

12. Suppose you are required to do a GIS project for a class. What types of activities or operations do you have to perform to complete the project?
13. Name *two* examples of vector data analysis.
14. Name *two* examples of raster data analysis.
15. Describe an example from your discipline in which a GIS can provide useful tools for building a model.

APPLICATIONS: INTRODUCTION

ArcGIS uses a single scalable architecture and user interface. ArcGIS has three versions: ArcView, ArcEditor, and ArcInfo. ArcView is the simplest version and has fewer capabilities than the other two versions. All three versions use the same applications of ArcCatalog and ArcMap and share the same extensions such as Spatial Analyst, 3D Analyst, Network Analyst, and Geostatistical Analyst. ArcInfo has the additional ArcInfo Workstation, a command-driven application similar to ARC/INFO version 7.x.

You can tell which version of ArcGIS you are using by looking at the title of an application. For example, the title of ArcCatalog may appear as ArcCatalog—ArcView or ArcCatalog—ArcInfo, depending on if you are using ArcView or ArcInfo. To check the availability of the extensions, you can do the following: close all ArcGIS applications, click the Start menu, point to Programs, point to ArcGIS, and select Desktop Administrator. Click on Availability in the next menu to display the available licenses.

This applications section covers two tasks. Task 1 introduces ArcCatalog and ArcToolbox, and Task 2 ArcMap and the Spatial Analyst extension. Typographic conventions used in the instructions include italic typeface for data sets (e.g., *emidalat*) and boldface for questions (e.g., **Q1**).

Task 1: Introduction to ArcCatalog

What you need: *emidalat*, an elevation raster; and *emidastrm.shp*, a stream shapefile.

Task 1 introduces ArcCatalog, an application for managing data sets.

1. Start ArcCatalog. ArcCatalog lets you set up connections to your data sources, which may reside in a folder on a local disk or on a database on the network. For Task 1, you will first connect to the folder containing the Chapter 1 database (e.g., chap1). Click the Connect to Folder button. Navigate to the chap1 folder and click OK. The chap1 folder now appears in the Catalog tree. Expand the folder to view the data sets.
 2. Click *emidalat* in the Catalog tree. Click the Preview tab to view the elevation raster. Click the Metadata tab, and select FGDC for the style sheet. The narrative shows that *emidalat* is a raster dataset projected onto the Universal Transverse Mercator (UTM) coordinate system.
- Q1.** What does FGDC stand for?
3. Click *emidastrm.shp* in the Catalog tree. On the Preview tab, you can preview the geography or table of *emidastrm.shp*.
 4. ArcCatalog has tools for various data management tasks. You can access these tools by right-clicking a data set to open its context menu. Right-click *emidastrm.shp*, and the menu shows Copy, Delete, Rename, Create Layer, Export, and Properties. Using the context menu, you can copy *emidastrm.shp* and paste it to a different folder, rename it, or delete it. A layer file is a visual representation of a data set. The export tool can export a shapefile to a geodatabase, a coverage, and other formats. The properties dialog shows the data set information.
 5. This step lets you create a personal geodatabase and then import *emidalat* and *emidastrm.shp* to the geodatabase. Right-click

the Chapter 1 database in the Catalog tree, point to New, and select Personal Geodatabase. Click the new geodatabase and rename it *Task1.mdb*. If the extension *.mdb* does not appear, select Options from the Tools menu and on the General tab uncheck the box to hide file extensions.

6. There are two options for importing *emidalat* and *emidastrm.shp* to *Task1.mdb*. For the first option, right-click *Task1.mdb*, point to Import, and select Raster Datasets. In the next dialog, navigate to *emidalat*, add it for the input raster, and click OK to import.
 7. Now you will use the second option, ArcToolbox, to import *emidastrm.shp* to *Task1.mdb*. ArcCatalog's standard toolbar has a button called Show/Hide ArcToolbox Window. Click the button to open ArcToolbox. Dock the ArcToolbox window so that you can see both the window and the Catalog tree. Right-click ArcToolbox, and select Environments. The Environment Settings dialog can set the working directory, which is important for most operations. Click the dropdown arrow for General Settings. Navigate to the Chapter 1 database and set it to be the current workspace. Tools in ArcToolbox are organized into a hierarchy. The tool you need for importing *emidastrm.shp* resides in the Conversion Tools/To Geodatabase toolset. Double-click Feature Class to Feature Class to open the tool. Select *emidastrm.shp* for the input features, select *Task1.mdb* for the output location, specify *emidastrm* for the output feature class name, and click OK. Expand *Task1.mdb* to make sure that the import operations have been completed.
- Q2.** The number of usable tools in ArcToolbox varies depending on which version of ArcGIS you are using. Go to ArcGIS Desktop Help/Geoprocessing tool reference. The reference section offers two documents: "Geoprocessing commands quick reference guide" and "Licensing for geoprocessing

tools." Both documents have information on tools and their required license. Is the Feature Class to Feature Class tool for Task 1 available to all three versions of ArcGIS?

Task 2: Introduction to ArcMap

What you need: *emidalat* and *emidastrm.shp*, same as Task 1.

In Task 2, you will learn the basics of working with ArcMap.

1. You can start ArcMap by clicking the Launch ArcMap button in ArcCatalog or from the Programs menu. ArcMap is the main application for data display, data query, data analysis, and data output. ArcMap organizes data sets into data frames (also called *maps*). You open a new data frame called Layers when you launch ArcMap. Right-click Layers, and select Properties. On the General tab, change the name Layers to Task 2 and click OK.
2. Next, add *emidalat* and *emidastrm.shp* to Task 2. Click the Add Data button in ArcMap, navigate to the Chapter 1 database, and select *emidalat* and *emidastrm.shp*. To select more than one data set to add, click the data sets while holding down the Ctrl key. An alternative to using the Add Data button is to use the drag-and-drop method. You can add a data set in ArcMap by dragging it from the Catalog tree and dropping it in ArcMap's view window.
3. A warning message states that one or more layers are missing spatial reference information. Click OK to dismiss the dialog; *emidastrm.shp* does not have the projection information, although it is based on the UTM coordinate system, as is *emidalat*. You will learn in Chapter 2 how to define a coordinate system.
4. Both *emidastrm* and *emidalat* are highlighted in the table of contents, meaning that they are both active. You can deactivate one or the other by clicking on the empty space. The

table of contents has three tabs: Display, Source, and Selection. On the Display tab, you can change the drawing order of the layers by dragging and dropping a layer up or down. The Source tab shows the data source of each layer. (The Source tab also lists tables that have been added.) The Selection tab lets you choose the selectable layer.

- Q3.** Does ArcMap draw the top layer in the table of contents first?
- 5.** The Standard toolbar in ArcMap has such tools as Zoom In, Zoom Out, Pan, Select Elements, and Identify. When you hold the mouse point over a tool, a tooltip appears in a floating box giving the name of the tool, and a short message about the use of the tool appears in the status bar at the bottom of the ArcMap window.
- 6.** ArcMap has two views: Data View and Layout View. (The buttons for the two views are located at the bottom of the view window.) Data View is for viewing data, whereas Layout View is for viewing the map product for printing and plotting. For this task, you will stay with Data View.
- 7.** This step is to change the symbol for *emidastrm*. Click the symbol for *emidastrm* in the table of contents to open the Symbol Selector dialog. You can either select a preset symbol (e.g., river) or make up your own symbol for *emidastrm* by specifying the color, width, and properties of the symbol. Choose the preset symbol for river.
- 8.** Next, classify *emidalat* into the elevation zones <900, 900–1000, 1000–1100, 1100–1200, 1200–1300, and >1300 meters. Right-click *emidalat*, and select Properties. Click the Symbology tab. Click Classified in the Show frame. Click Yes in the Compute Unique Values dialog. Change the number of classes to 6, and click the Classify button. The Method dropdown list shows seven methods. Select Manual. There are two ways to set the break values for the elevation zones manually. To use the first method, click the first break line and drag it to a data value near 900. Then, set the other break lines near 1000, 1100, 1200, 1300, and 1337. To use the second method, which is normally preferred, click the first cell in the Break Values frame and enter 900. Then enter 1000, 1100, 1200, and 1300 for the next four cells. (If the break value you entered is changed to a different value, reenter it.) Use the second method to set the break values, and click OK to dismiss the Classification dialog.
- Q4.** List the other classification methods besides Manual that are available in ArcMap.
- 9.** You can change the color scheme for *emidalat* by using the Color Ramp dropdown list in the Layer Properties dialog box. Sometimes it is easier to select a color scheme using words instead of graphic views. In that case, you can right-click inside the Color Ramp box and uncheck Graphic View. The Color Ramp dropdown list now shows White to Black, Yellow to Red, etc. Select Elevation #1. Click OK to dismiss the dialog.
- 10.** ArcMap has access to several extensions including Spatial Analyst. Select Extensions from the Tools menu and check Spatial Analyst. Then, select Toolbars from the View menu and check Spatial Analyst. The Spatial Analyst toolbar should now appear in ArcMap. Click the Spatial Analyst dropdown arrow, point to Surface Analysis, and select Slope. In the Slope dialog, select *emidalat* for the input surface and click OK to run the command. *Slope of emidalat* is the slope layer of *emidalat*. An alternative is to use ArcToolbox in ArcMap. The Slope tool in the Spatial Analyst Tools/Surface toolset can perform the same operation except that you have to save the output on disk.
- Q5.** To use an extension such as Spatial Analyst, you must work with the Tools menu and the View menu. Why?

11. You can save Task 2 as a map document before exiting ArcMap. Select Save or Save As from the File menu in ArcMap. Navigate to the Chapter 1 database, enter *chap1* for the file name, and click Save. ArcMap automatically adds the extension *.mxd* to *chap1*. Data sets displayed in Task 2 are now saved with *chap1.mxd*. To re-open *chap1.mxd*, *chap1.mxd* must reside in the same folder as the data sets it references. You can save a map document with the relative path name option (e.g., without the drive name). Select Document Properties from ArcMap's File menu. In the next dialog, click on Data Source Options. The Data Source Options dialog has the options of full path names and relative path names.
12. To make sure that *chap1.mxd* is saved correctly, first select Exit from ArcMap's File menu. Then launch ArcMap again. Click File and select *chap1.mxd*.

Challenge Task

What you need: *menan-buttes*, an elevation raster.

This challenge question asks you to display *menan-buttes* in 10 elevation zones and save the map along with Task 2 in *chap1.mxd*.

1. Open *chap1.mxd*. Select Data Frame from ArcMap's Insert menu. Rename the new data frame Challenge, and add *menan-buttes* to Challenge.
2. Display *menan-buttes* in 10 elevation zones by using the elevation #2 color ramp and the following break values: 4800, 4900, 5000, 5100, 5200, 5300, 5400, 5500, 5600, and 5619 (feet).
3. Save Challenge with Task 2 in *chap1.mxd*.

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