

GIS Analysis Pathway

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ArcGIS Desktop II: Tools and Functionality

3 days (24 hours)

Authored by ESRI

▼Overview

*This course is part of the [ArcGIS Desktop 9.3 Foundational Training Curriculum](#). The ArcGIS 9.2 version of this course was titled *Introduction to ArcGIS I*.*

ArcGIS Desktop software is an integrated system that includes all the tools needed to get the most out of a GIS. This course teaches the range of functionality available in the software and the essential tools for visualizing, creating, managing, and analyzing geographic data. The hands-on course exercises emphasize practice with ArcMap and ArcCatalog (the primary applications included with ArcGIS Desktop software) to perform common GIS tasks and workflows. The tools for creating and managing geographic data, displaying data on maps in different ways, and combining and analyzing data to discover patterns and relationships are highlighted, and you learn how ArcGIS Desktop provides a complete GIS software solution. By the end of the course, you will be prepared to start working with the software on your own.

▼Who Should Attend

This course is designed for those with an education in or workplace experience with GIS but no ArcGIS software experience. This course assumes knowledge of basic GIS concepts. This course teaches the skills and knowledge needed to take other ArcGIS courses, including [ArcGIS Desktop III: GIS Workflows and Analysis](#).

▼Goals

Those who complete this course will be able to

- List common GIS tasks and identify which ArcGIS Desktop application is used for each task.
- Understand what the geodatabase offers for GIS data storage.
- Create and edit geodatabase features.
- Control the appearance and display of data layers in ArcMap.
- Classify and symbolize map data.
- Label map features.
- Change the coordinate system and map projection used to display a dataset.

- Access feature information in tables and control table display properties.
- Query and analyze GIS data.
- Create presentation-quality maps and graphs.

▼ **Topics Covered** [Table of Contents](#) [PDF 25kb]

- Investigating geographic data: How geographic data is stored; Vector and raster data; Geodatabase basics and advantages; Shapefiles; Coverages; CAD data; Managing data in ArcCatalog; Displaying data in ArcMap; ArcMap basics; Data and layers.
- Managing map layers: Zooming to layers; Bookmarks; Display windows; Scale ranges; Group layers; Selection layers; Layer files; Creating hyperlinks.
- Symbolizing categorical data: Symbology; Choosing symbology; Types of symbols (marker, line, fill); Creating symbols.
- Symbolizing quantitative data: Symbology options (graduated colors, graduated symbols, proportional symbols, dot density, charts); Classification methods (Natural Breaks, Equal Interval, Quantile, Manual); Excluding data from a classification; Rendering raster data.
- Labeling map features: Label placement for different feature types (points, lines, polygons); Label symbology; Controlling label display using scale range and SQL query; Label classes; Label expressions; Label ranks and weights; What is annotation?; Geodatabase annotation; Map annotation.
- Using coordinate systems and map projections: What is a coordinate system?; Geographic coordinate systems; Datums; Projected coordinate systems; Map projections; Feature classes and coordinate systems; Data frames and coordinate systems; Geographic transformations; Working with an unknown coordinate system; Projecting data; Defining a projection.
- Making a map layout: Working in layout view; Tools for arranging map elements; Data frame properties for layouts; Adding legends, scale bars, and other map elements; Exporting maps; Working with map templates.
- Managing tables: Table structure; Layer attribute tables; Nonspatial tables; Getting information from tables; Field properties; Table appearance; Creating graphs and reports; Connecting tables using joins and relates; Cardinality.
- Editing features and attributes: Reasons to edit data; Working with the Editor toolbar; Edit sketches; Common editing tools; Edit tasks; Snapping to features while editing; Editing attributes; Calculating values for geometry fields; Working with coincident geometry in a map topology; Typical editing workflow.

- Creating geodatabases and feature classes: Types of geodatabases; Geodatabase organization; Feature class organization; Feature class properties and attributes; Metadata; Creating, viewing, and editing metadata; Importing and exporting metadata; Creating features in a new feature class.
- Getting locations from attributes: Adding x,y coordinate data; Finding places and addresses; Finding routes and nearby places; Geocoding; Geocoding components (address table, address locator, reference data); Address matching overview; Geocoding workflow; Reference data sources.
- Solving spatial problems with query and analysis: GIS analysis basics; Typical analysis workflow; Common analysis operations (attribute and spatial queries, clipping data from layers, buffering features, overlaying features); Overview of geoprocessing; Analysis results.
- Customizing ArcGIS Desktop: Why customize the interface?; Customize dialog box; Locating commands; Adding new toolbars, commands, and menus; Saving customizations; Saving to a template; Storing templates.

▼Prerequisites

Students should have completed [ArcGIS Desktop I: Getting Started with GIS](#) or [Getting Started with GIS](#) or have equivalent knowledge.

▼Software Used in Course

This course is designed to work with the following software:

ArcGIS Desktop*	Version
ArcEditor	9.3
ArcInfo	9.3
ArcView	9.3

*Only one of the listed licenses will be used in the classroom.

ArcGIS Desktop III: GIS Workflows and Analysis

2 days (16 hours)

Authored by ESRI

▼Overview

*This course is part of the [ArcGIS Desktop 9.3 Foundational Training Curriculum](#). The ArcGIS 9.2 version of this course was titled *Introduction to ArcGIS II*.*

Understanding how and when to apply ArcGIS tools and functions is the key to creating an efficient GIS workflow. Building on the skills and knowledge taught in *ArcGIS Desktop II: Tools and Functionality*, this course shows how to apply ArcGIS tools in a workflow context with a focus on working with data stored in a geodatabase and performing geoprocessing and analysis. In the course exercises, you organize and edit data stored in a geodatabase, prepare data for analysis, create and edit geoprocessing models using ModelBuilder, and work through a challenging analysis project.

▼Who Should Attend

This course is designed for experienced ArcGIS users who want to learn more about the ArcGIS tools for creating and editing data and GIS analysis.

▼Goals

Those completing this course will be able to

- Add data from different sources to a geodatabase.
- Work with subtypes to edit data.
- Edit and validate feature geometry and attributes using geodatabase topology.
- Run analysis tools using dialog boxes and models.
- Build a complex model using ModelBuilder.

▼Topics Covered [Table of Contents](#) [PDF 21kb]

- Getting data into the geodatabase: Advantages of migrating data to the geodatabase; File and personal geodatabases; Loading and importing data; Data sources available for conversion; ArcToolbox conversion tools; Importing and exporting data in ArcCatalog; Importing and exporting data using XML; Copying and pasting data between geodatabases; Batch and single conversions; Loading data into existing feature classes using the Simple Data Loader; Displaying x,y coordinate data from a table; Accessing

tabular data using an OLE DB connection; Adding data from a GIS server; Working with map projections and datums.

- Geodatabase behavior: What is behavior?; Advantages of using behaviors; Default values; Subtypes; Domains; Geodatabase topology.
- Editing GIS data: Creating new data (digitizing, copying and pasting features, Editor menu commands); Constructing an edit sketch using constraints (direction, length, parallel); Creating adjacent polygons using the Auto-Complete Polygon task; Modifying existing features; Reshaping existing features and boundaries; Exploding multipart features; Editing using domains, subtypes, and topology.
- Aligning spatial data: Common data alignment problems; Georeferencing CAD data; Matching layer boundaries; Transformation; Rubber sheeting; RMS error.
- Managing geoprocessing tools and settings: Types of toolboxes and how they are stored; Types of tools (system tools, models, scripts); Locating tools in ArcToolbox; Executing tools; Tool parameters; Parameter error detection; Environment settings; Tool layers; Geoprocessing results.
- Analyzing GIS data: Review of common analysis tools (Buffer, Clip, Intersect, Select, Union); Working with feature proximity tools (Near, Spatial Join, Multiple Ring Buffer, Create Thiessen Polygons); Analyzing tabular data; Creating a raster subset; Analysis options outside of core ArcGIS Desktop; Typical analysis workflow.
- Using ModelBuilder for analysis: Working with ModelBuilder; Creating and designing models; Model elements (tools and variables); Setting general model properties; Setting model parameters; Environment settings; Intermediate data; Running and troubleshooting a model; Creating model documentation.
- GIS analysis projects: Real-world GIS analysis projects (Find the best site for a new shelter, Find the mileage of flooded roads); The analytical process for each project.

▼Prerequisites

Students should have completed [ArcGIS Desktop II: Tools and Functionality](#) or [Learning ArcGIS Desktop](#) or have equivalent knowledge.

▼Software Used in Course

This course is designed to work with the following software:

ArcGIS Desktop	Version
ArcInfo	9.3

Understanding Map Projections and Coordinate Systems

6 modules (18 hours)

Authored by ESRI

▼ Overview

Accurately representing features found on the earth's three-dimensional surface on a flat piece of paper or computer screen is a huge logistical problem—one whose solution involves mathematics, human ingenuity, and ever-evolving technology. In a GIS, map projections and coordinate systems are used to map real-world features. This six-module course introduces the fundamental concepts behind map projections and coordinate systems. Essential characteristics of all map projections—aspect, perspective, and distortion—are discussed. The emphasis is on theory, but students gain practical experience working with ArcGIS software to apply map projections, modify their properties, and manipulate data stored in different coordinate systems. This course does not teach the mathematics behind individual map projections.

▼ Who Should Attend

This course is designed for students and GIS professionals who want to understand the properties of different map projections and coordinate systems.

▼ Goals

Those completing this course will be able to

- Explain map projection distortion.
- Define map projection plane and aspect.
- Set map projection parameters.
- List strengths and weaknesses of different map projections.
- Describe horizontal datums.
- Understand the properties of different coordinate systems.

▼ Topics Covered

- Sizing Up the Earth: Discovering the earth's shape and size; Refining the earth's shape; Establishing location
- Flattening the Earth: Birth of the map projection; Developable surfaces; Refining the map projection

- Understanding Aspect and Perspective: Aspect for cylindrical projections; Aspect for planar projections; Aspect for conic projections; Perspective; Classifying projections
- Understanding and Controlling Distortion: Understanding distortion; Examining tangents and secants; Projection parameters; Choosing a projection
- Geographic and Planar Coordinate Systems: What is a coordinate system?; Commonly-used coordinate systems
- Introduction to Datums: Basics of datums; Datum transformations

▼Prerequisites

Students should be familiar with basic GIS concepts. Familiarity with ArcGIS software is beneficial.

▼Software Required

To complete course exercises, you need the following software:

ArcGIS Desktop*	Version
ArcView	9.1, 9.2 or 9.3
ArcEditor	9.1, 9.2 or 9.3
ArcInfo	9.1, 9.2 or 9.3

*Only one product in this category is required.

Advanced Analysis with ArcGIS

3 days (24 hours)

Authored by ESRI

▼Overview

ArcGIS software provides many tools for solving complex spatial problems. This course examines modeling techniques used in spatial analysis and introduces processes and tools that can be used to perform a variety of GIS analysis tasks. The ArcGIS geoprocessing framework, which includes ArcToolbox, ModelBuilder, the command line, and scripts, is emphasized. Project-based exercises draw from a range of interesting real-world GIS applications. The course concludes with an exciting final project in which you are challenged to implement many of the tools taught throughout the course. This course is taught using an ArcInfo license of ArcGIS because some of the advanced analysis tools used in exercises require an ArcInfo license.

▼Who Should Attend

This course is designed for experienced ArcGIS users who want to learn about the advanced features of ArcGIS software for use in analysis.

▼Goals

Those completing this course will be able to

- Understand the analytical process and reasons for performing analysis.
- Describe various types of models.
- Understand the ArcGIS geoprocessing framework including ModelBuilder, the command line, tools, and scripts.
- Find and apply a variety of geoprocessing tools.
- Create models and document workflows with ModelBuilder.

▼Topics Covered [Table of Contents](#) [PDF 45kb]

- Introduction to analysis: What is spatial analysis?; Simple types of analysis; Common issues in analysis; Documenting workflow.
- Modeling techniques: Spatial modeling concepts and issues; Types of models for analysis.
- Geoprocessing in ArcGIS: Overview of the geoprocessing framework in ArcGIS; Toolboxes and tools; Executing tools; Creating toolboxes and updating documentation; Executing tools from the command line.

- Using the Analysis toolbox: Overlay operations; Proximity analysis; Extracting features for analysis; Frequency and summary statistics of attributes.
- Building models in ModelBuilder: Why use models?; Creating a model; Executing models; Changing model properties; Validating a model; Distributing models; Advanced modeling techniques.
- Introduction to the Spatial Statistics toolbox: Introduction to spatial statistics; Analyzing patterns and measuring geographic distributions.

▼Prerequisites

Students should have completed [ArcGIS Desktop II: Tools and Functionality](#) or [Learning ArcGIS Desktop](#) and [ArcGIS Desktop III: GIS Workflows and Analysis](#) or have equivalent knowledge.

▼Software Used in Course

This course is designed to work with the following software:

ArcGIS Desktop	Version
ArcInfo	9.3

ArcGIS Extensions	Version
Spatial Analyst	9.3

Working with ArcGIS Network Analyst

2 days (16 hours)

Authored by ESRI

▼Overview

Built around the network dataset, ArcGIS Network Analyst software incorporates an advanced connectivity model to accurately represent real-world multimodal networks. This course teaches how to create network datasets and migrate existing data, such as shapefiles and coverages, into a network dataset in order to model and analyze transportation networks. You work with network datasets to solve different types of network problems such as finding the most efficient travel route, finding the closest facility, and defining service areas based on travel time. The course also teaches how to calculate origin-destination matrices for network locations and assign routes and stops for a fleet of vehicles.

Note: Except for comparison purposes, the course does not cover geometric networks, which are typically used to model directed flow networks in utilities such as electric and gas, pipeline, water/wastewater, telecommunications, and location-based services.

▼Who Should Attend

This course is designed for experienced ArcGIS users who want to perform GIS-based routing and transportation network analysis. Those working in the transportation, logistics, public safety, local government, utilities, and business industries may find the course of particular interest.

▼Goals

Those completing this course will be able to

- Understand the fundamental concepts of the ArcGIS network dataset.
- Create network datasets.
- Define network dataset properties such as network elements, connectivity groups, and network attributes.
- Migrate existing network data sources to ArcGIS network datasets.
- Generate and use turn movements within network datasets.
- Solve routing, closest facility, service area, origin-destination, and vehicle routing problems in a transportation network.
- Perform transportation network analysis using tools and models.

▼ **Topics Covered** [Table of Contents](#) [PDF 18kb]

- Fundamentals of network systems: Directed flow networks; Undirected flow networks; Physical and logical network representation; Edges, junctions, and turns; Overview of working with a network dataset.
- Network Analyst basics and the Route solver: Network analysis workflow; the Network Analyst toolbar and Network Analyst window; Network layers vs. network analysis layers; Network locations—stops, barriers, and routes; Network analysis layer properties—impedance, turns, restrictions, and time windows; Route solver concepts; Route solver types; Route outputs and direction reports.
- Additional network solvers: Closest Facility solver, options and results; Service Area solver, options and results; Origin-Destination Cost Matrix solver, options and results; Vehicle Routing Problem solver, options and results.
- Advanced network analysis options: Setting network locations; Network location attributes; Network location analysis properties; Time windows; Curb approach; Edge hierarchy; Exact vs. hierarchical routes.
- Preparing data for network analysis: Workflow for network analysis; Allowable data sources; Data quality requirements; Feature coincidence, connectivity, and the Integrate tool; Network attributes; Migrating coverage and shapefile networks to the geodatabase.
- Network dataset connectivity: Connectivity groups, policies and elevations; Connectivity with sources and subtypes; Connectivity requirements; Multiple connectivity groups; Connectivity between groups; Edge and junction connectivity policies; Elevation levels and connectivity; Modeling intersections and overpasses; Connectivity scenarios and solutions.
- Network attributes: Edge, junction, and turn attributes; Network attribute properties; Network attribute types; Cost attributes; Restriction attributes; Hierarchy attributes; Descriptor attributes; Edge directionality attributes; Setting network element attributes with Evaluators; Creating parameters on attributes.
- Creating and building network datasets: Workflow for building a network; Selecting sources; Setting connectivity; Setting turns and turn penalties; Setting network attributes; Setting direction properties; Building network datasets for geodatabases, shapefiles, or StreetMap datasets.
- Modifying network datasets: Editing network point, line, and turn features; Editing network dataset properties; Rebuilding the network dataset; Creating multimodal networks; Multimodal networks and connectivity groups; Multimodal analysis.

- Network Analyst and geoprocessing: Geoprocessing framework review; Network Analyst Tools toolbox; Network Analyst tools; Network solvers in ModelBuilder.

▼Prerequisites

Students should have completed [ArcGIS Desktop II: Tools and Functionality](#) or [Learning ArcGIS Desktop](#) and [ArcGIS Desktop III: GIS Workflows and Analysis](#). Completion of [Building Geodatabases](#) is recommended.

▼Software Used in Course

This course is designed to work with the following software:

ArcGIS Desktop*	Version
ArcView	9.3
ArcEditor	9.3
ArcInfo	9.3

*Only one of the listed licenses will be used in the classroom.

ArcGIS Extensions	Version
Network Analyst	9.3

Working with ArcGIS Spatial Analyst

3 days (24 hours)

Authored by ESRI

▼Overview

ArcGIS Spatial Analyst software provides tools for conducting sophisticated spatial analyses and creating different types of spatial models. This course covers fundamental raster data concepts and shows how to use ArcGIS Spatial Analyst tools to create, process, and analyze spatial data. You focus on problems that are best solved in a raster environment such as surface analysis and distance measurement. The use of ArcGIS Spatial Analyst tools in the ArcGIS geoprocessing framework is emphasized.

▼Who Should Attend

This course is designed for experienced ArcGIS users who want to conduct raster-based analysis, conversion, and editing.

▼Goals

Those completing this course will be able to

- Understand fundamental raster concepts.
- Display and query raster data.
- Georeference, transform, and project raster data.
- Create geodatabase raster datasets and raster catalogs.
- Understand how ArcGIS Spatial Analyst tools are organized.
- Apply ArcGIS Spatial Analyst tools for surface and distance analyses.
- Use groundwater hydrology tools.
- Use map algebra functions.
- Interpolate surfaces from sample points.
- Understand basic suitability modeling methodology.
- Use ModelBuilder to create suitability models.

▼Topics Covered [Table of Contents](#) [PDF 61kb]

- Basics of ArcGIS Spatial Analyst: Overview of the extension; Understanding raster concepts; ArcGIS Spatial Analyst interface; Comparing rasters and feature layers; Querying rasters.

- Structure of rasters: How to create raster datasets; Raster storage and management.
- Aligning data: Raster registration and georeferencing; How projection affects analysis; Importing and exporting raster datasets.
- Conducting surface analyses: Calculating density; Choosing an interpolation method; Interpolating a continuous raster from sample points; Contours and hillshading; Visibility analysis.
- Map algebra functions: Writing expressions; Expression syntax.
- Calculating distance measurements: Euclidean distance; Cost–distance; Finding the least-cost path.
- Surface hydrology: Identifying watershed basins; Determining surface runoff characteristics.
- Designing and implementing GIS models: Spatial modeling concepts and issues.

▼Prerequisites

Students should have completed [ArcGIS Desktop II: Tools and Functionality](#) or [Learning ArcGIS Desktop](#) or have equivalent knowledge.

▼Software Used in Course

This course is designed to work with the following software:

ArcGIS Desktop*	Version
ArcView	9.3
ArcEditor	9.3
ArcInfo	9.3

*Only one of the listed licenses will be used in the classroom.

ArcGIS Extensions	Version
Spatial Analyst	9.3

Solving Disaster Management Problems Using ArcGIS 9

6 modules (18 hours)

Authored by [Glenn Johnson](#)

▼Overview

GIS is a powerful tool that can assist decision making in all phases of the disaster management cycle. This course teaches how to apply GIS to protect life, property, and critical infrastructure from natural and human-caused disasters. Using ArcGIS Desktop software, students learn how to perform tasks such as vulnerability analysis, multihazard mapping, and shelter planning. In course exercises, students identify and create data necessary for disaster planning and recovery and present GIS data in ways that support emergency management analyses.

▼Who Should Attend

This course is designed for public-sector professionals, risk management professionals, and anyone interested in applying GIS to disaster management activities.

▼Goals

Those completing this course will be able to

- Recognize the key benefits of GIS to disaster management planning.
- Organize disaster management data and create map templates.
- Use hazard maps to identify critical resources, infrastructure, and populations in harm's way.
- Perform what if scenarios using hazard maps.
- Map human-caused disasters.
- Understand how GIS modeling can be used in emergency training exercises.
- Identify data required for shelter planning and damage assessment.
- Use GIS to help evaluate a community's shelter requirements.
- Explain how GIS can be used to streamline the damage assessment process.

▼Topics Covered

- Introduction to GIS for Disaster Management: GIS and the emergency management process; Disaster management database content and typical sources
- Mapping Natural Hazards: Analyzing vulnerability; Mapping natural hazards

- Mapping Multi-Hazards and Human-Caused Disasters: Human-caused disasters; Mapping multi-hazards
- Planning for Shelters: Seeking shelter
- Assessing Damage: Data collection, analysis, and mapping of damaged areas
- Mitigating Disasters and Recovering from the Inevitable: Mitigating hazards; The recovery process

▼Prerequisites

Students should have completed [Learning ArcGIS Desktop](#) or have equivalent knowledge. Familiarity with emergency management is beneficial.

▼Software Required

To complete course exercises, you need the following software:

ArcGIS Desktop*	Version
ArcView	9.1, 9.2 or 9.3
ArcEditor	9.1, 9.2 or 9.3
ArcInfo	9.1, 9.2 or 9.3

*Only one product in this category is required.

Spatial Analysis of Geohazards Using ArcGIS 9

6 modules (18 hours)

Authored by ESRI and [William Harbert Ph.D.](#)

▼Overview

Geologic hazards loom all around. As population growth forces more communities to expand into areas at risk, concern increases about the danger that geohazards pose to people, property, and the environment. This course shows how GIS can be used to determine where geohazards are likely to occur and assess their potential impact on the human community. Students work with ArcGIS Desktop software to analyze and map a variety of geohazards. A better understanding of these events is the first step toward effective disaster planning.

▼Who Should Attend

This course is designed for earth scientists, public sector professionals, students, and others who want to apply GIS to better understand geohazards.

▼Goals

Those completing this course will be able to

- Use hazard maps to identify areas at risk from earthquakes, volcanoes, and floods.
- Import data from an earthquake catalog and visualize it in 3D.
- Map building damage density.
- Calculate the speed and travel time of a tsunami using bathymetry data.
- Identify the population at risk for any given category hurricane.
- Map the estimated water depth above the surface within a hurricane inundation area.
- Estimate accumulated precipitation by integrating time-series Doppler radar data.
- Model a real-life landslide event.

▼Topics Covered

- Earthquakes I: What is an earthquake?; Measuring earthquakes
- Earthquakes II: How earthquakes cause damage; Case study: the Northridge earthquake
- Volcanoes: Volcanoes; Volcanic hazards; Case Study: Mount St. Helens: When the sleeping giant woke
- Floods: Floods and floodplains; Types of floods; How floods cause damage
- Coastal Geohazards: Tsunamis; Storm Surges

- Landslides: Analyzing landslide hazards; Case study: Forest Falls - a model of a mudslide

▼Prerequisites

Students should have completed [Learning ArcGIS Desktop](#) or have equivalent knowledge.

▼Software Required

To complete course exercises, you need the following software:

ArcGIS Desktop*	Version
ArcView	9.1, 9.2 or 9.3
ArcEditor	9.1, 9.2 or 9.3
ArcInfo	9.1, 9.2 or 9.3

*Only one product in this category is required.

ArcGIS Extensions	Version
Spatial Analyst	9.1, 9.2 or 9.3

Note: ArcGIS 3D Analyst is used in some exercises, but is not required to complete the course.

Turning Data into Information Using ArcGIS 9

6 modules (18 hours)

Authored by ESRI and [Paul A. Longley Ph.D.](#), [Michael F. Goodchild Ph.D.](#), [David J. Maguire Ph.D.](#), and [David W. Rhind Ph.D.](#)

▼Overview

Along with the explosive growth of GIS over the last decade, a considerable increase in the availability and use of digital sources of spatial data has occurred. Producing new and useful information from spatial data requires a thorough understanding of their limitations and the methods used to process them.

This course examines the scientific methods used to derive useful information from spatial data. A companion to the book *Geographic Information Systems and Science, Second Edition* published by John Wiley & Sons Ltd, the course is designed to complement this book and reinforce its concepts through exercises and examples. Students explore GIS theory related to the visualization, measurement, transformation, and optimization of spatial data. An underlying theme that uncertainty is an inherent characteristic of spatial data is thoroughly examined and students learn how to identify it, measure it, and live with it.

▼Who Should Attend

This course is designed for those with a basic, intermediate, or advanced knowledge of GIS who want to develop the skills associated with creating useful information from spatial data. This course is a companion to the book *Geographic Information Systems and Science, Second Edition*. The book can be ordered through [John Wiley & Sons](#) but is not required to complete the course. Students and GIS professionals alike will find this course provides core skills that will be a beneficial addition to their GIS knowledge base.

▼Goals

Those completing this course will be able to

- Describe what spatial data are and how information is derived from them.
- Identify how to best represent spatial data.
- Assess the nature of spatial data and techniques of spatial autocorrelation, sampling, and interpolation.
- Understand how uncertainty in spatial data is propagated through the conception, measurement, and analysis of geographic phenomena.

- Comprehend how GIS-based visualization allows users to derive information, interact with spatial data, and represent attributes and spatial objects.
- Query and measure spatial and other attribute data.
- Perform spatial overlays, interpolation, and density estimations in order to transform spatial data into meaningful information.
- Produce statistical summaries of spatial data.
- Conduct optimization studies with spatial data to identify desired point locations and routes.
- Understand the rationale of and methods for spatial hypothesis testing.
- Assess the uncertainties associated with spatial data.

▼Topics Covered

- Basics of Data and Information: Representing geography; The nature of geographic data; Creating and visualizing information; Uncertainty
- Cartography, Map Production, and Geovisualization: GIS-based visualization; Representing attributes and spatial objects; Scientific visualization; Advanced methods for improving visualizations
- Query and Measurement: Querying views of a GIS; Advanced queries; Querying for measurements
- Transformations and Descriptive Summaries: Buffering, point-in-polygon, and polygon overlay; Spatial interpolation and density estimation; Centers and dispersion; Histograms, pie charts, and scatterplots; Spatial dependence and fragmentation
- Optimization and Hypothesis Testing: Optimization; Hypothesis testing
- Uncertainty: Measuring uncertainty of nominal and ordinal values; Measuring uncertainty of interval or ratio values; Uncertainty issues for spatial data

▼Prerequisites

Students should have completed [Learning ArcGIS Desktop](#) or have equivalent knowledge.

▼Software Required

To complete course exercises, you need the following software:

ArcGIS Desktop*

Version

ArcView

9.1, 9.2 or 9.3

ArcEditor

9.1, 9.2 or 9.3

ArcInfo

9.1, 9.2 or 9.3

*Only one product in this category is required.

ArcGIS Extensions

Version

Spatial Analyst

9.1, 9.2 or 9.3