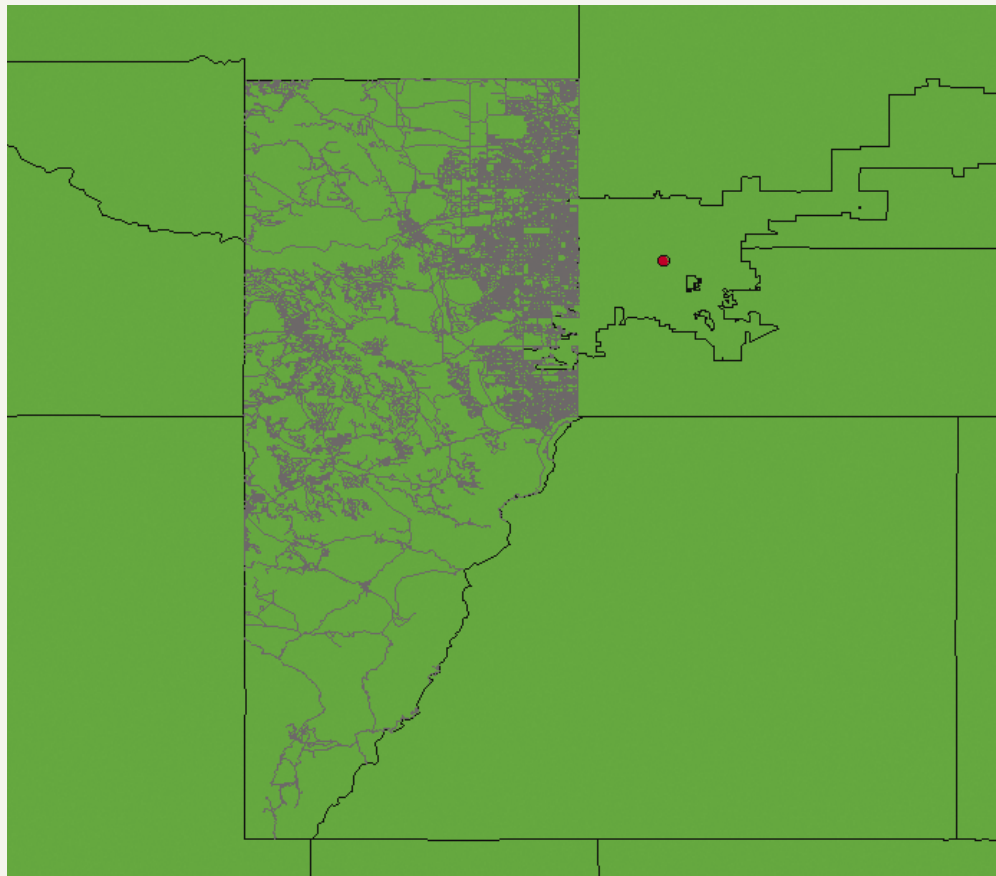


This moves forward through the sequence of zoomed extents you have viewed.

- 2 Continue to click this button until you reach the most recently viewed extent.

## ***YOUR TURN***

Zoom to the county polygons in Colorado and then to the streets in Jefferson County, Colorado. Leave your map zoomed into the streets.

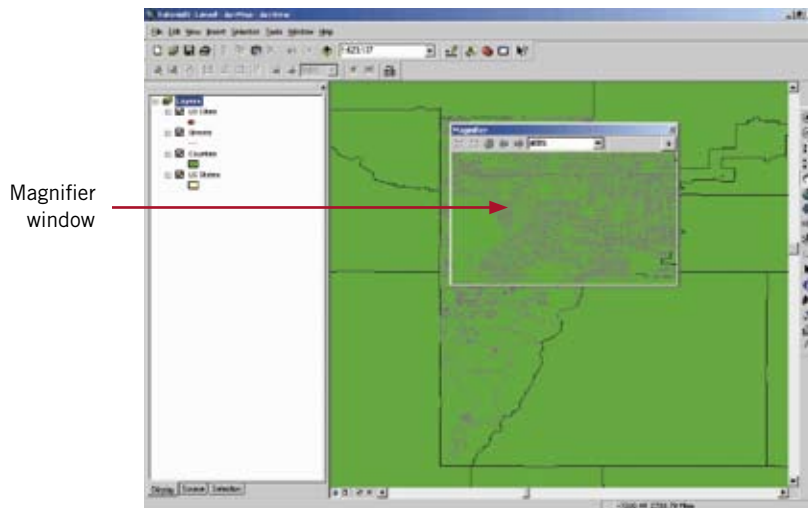


# Magnifier window

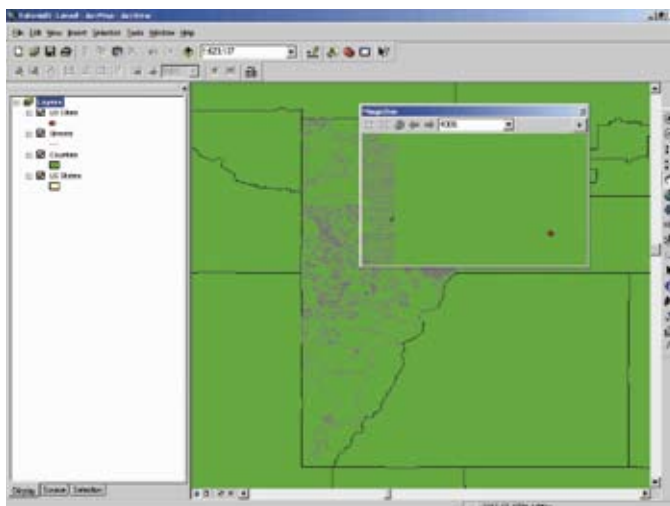
The magnifier window adjusts the map display to see more detail or get an overview of an area. This window works like a magnifying glass: as you pass the window over the map display, you see a magnified view of the location under the window. Moving the window does not affect the current map display.

## Opening the magnifier

- 1 Click Window, Magnifier.
- 2 Drag the Magnifier over an area of the map to see crosshairs for area selection and then release to see the zoomed details.

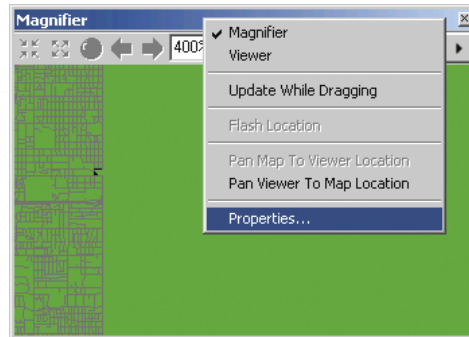


- 3 Drag the Magnifier to a new area to see another detail on the map.

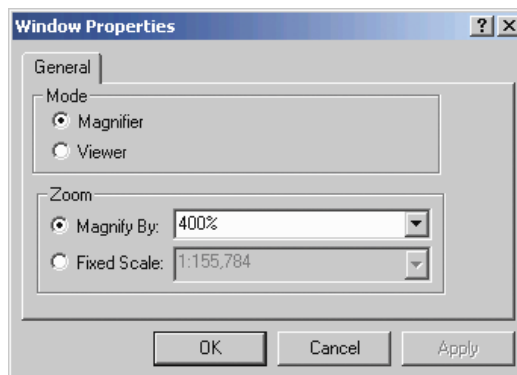


## Magnifier properties

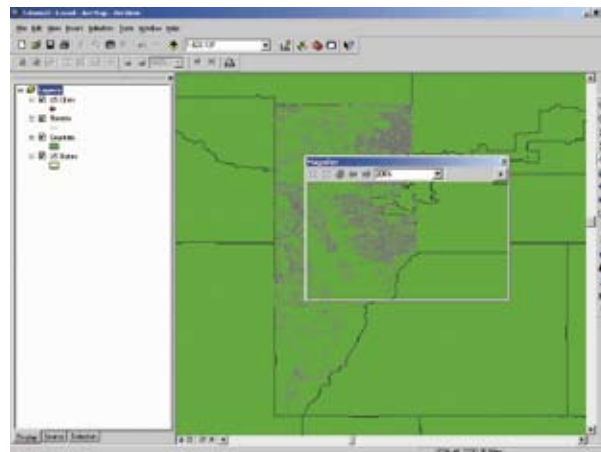
- 1 Right-click the title bar of the Magnifier window.



- 2 Click Properties.



- 3 Change the Zoom percentage to 200%.
- 4 Click OK.
- 5 Drag the Magnifier to a different location and see the resulting view.



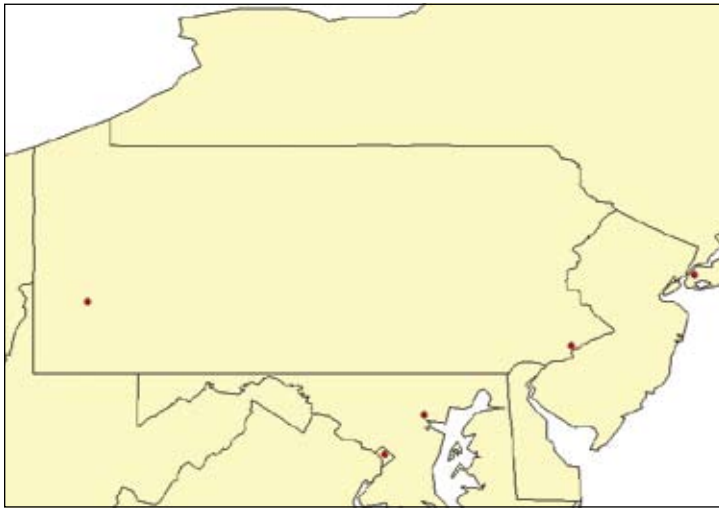
- 6 Close the Magnifier window.

# Overview window

The Overview window shows the full extent of the layers in a map. A box shows the area currently zoomed to. You can move the box to pan the map display. You can also make the box smaller or larger to zoom the map display in or out.

## *Opening the Overview window*

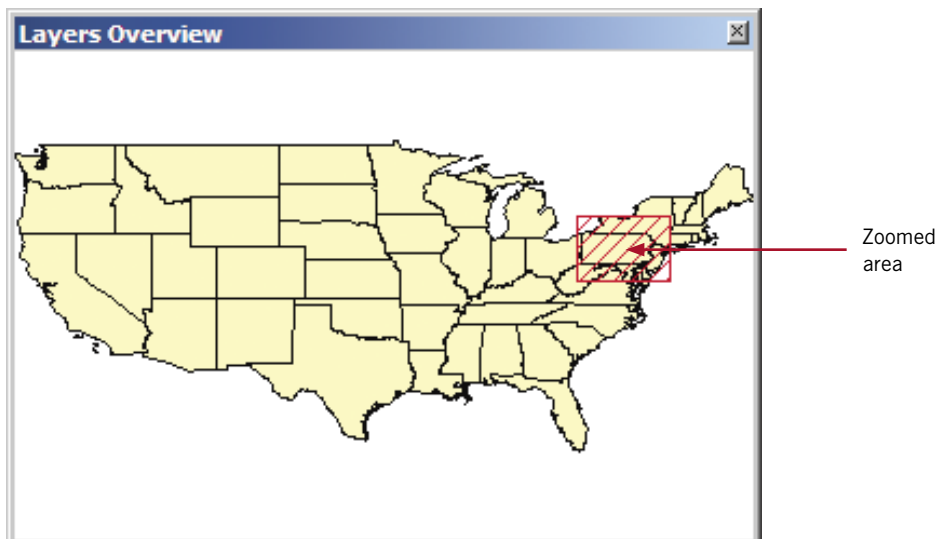
- 1 Click **View, Zoom Data, Full Extent**.
- 2 Zoom to a small area of the map (one or two states).



- 3 Click **Window, Overview**.

The current extent of the map display is highlighted with a box and red hatch pattern.

- 4 Move the cursor to the center of the hatch pattern, click and drag to move it to a new location, and release.



The extent of the map display updates to reflect the changes made in the Layers Overview window. Note: If you right-click the top of the Layers Overview window and then click Properties, you can modify the display.



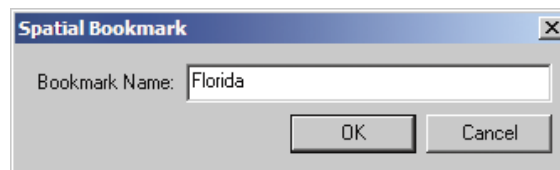
# Spatial bookmarks

Spatial bookmarks save the extent of a map display or geographic location so you can return to it later without having to use the Pan and Zoom tools.

- 1 Close the Layers Overview window.
- 2 Click View, Zoom Data, Full Extent.
- 3 Zoom to the state of Florida.



- 4 Click View, Bookmarks, Create.
- 5 Type **Florida** in the Bookmark Name field.
- 6 Click OK.
- 7 Click View, Zoom Data, Full Extent.
- 8 Click View, Bookmarks, Florida.



ArcMap zooms to the saved bookmark of Florida.

## YOUR TURN

Create spatial bookmarks for the states of California, New York, and Colorado. Try out your bookmarks. Use View, Bookmarks, Manage to remove the California bookmark.



# Measure distances

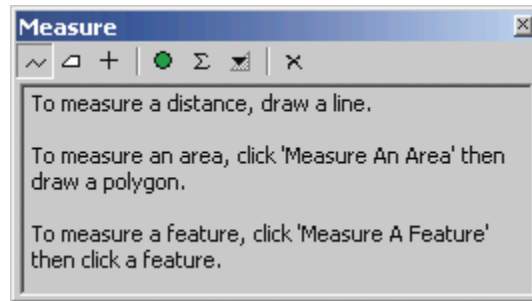
## *Measure the horizontal distance of Colorado*

1 Use your bookmark (or use the Full Extent and Zoom In tools) to zoom to Colorado.

2 From the Tools toolbar, click the Measure button.



The Measure dialog box opens with the Measure Line tool enabled.

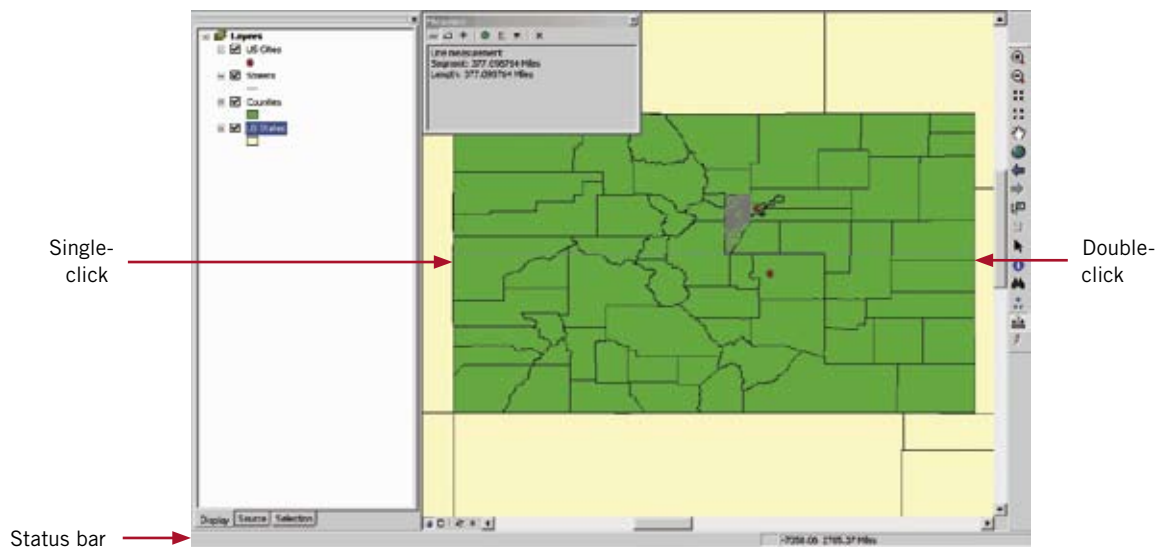


3 In the Measure dialog box, click the Choose Units button  and click Distance, Miles. Leave the Measure dialog box open.

4 Click once on the western boundary of the state of Colorado.

5 Drag the mouse to the eastern boundary of Colorado and double-click.

The distance should be about 377 miles.



***Change distance measurements***

- 1 In the Measure dialog box, click the Choose Units tool and click Distance, Kilometers.

The distance is approximately 607 kilometers.

- 2 Close the Measure dialog box and from the Tools toolbar click the Select Elements button.

***YOUR TURN***


Measure the vertical distance (top to bottom) of Colorado. The distance should be about 275 miles or 445 kilometers.

Measure the length and height of the continental United States. The length is approximately 2,700 miles and the height 1,600 miles, but these measurements are difficult to make precisely.

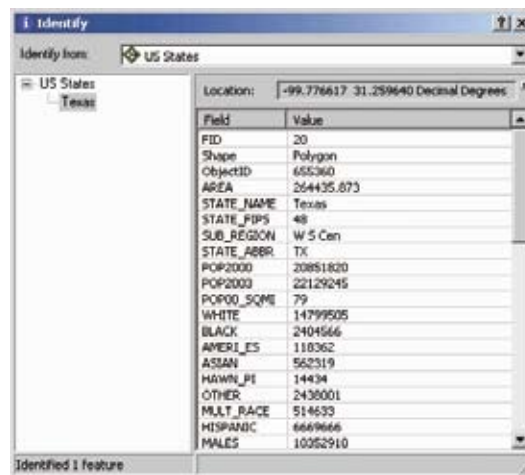
# Identify features

To display the data attributes of a map feature, click the feature with the Identify tool. This tool is the easiest way to learn something about a location on a map.

## *Identify various U.S. states*

- 1 If necessary, zoom to the full extent.
- 2 From the Tools toolbar, click the Identify button. 
- 3 Click anywhere on the map.
- 4 From the Identify window, click the Identify from drop-down list and click US States.
- 5 Click inside the state of Texas.

The state temporarily flashes and its attributes appear in the Identify dialog box.

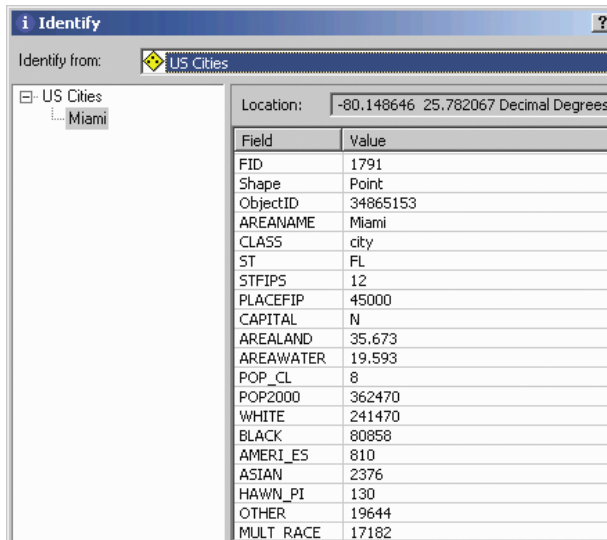


Leave this window open.

## *Identify various U.S. cities*

- 1 From the Identify window, click the Identify from drop-down list and click US Cities.
- 2 Click the red circular point marker for Miami (at the southern tip of Florida).

Make sure the point of the arrow is inside the circle when you click the mouse button. Notice which feature flashes—that is the feature for which you get information.



**3 Continue clicking other cities to see the identify results.**

Hold down the Shift key to retain information for more than one city. Then click the name of a city in the left panel of the Identify window to view that city's information.

### ***Use more Identify tool capabilities***

- 1 Without holding down the Shift key, click Miami with the Identify tool.**
- 2 Right-click the name Miami in the Identify window and click Flash. This flashes Miami's point marker.**
- 3 Right-click the name Miami again and click Zoom To. The map display zooms to Miami.**

ArcMap will identify the US States only because its layer is set in the dialog box.

- 4 Right-click the name Miami once again and click Create Bookmark.**
- 5 Close the Identify window.**
- 6 Click View, Zoom Data, Full Extent.**
- 7 Click View, Bookmarks, Miami.**

## ***YOUR TURN***

Restrict the Identify results to the Counties layer and identify Colorado counties. Practice making bookmarks for various counties using the Identify tool.

# Selecting features

Selecting features identifies the features on which you want to perform certain operations. For example, before you move, delete, or copy a feature, you must select it. Selected features appear highlighted in the layer's attribute table and in the map.

## Select button

- 1 Click View, Zoom Data, Full Extent.
- 2 Turn off the Streets and Counties layers.
- 3 From the Tools toolbar, click the Select Features tool.
- 4 Click inside Texas.



Texas is selected and highlighted with a thick, bright blue line.



## Selecting multiple features

- 1 Hold down the Shift key and click inside the three states adjacent to Texas.

All of the selected states are selected and highlighted.

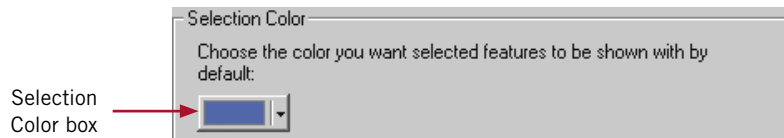


### ***Clearing selected features***

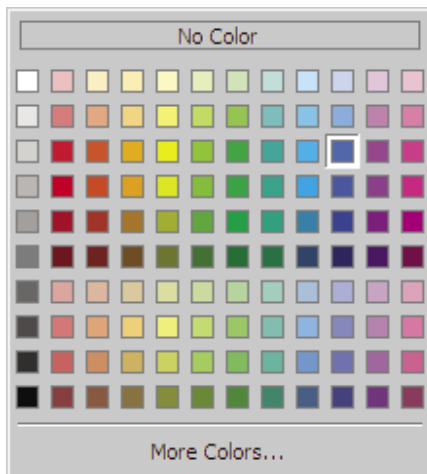
- 1 Click Selection, Clear Selected Features.

### ***Selection Color***

- 1 Click Selection, Options.
- 2 Click the color box in the Selection Color frame.



- 3 Pick a new color.



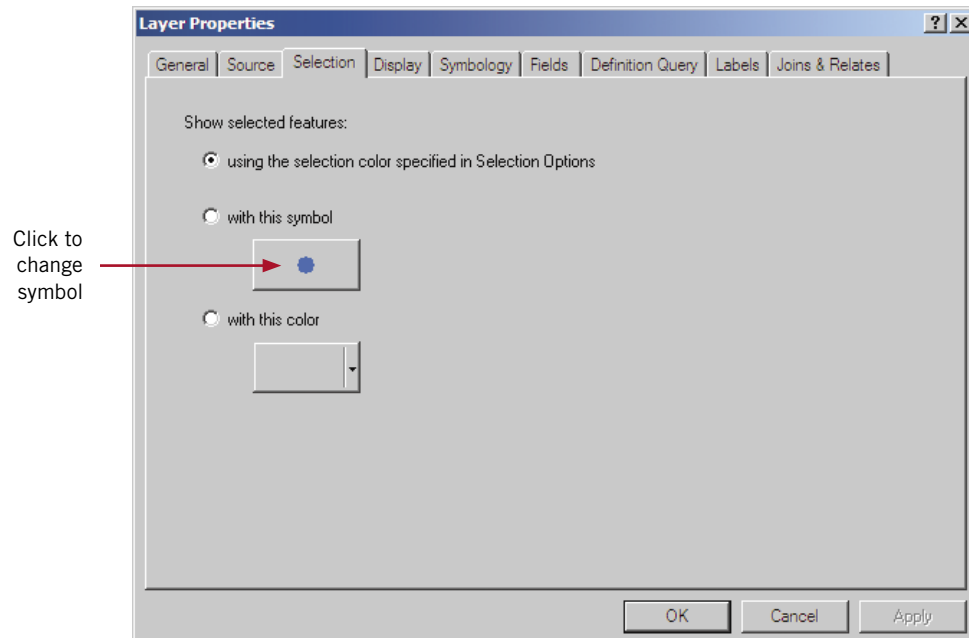
- 4 Click OK.

## Changing selection symbol

- 1 Right-click the US Cities layer in the table of contents.
- 2 Click Properties.

The resulting Layer Properties dialog box is one that you will use often. It allows you to modify many properties of a map layer.

- 3 Click the Selection tab.
- 4 Pick a new symbol and/or color for the point features.

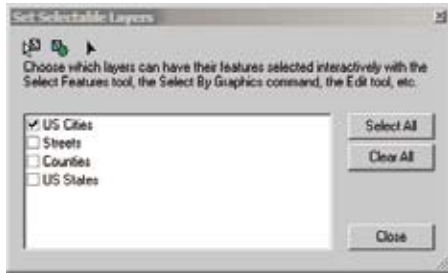


- 5 Click OK and click OK again.

## Selectable layers

Making a layer selectable allows its features to be selected using the Select Features tool, Select by Graphics tool, Find tool, and so forth.

- 1 Click Selection, Set Selectable Layers.
- 2 Click off the check boxes for Streets, Counties, and US States to make only US Cities selectable.



- 3 Click Close.
- 4 Click the Select Features button  and click a city.

The selected city gets the selection symbol and color that you chose on the previous page.

- 5 Clear the selected features.

## YOUR TURN

Create a new layer from selected features by selecting multiple cities in one state. After the cities are selected, right-click the US Cities layer, click Selection, and click Create Layer from Selected Features.



# Find features

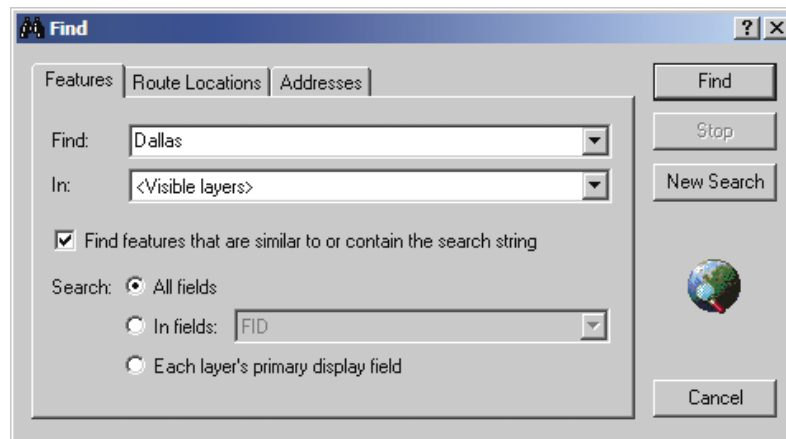
The Find tool is used to locate features in a layer or layers based on their attribute values. You can also use this tool to select, flash, zoom, bookmark, identify, or unselect the feature in question.

1 From the Tools toolbar, click the Find button.



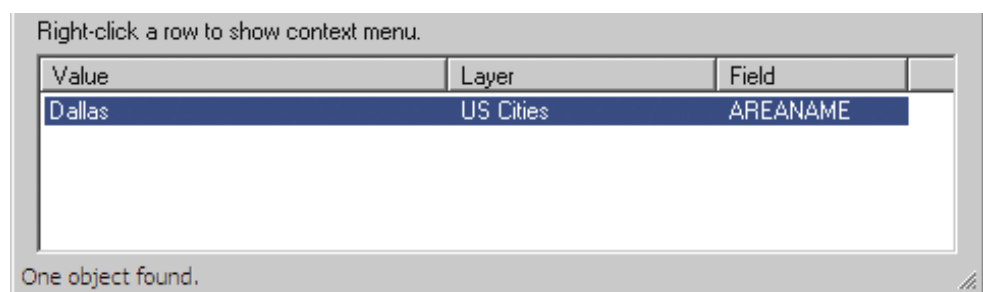
2 Click the Features tab.

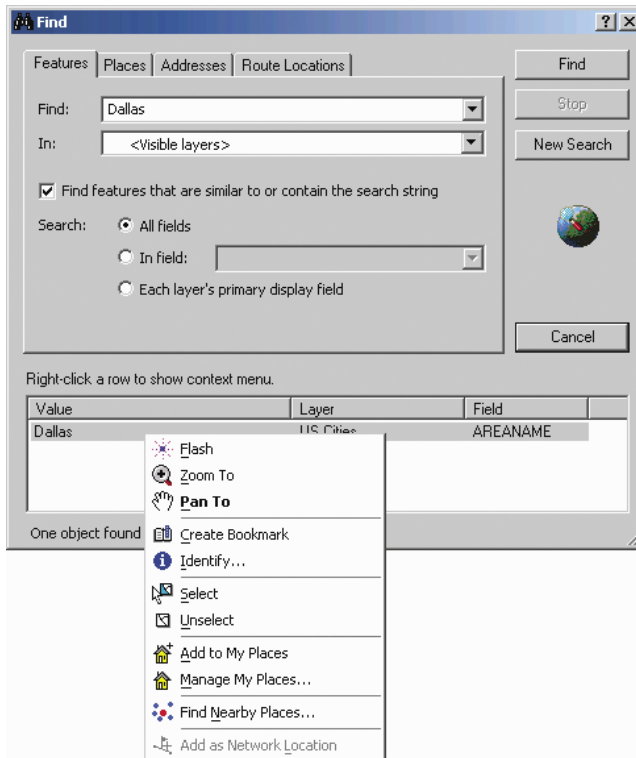
3 Type Dallas as a city name to find.



4 Click Find.

The results will appear in the following section of the Find dialog box.



**5 Right-click the city name and click Zoom To.****6 Click Cancel in the Find dialog box.****YOUR TURN**

Find other cities and practice showing them using other find options such as Flash Features, Identify Feature(s), and Set Bookmark. When finished, clear any selected features and zoom to the full extent.

# Work with feature attribute tables

Tabular attribute data associated with map features can be viewed using the layer's attribute table. To explore the attributes of a layer on a map, open its attribute table to select and find features with particular attribute values.

## *Open the table of the US Cities layer*

1 Right-click the US Cities layer in the table of contents.

2 Click Open Attribute Table.

The table opens, containing one record for each US City point feature. Every layer has an attribute table with one record per feature.

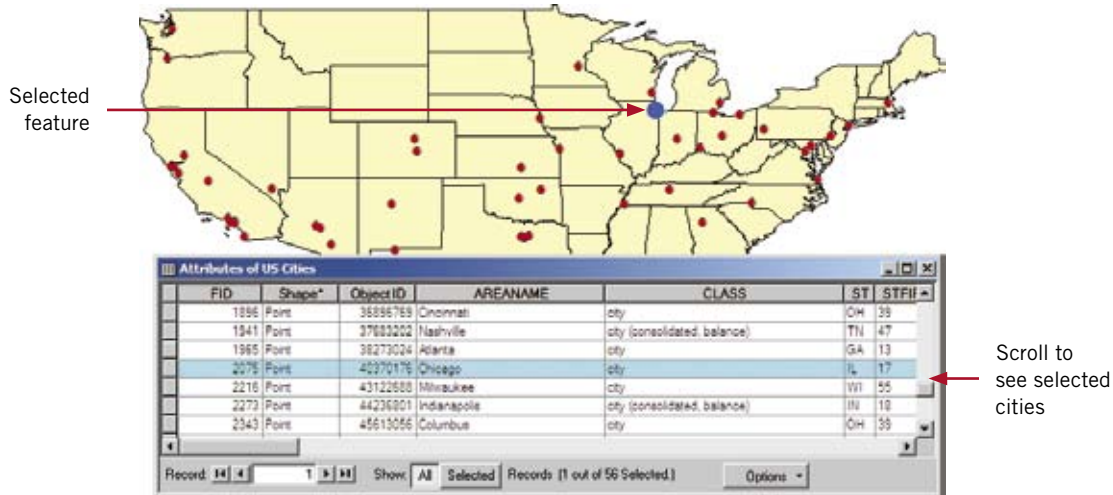
3 Scroll down in the table until you find Chicago (the order of records may be different on your computer) and click the record selector for Chicago to select that record.


If a feature is selected in the attribute table, it will also be selected on the map. You will see this on the next page.

FID	Shape*	ObjectID	AREANAM	CLASS	ST	STFIPS	PLACEFIP	CAPITAL	AREALAND
1675	Point	32571395	Tampa	city	FL	12	71000	N	112.064
1791	Point	34865153	Miami	city	FL	12	45000	N	35.673
1821	Point	35454979	Memphis	city	TN	47	48000	N	279.318
1896	Point	36896769	Cincinnati	city	OH	39	15000	N	77.967
1941	Point	37683202	Nashville	city (consolida	TN	47	52006	Y	473.315
1965	Point	38273024	Atlanta	city	GA	13	04000	Y	131.746
2075	Point	40370176	Chicago	city	IL	17	14000	N	227.131
2216	Point	43122688	Milwaukee	city	WI	55	53000	N	96.064
2273	Point	44236801	Indianapolis	city (consolida	IN	18	36003	Y	361.478
2343	Point	45613056	Columbus	city	OH	39	18000	Y	210.267
2357	Point	45809667	Toledo	city	OH	39	77000	N	80.622
2394	Point	46465024	Cleveland	city	OH	39	16000	N	77.58
2477	Point	48103424	Detroit	city	MI	26	22000	N	138.768
2578	Point	49938433	Pittsburgh	city	PA	42	61000	N	55.584
2719	Point	52690944	Charlotte	city	NC	37	12000	N	242.267

### Show the connection between layers and tables

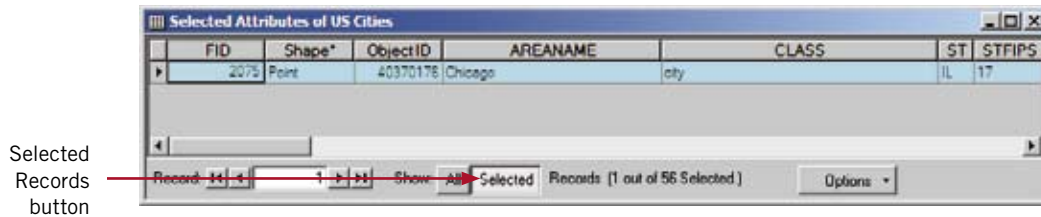
- 1 Resize the Attributes of US Cities table to see both the map and table on the screen.



- 2 Click the Select Features button  and click various cities on the map.
- 3 Scroll through the Attributes of US Cities to see the selected cities.

### Show only selected records

- 1 In the Attributes of US Cities table, click the Selected Records button.



This will show only the records for the features selected in the map.

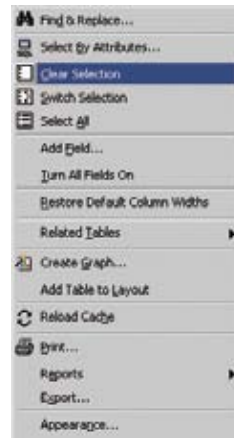
- 2 Click the All Records button to show all records again.

### Clear selections

- 1 In the Attributes of US Cities table, click the Options button. (If you cannot see the Options button, widen the table to the right until it appears.)

Options ▾

- 2 Click Clear Selection.



### Select more than one record from the table

- 1 In the Attributes of US Cities table, click the record selector for Atlanta.
- 2 Hold down the Ctrl key and select the following records: Jacksonville, Miami, and Tampa.

This will highlight these selected features both in the table and the map. Scroll up or down to find these records.

FID	Shape	Object ID	AREANAME
1314	Point	25555041	Houston
1414	Point	27500650	New Orleans
1525	Point	29753345	Jacksonville
1675	Point	32571395	Tampa
1751	Point	34855153	Miami
1821	Point	35454579	Memphis
1856	Point	36896769	Cincinnati

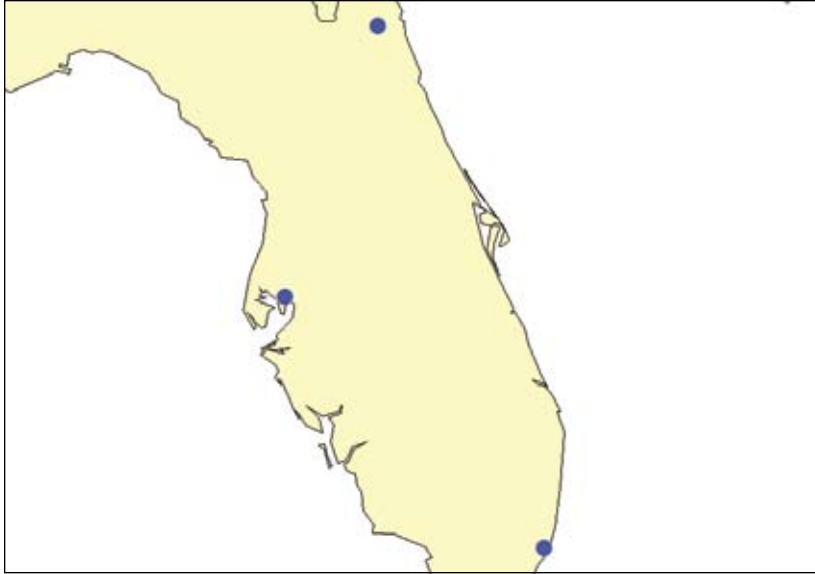
Record: 1 | Show: All Selected | Records (4 out of 56 Selected)

- 3 Hold down the Ctrl key and click the Atlanta record again to deselect it.

### Zoom to selected feature

- 1 Click View, Zoom Data, Zoom to Selected Features.

This will zoom to the three selected cities in Florida.




### Switch selections

- 1 In the Attributes of US Cities table, click the Options button.


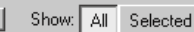
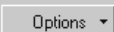
Options ▾

- 2 Click Switch Selection.

 Switch Selection

This reverses the selection: it selects all of those that were not selected and deselects those that were selected.

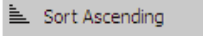
Attributes of US Cities					
FID	Shape*	Object ID	AREANAME	CLASS	
1223	Point	23789571	Fort Worth	city	T
1255	Point	24379392	Dallas	city	T
1280	Point	24969216	Austin	city	T
1314	Point	25559041	Houston	city	T
1414	Point	27590659	New Orleans	city	L
1525	Point	29753345	Jacksonville	city	F
1675	Point	32571395	Tampa	city	F
1791	Point	34865153	Miami	city	F
1821	Point	35454979	Memphis	city	T
1896	Point	36896769	Cincinnati	city	C
1941	Point	37693202	Nashville	city (consolidated, balance)	T
1965	Point	38273024	Atlanta	city	G
2075	Point	40370176	Chicago	city	IL
2216	Point	43122688	Milwaukee	city	W

Record:  1  Show:  All  Selected Records: (53 out of 56 Selected.) 

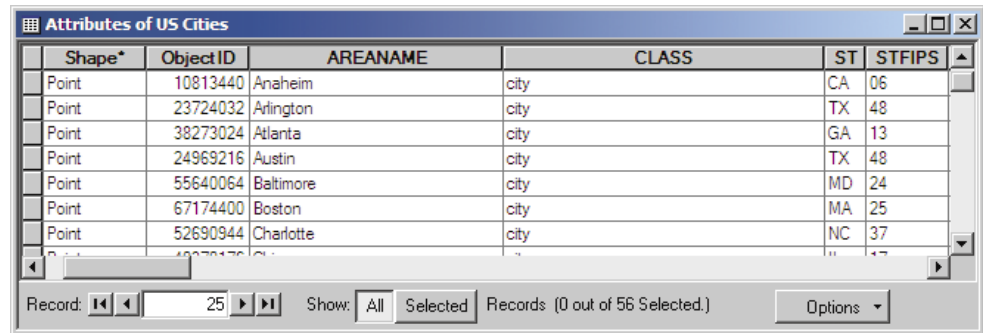
## Clear selections

- 1 In the Attributes of US Cities table, click Options and Clear Selection. 

## Sort a field

- 1 In the Attributes of US Cities table, right-click the AREANAME field name.
- 2 Click Sort Ascending. 

This will sort the table from A to Z by the name of each U.S. city.




Shape*	ObjectID	AREANAME	CLASS	ST	STFIPS
Point	10813440	Anaheim	city	CA	06
Point	23724032	Arlington	city	TX	48
Point	38273024	Atlanta	city	GA	13
Point	24969216	Austin	city	TX	48
Point	55640064	Baltimore	city	MD	24
Point	67174400	Boston	city	MA	25
Point	52690944	Charlotte	city	NC	37

Record: 25 Show: All Selected Records (0 out of 56 Selected.) Options

- 3 Scroll to the right in the table and right-click the POP2000 field name.
- 4 Click Sort Descending. 

This will sort the field from the highest populated city to the lowest populated city.



AREANAM	CLASS	ST	STFIPS	PLACEFIP	CAPITAL	AREALAND	AREAWATER	POP_CL	POP2000	WHITE	BL
New York	city	NY	36	51000	N	303 309	165 563	10	8008278	3576395	21
Los Angeles	city	CA	06	44000	N	489 072	29 218	10	3694820	1734036	4
Chicago	city	IL	17	14000	N	227 131	6 869	10	2896018	1219318	10
Houston	city	TX	48	35000	N	579 413	22 277	10	1953631	962610	4
Philadelphia	city	PA	42	60000	N	135 089	7 546	10	1517550	683267	6
Phoenix	city	AZ	04	55000	Y	474 862	0 227	10	1321045	938953	
San Diego	city	CA	06	66000	N	324 341	47 69	10	1223400	736207	
Dallas	city	TX	48	19000	N	342 542	42 466	10	1188580	604209	3
San Antonio	city	TX	48	65000	N	407 557	4 514	10	1144646	774708	

Record: 18 Show: All Selected Records (0 out of 56 Selected.) Options

**Move a field**

- 1 Click the gray title of the POP2000 field in the Attributes of US Cities table.
- 2 Click, drag, and release the POP2000 field to the left of another field.

FID	Shape*	ObjectID	AREANAM	POP2000	CLASS	ST	STFIPS	PLACEFIP	CAPITAL	AREALAND	ARE
3279	Point	63176706	New York	8008278	city	NY	36	61000	N	303 309	
446	Point	6979433	Los Angeles	3654620	city	CA	06	44000	N	469 072	
2075	Point	40370176	Chicago	2896016	city	IL	17	14000	N	227 131	
1314	Point	26669041	Houston	1963631	city	TX	48	36000	N	579 413	
3004	Point	50441154	Philadelphia	1517550	city	PA	42	60000	N	136 069	
708	Point	13959165	Phoenix	1321045	city	AZ	04	56000	Y	474 862	
666	Point	13172739	San Diego	1223400	city	CA	06	66000	N	324 341	
1255	Point	24379262	Dallas	1100580	city	TX	48	19000	N	342 542	
1191	Point	23265293	San Antonio	1144646	city	TX	48	65000	N	407 557	

- 3 Close the Attributes of US Cities.

**YOUR TURN**

Move and sort by other field names. Try sorting by multiple fields. For example, you could sort US Cities alphabetically or by whether or not they are state capitals.

To sort by multiple fields, rearrange the table's fields so the field whose values will be sorted first appears directly to the left of the field whose values will be sorted second. While holding down the Ctrl key, click the heading of the two fields you want to use to sort the records. Right-click the name of one of the selected fields and choose a sort order. When you sort, the selected fields will be in the sort order you chose.

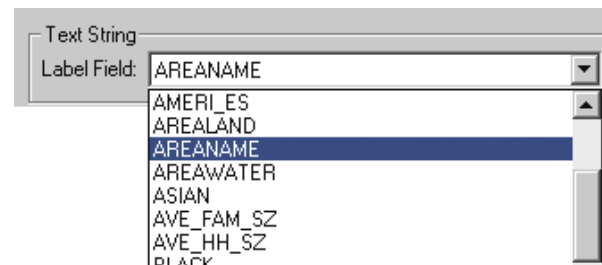


# Label features on the map

Labels are text items on the map that are dynamically placed and whose text values are derived from one or more feature attributes.

## *Set label properties*

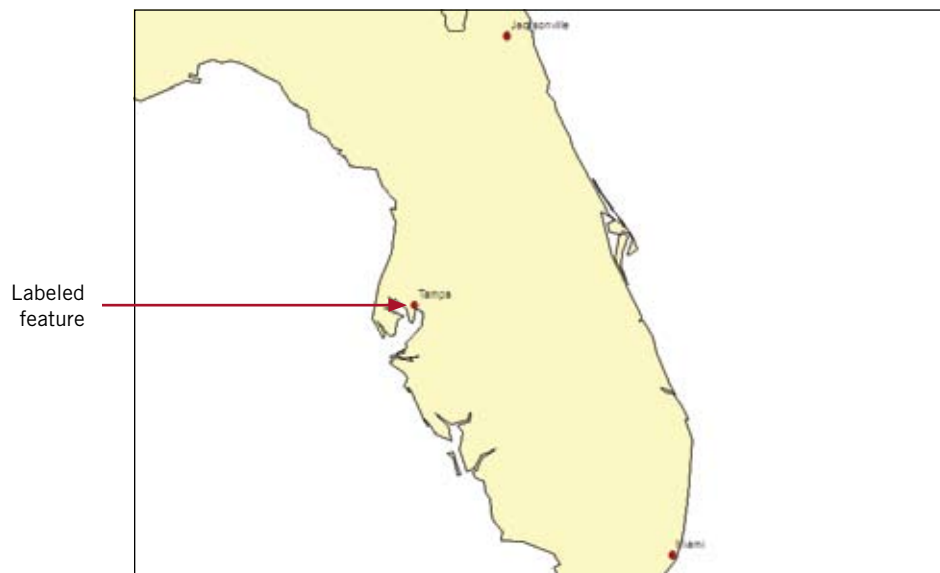
- 1 Zoom to Florida if the map is not already zoomed to that state.
- 2 Right-click the US Cities layer in the table of contents.
- 3 Click Properties.
- 4 Click the Labels tab.
- 5 Click the Label Field drop-down arrow and click AREANAME if not already selected.
- 6 Click OK.



## *Label features*

- 1 Right-click the US Cities layer in the table of contents.
- 2 Click Label Features.

All of the features on the map are labeled.



### ***Remove labels***

- 1 Right-click the US Cities layer in the table of contents.
- 2 Click Label Features.

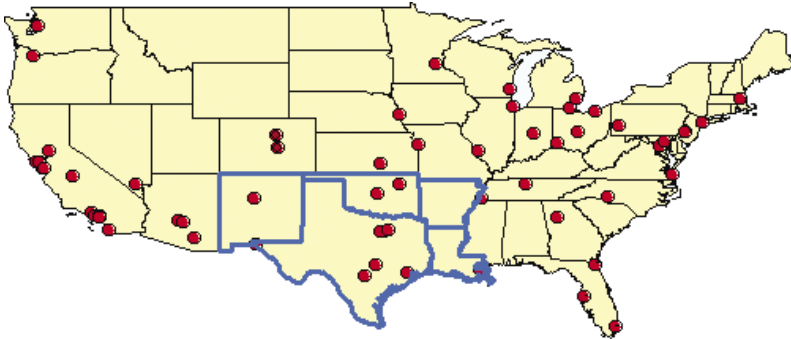
Labels in the map are turned off.

- 3 Click Label Features again to turn them back on.

### ***Get statistics***

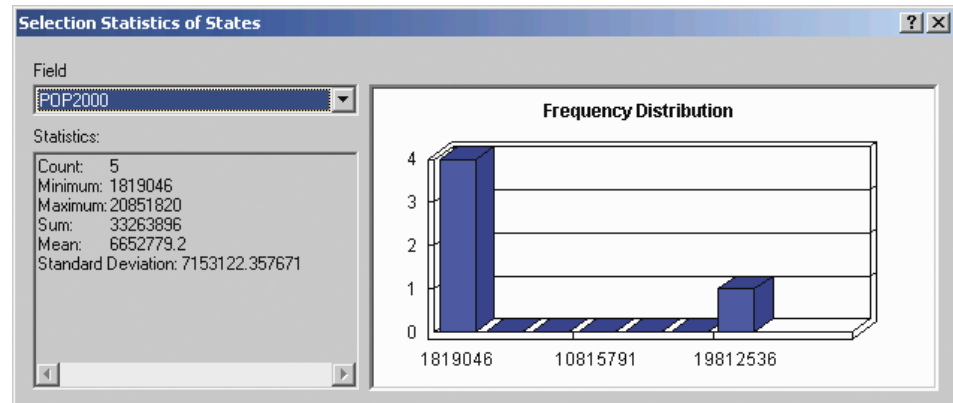
You can get descriptive statistics, such as the mean and maximum value of an attribute, in ArcMap by opening a map layer's attribute table and applying a tool.

- 1 Zoom to the full extent.
- 2 At the bottom of the table of contents, click the Selection tab.
- 3 Check US States so that it is selectable.
- 4 At the bottom of the table of contents, click the Display tab.
- 5 Hold down the Shift key and use the Select Features tool to select the state of Texas and the four states adjacent to it.



- 6 In the table of contents, right-click US States.
- 7 Click Open Attribute Table.
- 8 Right-click the gray column heading for the POP2000 attribute.
- 9 Click Statistics.

The resulting window has statistics for the five selected states; for example, the mean 2000 population is 6,652,779.



## YOUR TURN

Get statistics for a new selection of states and attributes of your choice.

# Relative paths and saving maps

When a layer is added to a map, the path name to the data is stored in the map, but the layer is not copied from its original location. When a map is opened, ArcMap locates the layer data it needs using these stored path names. If ArcMap cannot find the data for a layer, the layer will appear in the ArcMap table of contents but it won't be drawn. Instead, a red exclamation mark (!) will appear next to the layer to indicate that it needs to be repaired.

## ***Absolute path names***

An example of an absolute full path is C:\Gistutorial\Tutorial1.mxd. To share maps saved with absolute paths, everyone who uses the map must either do so on the same computer or have the data on their computer in exactly the same folder structure (e.g., C:\Gistutorial). This is not conducive for a computer lab environment because instructors, teaching assistants, and students all work on different machines. Instead, the relative path option is favored.

You can view information about the data source for a layer by clicking the Source tab in the Layers Properties box.

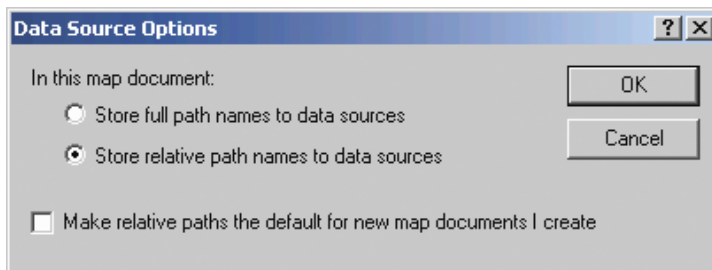
## ***Relative path names***

An example of a relative path is \Gistutorial\Tutorial1.mxd. Relative paths in a map specify the location of the layers relative to the current location on disk of the map document (.mxd file). Because relative paths do not contain drive letter names, they enable the map and its associated data to point to the same directory structure regardless of the drive that the map resides on. If a project is moved to a new drive, ArcMap will still be able to find the maps and their data by traversing the relative paths.

This option, for example, allows you to share maps that you made with data on your local F:\ drive with people who only have a C:\ drive. This also allows you to easily move the map and its data to a different hard drive on your computer, or give the map and its data to another person to copy to their computer.

## ***Saving layers as relative path names***

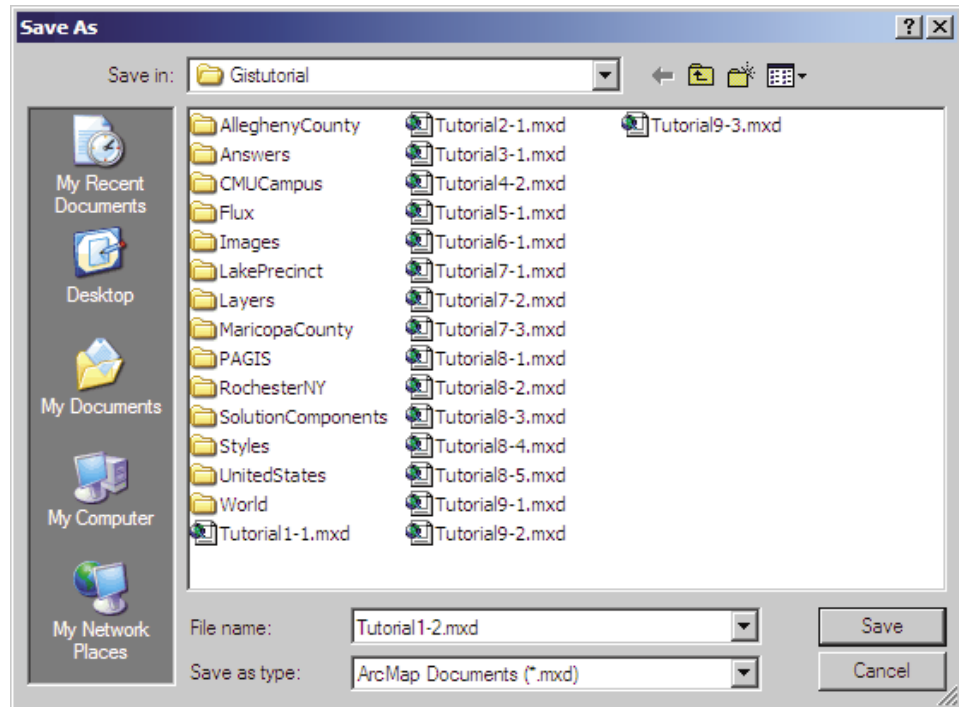
- 1 Click File, Document Properties.
- 2 Click Data Source Options.
- 3 Click the Store relative path names to data sources radio button.



- 4 Click OK and OK again to close the Data Source Options and Tutorial1-1.mxd Properties windows.

### ***Save the project and exit ArcMap***

- 1 Click File, Save As.
- 2 Navigate to the \Gistutorial folder and save the map as Tutorial1-2.mxd.



When you save a map, you save it to a map document file, which has an .mxd file extension. When working with ArcMap you usually spend time setting properties that affect the look and functionality of your map and its layers. For example, in this map you added layers, changed their symbology, and created bookmarks. By saving this map document, all of the work is preserved in the Tutorial1-2.mxd file, which you can reopen anytime or share with others.

- 3 Click File, Exit.

## Assignment 1-1

# Statistics on U.S. housing

In this assignment, you will compare statistics for U.S. states on the number of housing units, number of renter- and owner-occupied units, and highest number of vacant units.

Start with the following:

- **\Gistutorial\UnitedStates\States**—polygon layer of U.S. states with census 2000 data.  
**Attributes of States table**—attribute table for U.S. states that includes the following fields needed for the assignment:
 

<b>STATE_ABBR</b>	two-letter state abbreviation
<b>HSE_UNITS</b>	number of housing units per state
<b>RENTER_OCC</b>	number of renter-occupied units per state
<b>OWNER_OCC</b>	number of owner-occupied units per state
<b>VACANT</b>	number of vacant units per state

### Change the map and get statistics

Create a new map document called C:\Gistutorial\Answers\Assignment1\Assignment1-1.mxd with relative paths and with the above layer of the US States added and symbolized with a hollow-filled color and a medium gray outline. Using the States attribute table and a bright red selection color, select the five states having the highest number of vacant units. Label each state with its abbreviation.

#### Create data document

- Create a Microsoft Word document called C:\Gistutorial\Answers\Assignment1\Assignment1-1.doc.
- In the Word file, create a table with statistics as follows for the five states with the highest number of vacant units only.
- With your finished map document, in ArcMap click File, Export Map and browse to your Gistutorial\Answers\Assignment1 folder to save Assignment1-1.jpg there. In your Word document, place the insertion point after your table and click Insert, Picture, From File. Then browse to Gistutorial\Answers\Assignment1\Assignment1-1.jpg and insert the map image.

Attribute	Mean	Minimum	Maximum
HSE_Units			
Renter_Occ			
Owner_Occ			
Vacant			

*Hint: Copying and pasting statistics*

- Select a statistic in the Statistics output table, press Ctrl + C to copy the statistic, click in the appropriate cell of your Word table, and press Ctrl + V to paste it.

## Assignment 1-2

# Erin Street Crime Watch

Crime prevention depends very much on what the criminology literature calls “informal guardianship”: residents and their neighbors keep an eye on suspicious behavior and intervene in some fashion. Police departments therefore actively promote and support crime watch or block watch citizen groups and keep them informed on crime trends. Suppose that the police commander of a precinct has a notebook computer, ArcMap, and a portable color projector for use at crime watch meetings. Your job is to get the commander ready for a meeting with the 100 block Erin Street crime watch group.

Start with the following:

- **C:\Gistutorial\PAGIS\Midhill\Street**—arc layer for street centerlines in the Middle Hill neighborhood of Pittsburgh. Note: This is a TIGER street centerline map from the U.S. Census Bureau. You will study and use TIGER maps extensively in GIS.
  - Attributes of Street table**—attribute table for streets in the Middle Hill neighborhood that includes the following fields needed for the assignment:
    - Fname** = street name
    - Address Ranges**
      - LeftAdd1** = beginning house number on the left side of the street
      - LeftAdd2** = ending house number on the left side of the street
      - RgtAdd1** = beginning house number on the right side of the street
      - RgtAdd2** = ending house number on the right side of the street
- **C:\Gistutorial\PAGIS\Midhill\Curbs**—arc layer for curbs in the Middle Hill neighborhood of Pittsburgh. Note that this and the remaining layers are in a map format called a coverage. After you browse to the Midhill folder, you have to double-click the Curbs coverage icon and then double-click Arc to add the curbs to your map document.
- **C:\Gistutorial\PAGIS\Midhill\Building**—polygon layer for buildings in the Middle Hill neighborhood of Pittsburgh.
- **C:\Gistutorial\PAGIS\Midhill\Mid911**—point layer for 911 emergency calls for service in the Middle Hill neighborhood of Pittsburgh.
  - Attributes of Mid911 table**—attribute table for mid911 points that includes the following attributes needed for the assignment:
    - Nature\_Code** = call type
    - Date** = date of crime
    - Address** = addresses of crime locations

### *Change the map and get statistics*

Create a new map document with the above layers saved as C:\Gistutorial\Answers\Assignment1\Assignment1-2.mxd with relative paths that includes a zoomed view of the Erin Street block selected and labeled with street names. Display streets, curbs, and buildings as medium-light gray lines, and 911 calls as bright red circles. Create a spatial bookmark of the zoomed area called Erin Street.

**Create data document**

- Create a table of addresses, dates of calls, and call types for crimes in the 100 block of Erin Street (see hints). The street names will include Davenport, Erin, and Trent. Create **C:\Gistutorial\Answers\Assignment1\Assignment1-2.doc** and paste the table into it as directed in the hints below.

Address	Date	Call Type

*Hints*

- The 100 block of Erin Street is the segment of Erin Street whose address range is from 100 to 199 and perpendicular to streets Webster and Wylie. The crime reports are prepared for the two blocks on either side of Erin Street in this range. Use both the attribute table and Identify tool to find and label these streets.
- Although it appears that there are only six points, there are actually thirteen total because multiple calls are at the same location. Use the Select Features button and information in the attribute table to get the data on all relevant calls.
- Data can be exported from the attribute table. In the table, choose “Options” and “Export.” Save the selected records to a .dbf file. Open the .dbf file in Microsoft Excel, edit the records, and paste from there into Assignment1-2.doc.

**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 1. 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 required files as one .zip document for review and grading. Include your name and assignment number in the .zip document (YourNameAssn1.zip).

**ArcMap documents**

C:\Gistutorial\Answers\Assignment1\Assignment1-1.mxd  
 C:\Gistutorial\Answers\Assignment1\Assignment1-2.mxd

**Word documents**

C:\Gistutorial\Answers\Assignment1\Assignment1-1.doc  
 C:\Gistutorial\Answers\Assignment1\Assignment1-2.doc