INTERMEDIATE PLANNING INFORMATION SYSTEMS

URP 6275

3 CREDITS

SPRING / 2026 ** CLASS IS AVAILABLE ONLINE THROUGH E-LEARNING @ UF

INSTRUCTOR: *Katherine (Kate) Norris*

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OFFICE HOURS: *Zoom (Tuesdays 12:00 pm-1:00 pm) and by appointment*

If this time slot doesn't work for you and you need assistance, please email me so that we can set up a different time to meet. To access office hours there is a zoom button on the main canvas page, or you can use the email announcement with the link.

COURSE WEBSITE: https://elearning.ufl.edu/

COURSE COMMUNICATIONS:

All communication with course faculty will take place within Canvas. All emails will be sent and received within Canvas. You should NOT be emailing the course instructor outside of the system. The instructor is also available for phone calls or live chat by appointment. Please contact the instructor by Canvas email to arrange a call or chat.

RECOMMENDED TEXT:

- Class reading materials are available as downloadable PDFs and Online Links.
- Class lecture video slides are available as downloadable PDFs.
- Students can install and use ArcGIS Pro free of charge on UF-owned or personally-owned computers as long as it is for class purposes only. Students can also access ArcGIS Pro via UFApps.
    - https://www.geoplan.ufl.edu/software/arcgis-pro/

ADDITIONAL RESOURCES:

Course Materials PDFs are available for download through the E-Learning Canvas Course Page.

COURSE DESCRIPTION:

This course builds upon the foundational concepts and principles of Geographic Information Systems (GIS) introduced in URP 6270, Introduction to Planning Information Systems. This course will advance both the technical skills and theoretical/ conceptual skills to allow students to solve intermediate spatial problems using GIS. Using ArcGIS Pro software, students will learn intermediate concepts and skills for data management, editing, analysis, and automation. Additionally, students will learn about common errors and pitfalls with GIS data and how to troubleshoot and correct the issues.

PREREQUISITE KNOWLEDGE AND SKILLS:

Completion of URP 6270, Introduction to Planning Information Systems.

PURPOSE OF COURSE:

The purpose of this course is to advance Geographic Information Systems (GIS) technical and conceptual skills to allow students to solve intermediate spatial problems using GIS.

COURSE GOALS AND/OR OBJECTIVES:

Upon successful completion of this course, students will be able to:

- Identify and resolve common errors and inconsistencies in spatial and attribute data.
- Understand geoprocessing functionality and how to apply it for geospatial problem-solving appropriately.
- Understand how to structure and execute SQL queries for data analysis and manipulation.
- Be able to edit geographic features and attributes within GIS data.
- Be able to geocode address information.
- Understand how to manage and organize GIS project files.
- Understand and execute basic automation techniques within ArcGIS Pro software.
- Understand and execute basic planning related to Spatial Analysis.
- Understand and execute basic planning related to Spatial Statistics.

HOW THIS COURSE RELATES TO THE STUDENT LEARNING OUTCOMES IN THE SUSTAINABILITY AND THE BUILT ENVIRONMENT (SBE) PROGRAM AND THE URBAN AND REGIONAL PLANNING ONLINE MASTER'S PROGRAM:

Students taking this course will: through lectures, reading assignments, homework, exercises, essays, and class participation, develop practical quantitative skills necessary for support of research and professional practice. Students are also required to think critically about Geographic Information Systems tools and techniques. Each student's work will be reviewed based on the department's student learning outcomes as those relate to urban spatial analysis.

TEACHING PHILOSOPHY:

I expect all students should be able to accomplish the basic requirements for the course and attain a minimum "B" grade. I will not hesitate to mark lower when a student does not meet that expectation and adequately display an understanding of the materials presented. In order to attain an "A" grade requires performance that displays quality work, depth of knowledge, and the ability to synthesize of ideas into actions or solutions.

I will be happy to meet individually with any student during office hours or by appointment for additional discussion on concepts, techniques, or methodology presented in this course.

There isn't a final project or final exam this semester, the 9 quizzes are all open book/note. The quiz questions come from the lecture videos, the lecture videos are all downloadable as PDFs, the PDF links are at the top of the Module Lecture areas in Canvas. The quiz questions are all derived from the words on the slides, this is to support the different types of learners that we have in class.

Online learning is a hard format for some, it's hard when you can't just raise your hand to ask a question. Some students do better reading the slide materials, some do better listening, and some need both. So I tried to set the class up to help meet the needs of these different types of learners.

I have two kids and I fully understand that life can get crazy from time to time. If something comes up (job, family, kids, illness, moving, etc.) and you miss a module due date, please know that it's okay, just give me a heads up if possible. My goal is to help get you back on track, not nickel and dime you with late points.

If you turn an assignment in and I find major errors that need addressing, you will most likely be given the option to resubmit the assignment if you would like for a better grade. I'm here to support your learning process, and I fully believe that you learn GIS best by doing GIS, and re-doing GIS if needed.

In GIS there is often more than one way of doing things and still getting to the right answer. Some ways are faster and some ways are slower, some ways are cleaner and some ways offer more options to create human errors. So just know that yes, this does happen.

INSTRUCTIONAL METHODS:

The concepts and techniques will be covered in lectures, videos, and hands-on class exercises. Student will learn the concepts of spatial thinking and problem solving through course materials, and then apply and practice those concepts through homework assignments and projects, which utilize GIS software techniques.

COURSE POLICIES:

ATTENDANCE POLICY:

Students are responsible for satisfying all academic objectives as defined by the instructor. Absences count from the first class meeting. In general, acceptable reasons for absence from or failure to participate in class include illness, serious family emergencies, special curricular requirements (e.g., judging trips, field trips, and professional conferences), military obligation, severe weather conditions, religious holidays, and participation in official university activities such as music performances, athletic competition or debate. Absences from class for court-imposed legal obligations (e.g., jury duty or subpoena) must be excused. Other reasons also may be approved.

Students shall be permitted a reasonable amount of time to make up the material or activities covered in their absence.

Students cannot participate in classes unless they are registered officially or approved to audit with evidence of having paid audit fees. The Office of the University Registrar provides official class rolls to instructors.

If a student does not participate in at least one of the first two class meetings of a course or laboratory in which they are registered, and he or she has not contacted the department to indicate his or her intent, the student can be dropped from the course. Students must not assume that they will be dropped, however. The department will notify students if they have been dropped from a course or laboratory.

The university recognizes the right of the individual professor to make attendance mandatory. After due warning, professors can prohibit further attendance and subsequently assign a failing grade for excessive absences.

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at:

https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/

QUIZ/EXAM POLICY:

Quizzes and Exams will be given to test students' knowledge of course material.

MAKE-UP POLICY:

Students shall be permitted a reasonable amount of time to make up the material or activities covered in their absence if the absence is due to the one of accepted reasons listed in the Attendance Policy. If you are unable to turn in an assignment on time, please contact me before the due date to discuss your options. A grade reduction of 2.5% per week will occur after the 2nd week, unless there is an acceptable excuse for the late submittal.

Computer problems that arise during submission will not be accepted as an excuse for late work. If you have technical difficulties with E-Learning, please contact the UF Help Desk. If technical challenges cause you to miss a due date, you MUST report the problem to the Help Desk. Include the ticket number and an explanation of the issue based on consultation with the Help Desk in an e-mail to the instructor to explain the late assignment/exam. The course faculty reserves the right to accept or decline tickets from the UF Help Desk based on individual circumstances.

ASSIGNMENT POLICY:

Homework assignments and their due dates are specified in the course schedule. Homework assignments are due at the start of the next module (Monday at 11:55 pm) unless otherwise stated in the course schedule (Federal Holiday Exceptions).

COURSE TECHNOLOGY:

This course will be using ArcGIS Pro, you can choose to download and run ArcGIS on your personal computer (Recommended) or via UFApps (Not Recommended).

Acquiring personal computer software licensee for ArcGIS Pro

Students can acquire the latest version of ArcGIS software and a student license from the GeoPlan Center. Please note: it may take up to 24 hours to receive your software license. It is recommended that students install ArcGIS software prior to beginning the class: https://www.geoplan.ufl.edu/software/arcgis-pro/

Accessing ArcGIS via UFApps

The ArcGIS Pro software is available on UFApps (https://info.apps.ufl.edu/). UFApps provides access to software applications from any computing device--laptops, tablets, desktops, and smartphones--from any location, at any time.

In order to access UFApps and ArcGIS you will need to install software which is available from the UFApps website.

- Open your browser and navigate to https://info.apps.ufl.edu/.
- Navigate to the First Time Use – Web Access & Desktop Client section.
- The instructions will guide you through installing the required software and logging in to UFApps using the Desktop Client (PC or Mac).
- UFApps provides two virtual desktop workspaces, each with a different list of available applications. ArcGIS Pro is located in the Graphics Applications.

What is the M: drive? The M: drive is a scratch space to save the files you use with UFApps. Each UFApps user automatically gets access to the M: drive with a 10 GB per user quota. The M: drive provides the best performance when working with files in UFApps. For example: Let's say you're using Excel in UFApps, and you want to open up a large spreadsheet. If the file is stored on your local device, it has to travel all the way through the cloud to get to UFApps servers, and can be very slow.

COMPUTER REQUIREMENTS:

Students will need a Windows computer that meets or exceeds the specifications listed in the table below. For software-specific recommendations please see the ESRI links listed below. [Click Here to see ESRI's ArcGIS Pro 3.x system requirements]

Item	Supported and recommended
CPU	Minimum: 2 cores, simultaneous multithreading Simultaneous multithreading, or hyperthreading, of CPUs typically features 2 threads per core. A multithreaded 2-core CPU will have 4 threads available for processing, while a multithreaded 6-core CPU will have 12 threads available for processing. Full Motion Video has higher minimum and recommended CPU specifications. See Introduction to full-motion video for details.
	Recommended: 4 cores
	Optimal: 10 cores
Platform	x64
Storage	Minimum: 32 GB of free space
	Recommended: 32 GB or more of free space on a solid-state drive (SSD)
Memory/RAM	Minimum: 8 GB
	Recommended: 32 GB
	Optimal: 64 GB or more
Dedicated (not shared) graphics memory	Recommended: 4 GB or more If you're using a notebook computer with an integrated GPU, consider increasing the system RAM to compensate for the use of shared memory.
Visualization cache	The temporary visualization cache can consume up to 32 GB of space, if available, in the user-selected location. By default, the visualization cache is written to the user profile's `\Local` subfolder, so it does not roam with the user profile if roaming profiles are enabled by your system administrator.
DirectX*	Minimum: DirectX 11, feature level 11.0, Shader Model 5.0
	Recommended: DirectX 12, feature level 12.0, Shader Model 6.0
OpenGL*	Minimum: OpenGL 4.3 with the ARB_clip_control and EXT_texture_compression_s3tc extensions
	Recommended: OpenGL 4.5 with the ARB_shader_draw_parameters, EXT_swap_control, EXT_texture_compression_s3tc, and EXT_texture_filter_anisotropic extensions
Screen resolution	Minimum: 1024x768
	Recommended: 1080p or higher

UF POLICIES:

ACADEMIC POLICIES AND RESOURCES

To support consistent and accessible communication of university-wide student resources, instructors must include this link to academic policies and campus resources: https://go.ufl.edu/syllabuspolicies. Instructor-specific guidelines for courses must accommodate these policies. *If you have previously listed these policies separately on your syllabus, you may provide this link in their place to ensure that syllabuses stay up-to-date, reducing administrative burden without compromising student access to current policies and support services.*

The link above contains information on the following academic policies and resource topics, and more.

- Requirements for class attendance
- University Policy on Accommodating Students with Disabilities
- Information on current UF grading policies
- Student expectations for professional and respectful feedback (GatorEvals)
- University Policy on Academic Misconduct
- University Student Honor Code
- In-Class Recording
- Academic Resources
- Campus Health and Wellness Resources

UF POLICY ON COURSE SYLLABUSES: More information on the University of Florida's adopted syllabus policy requiring departments and course instructors to make available for free for each course, a syllabus containing specific information about the structure of the course. Can be found at the following link: https://syllabus.ufl.edu/syllabus-policy/uf-policy-on-course-syllabuses/

NETIQUETTE: COMMUNICATION COURTESY: All members of the class are expected to follow rules of common courtesy in all email messages, threaded discussions, and chats. The following Netiquette Guide for Online Courses describes what is expected and what will occur as a result of improper behavior. https://teach.ufl.edu/wp-content/uploads/2020/04/NetiquetteGuideforOnlineCourses.docx

GENERATIVE AI TOOLS:

Generative AI tools, such as Large Language Models (LLMs), are currently under scrutiny for regulatory concerns regarding the privacy and confidentiality of data both within the United States and internationally. It is important to note that data processed by LLM-

based AI tools may be stored by the parent company and could be used to generate responses for other users. Individuals have limited control over their data, and these companies typically do not provide mechanisms to modify or delete submitted data. As a result, sharing data with ChatGPT or similar AI services can be considered a public disclosure. Sensitive or restricted data should not be entered into these systems. Please remain mindful of our responsibilities in data stewardship and the critical need to protect information.

NaviGator AI (Available to UF Students, Faculty, and Staff) allows you to use different Large Language Models (LLMs) with your own dataset. You can use AI to discover trends and patterns, look for insights, and produce reports based on your data. UF provides this service to allow you to analyze your documents using different language models while keeping those documents secure within UF servers and contracted vendors. At this time, UF does not permit the usage of restricted or sensitive data with this service. Users only have access to their own datasets and conversation history. When interacting with the language models hosted by vendors, your messages and subsets of your documents will be sent to an LLM instance provided by Microsoft or Google. All data handled in this fashion is covered by our existing agreements with Microsoft and Google. None of this data contributes to training the large language model. No data is retained after deletion. If you have uploaded a file by accident, deleting the file or conversation will completely remove it from the system. Accessing Navigator AI off-campus does require a UF Gatorlink VPN Service: https://it.ufl.edu/ai/uf-navigator-ai/

When using AI tools, please review responses for factual accuracy, as these tools have been known to assert incorrect facts. AI is permitted on some assignments as long as the AI tool is cited in the APA style. If AI is prohibited for a particular assignment, this will be clearly stated. Students are personally responsible for submitted assignment content and quiz answers, and any violations of plagiarism or dishonesty will be handled in accordance with UF's policies.

SOFTWARE USE:

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

STUDENT PRIVACY:

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see:
FERPA and Confidentiality of Student Records

GETTING HELP:

For issues with technical difficulties for E-learning, please contact the UF Help Desk at:

- Learning-support@ufl.edu
- (352) 392-4357 - select option 2
- https://it.ufl.edu/helpdesk/

** Any requests for make-ups due to technical issues MUST be accompanied by the ticket number received from LSS when the problem was reported to them. The ticket number will document the time and date of the problem. You MUST e-mail your instructor within 24 hours of the technical difficulty if you wish to request a make-up.

Other resources are available at https://www.ufl.edu/current-students/ for:

- Counseling and Wellness Resources
- Disability Resources
- Resources for handling student concerns and complaints
- Library Help Desk support

Should you have any complaints with your experience in this course please visit https://policy.ufl.edu/regulation/4-012/ to submit a complaint.

GRADING POLICIES:

COURSE GRADE SUMMARY:

Component	Percent of Grade
Homework Assignments (10)	30%
Exercises (18)	25%
Discussions (8)	5%
Quizzes (9)	40%

- Please Note: Individual assignment values can be found in the Grade Book section in Canvas. On average each homework assignment counts for 2-3 Percent of the Total Grade, while on average each exercise assignment counts for 1-2 Percent of the Total Grade. Rubrics have been added to most assignments to help students understand the expectations for the assignment and how I intend to score your submissions.

GRADING SCALE:

Letter Grade	Percentage	Grade Points
A	93-100%	4.00
A-	90-92%	3.67
B+	88-89%	3.33
B	83-87%	3.00
B-	80-82%	2.67
C+	78-79%	2.33
C	73-77%	2.00
C-	70-72%	1.67
D+	68-69%	1.33
D	58-67%	1.00
D-	55-57%	0.67
E	Below 55%	0.00

For greater detail, see the Grades section of the Graduate Catalog for the University of Florida. It also contains the policies and procedures, course descriptions, colleges, departments, and program information for UF.
https://gradcatalog.ufl.edu/graduate/regulations/

EVALUATIONS:

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/

Students will be notified when the evaluation period opens and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/

Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/

COURSE SCHEDULE:

The course schedule is dependent on semester length (16 weeks). Usually, Modules 1&2 are due at the same time before being considered late, Modules 3&4 are due at the same time before being considered late, Modules 5&6 are due at the same time before being considered late, Modules 7&8 are due at the same time before considered late, and Module 9 is due before exams week.

16-Week Semester Schedule

Module 1: GIS Project and Data Design (Week 1)
Module 2: Working with Dirty Data (Week 2)
Module 3: Working with Attribute Tables (Week 4)
Module 4: Working with Python and the Field Calculator (Week 5)
Module 5: Geoprocessing and Analysis Tools, Techniques, and Best Practices (Week 7)
Module 6: Batch Processing, Model Builder, Python Scripting (Week 8)
Module 7: Imagery and Remote Sensing (Week 10)
Module 8: Spatial Analysis and Raster Data (Week 11)
Module 9: Spatial Statistics and Mapping Clusters (Week 13)

Disclaimer:

This syllabus represents my current plans and objectives. As we go through the semester, those plans may need to change to enhance the class learning opportunity. Such changes, communicated clearly, are not unusual and should be expected.

MODULE 1: GIS PROJECT AND DATA DESIGN

MODULE OVERVIEW

In this module, we take a step back from the desktop analysis to explore various aspects of GIS data and projects that will help you succeed as a GIS professional. There are 6 lectures covering the following topics: GIS project management, GIS systems architecture, where and how to get data, data best practices, spatial database design, and projections and coordinate systems. These lectures will lay the groundwork for your GIS projects. You will gain an understanding of how to avoid issues before you even start mapping or analysis. There is a focus on cutting down on wasted time by utilizing outside resources. In addition, you will be given information on where and how to get help on issues that may arise in these early stages of your project.

LEARNING OBJECTIVES

Upon completion of this module, you should be able to:

- Identify and resolve common issues that arise during GIS project management situations.
- Distinguish between the common GIS system architectures and the hardware and software solutions that make them unique.
- Recognize various spatial data formats, identify where to get data, apply data creation techniques, and implement best practices for data management.
- Recall spatial design concepts with a focus on the features of Esri's GeoDatabase.
- Create spatial data using appropriate geocoding techniques.
- Recognize common projection issues with a focus on datum transformations.

READINGS

Complete the following assigned readings for this module:

- The True Size of Africa by Kai Krause (Article Featured in The Economist) & (Map)

LECTURES

- GIS Project Management
- What is Your Environment? Systems Architecture, GIS Hardware and Software Capabilities
- Where and How to Get Data Parts 1, 2 & 3
- Data Best Practices
- Spatial Data Design and Management Parts 1 & 2
- Projections and Coordinate Systems

ASSIGNMENTS

- Discussion 1 - Introduce yourself to your classmates.
- Exercise 1a - Accessing the Esri Training Website: Working with the Geodatabase
- Exercise 1b - Projections: Understanding How to Use Define Projection and Project Tools
- Homework 1 - Create a Map with Multiple Data Sources
- Quiz 1

MODULE 2: WORKING WITH DIRTY DATA

MODULE OVERVIEW

Dirty Data can be defined as erroneous or incomplete information within a database or other computer program/system. Dirty Data comes in many formats; however, its effects are always the same: a negative impact on data quality. Dirty Data is usually the result of user error, haphazard data collection, or inappropriate data management and storage.

Dirty Data in a GIS project can create a "Garbage In, Garbage Out (GIGO)" scenario where the effect of a dataset's issue is compounded and embedded within a whole new dataset or analysis result. Unknown Garbage Out results may have long-standing impacts if planning and legislative decisions are based on them. In this module, you will learn about the different types of dirty data and how to recognize Geospatial Dirty Data. Next, you will learn about the Geoprocessing tools and techniques available for cleaning and preventing dirty data, and finally, the importance of metadata and how to create it.

LEARNING OBJECTIVES

Upon completion of this module, given a set of geographic data, you should be able to:

- Recognize potential data errors.
- Identify the appropriate method to repair data errors.
- Utilize GIS software to repair data errors.
- Implement data best practices for creating, managing, and analyzing geographic data.
- Identify and apply best practices of geospatial metadata creation.

READINGS

Complete the following assigned readings for this module:

- Understanding Statistical Data for Mapping Purposes

LECTURES

- What is Dirty Data
- Recognizing Geospatial Dirty Data
- Geoprocessing Tools for Dirty Data
- Geoprocessing Techniques for Dirty Data
- Metadata Creation Part 1 & 2

ASSIGNMENTS

- Discussion 2 - Dirty Data in Your Life
- Exercise 2 - Recognizing Spatial and Tabular Dirty Data
- Exercise 3 - Viewing, Editing and Creating Metadata
- Homework 2 - Combining Land Use Data from Different Sources
- Discussion - Modules 1 and 2 Big Picture Applications
- Quiz 2

MODULE 3: WORKING WITH ATTRIBUTE TABLES

MODULE OVERVIEW

Proper Data Management starts with knowing the type of data you are working with. Choosing the appropriate data type, field types, and storage container, as well as implementing best practices for file management, will decrease dirty data creation and speed up geoprocessing analyses, selection queries, and data sorting. Your choices will impact multiple data-related tasks, including tabular joins, data distribution, file sharing, and web mapping.

LEARNING OBJECTIVES

Upon completion of this module, given a set of geographic data, you should be able to:

- Identify appropriate field data types for data storage.
- Execute table selections and queries to explore data.
- Perform spatial and tabular join operations.
- Properly restructure attribute tables.

READINGS

Complete the following assigned readings for this module:

- Turn Raw Data into a Feature Layer

LECTURES

- Introduction to Fields Part 1 & 2
- Introduction to Tables
- Working with Tables Part 1 & 2
- Table Attachments & Geotagged Photographs
- Restructuring Tables

ASSIGNMENTS

- Exercise 4 - Performing Queries with the Query Builder
- Exercise 5 - Create Points from a CSV Table & Create a Point Feature Class with Geotagged Photos
- Homework 3 - Relationship Classes: Working with Parcel Data
- Quiz 3

MODULE 4: WORKING WITH PYTHON AND THE FIELD CALCULATOR

MODULE OVERVIEW

This Module includes detailed instructions about the functions and capabilities that are offered through the Map Field Calculator. This module reviews Python Functions and takes the user from a basic understanding of the Field Calculator through to advanced techniques. Knowledge gained in this module will help you clean and prepare data for analysis and reporting, improving the quality of your data products.

LEARNING OBJECTIVES

Upon completion of this module, you should be able to:

- Recognize geodatabase field properties that can be modified
- Recognize the differences in attribute values and data types when converting between a file geodatabase and a shapefile
- Recognize the limitations of the shapefile format
- Properly execute Python Functions in the Map Field Calculator

READINGS

Complete the following assigned readings for this module:

- No Readings

LECTURES

- Field Calculator Python Basics
- Field Calculator Python Basics and Geometry Properties
- Field Calculator Python String Functions Part 1 & 2
- Field Calculator Python Number Functions
- Field Calculator Python Advanced

ASSIGNMENTS

- Exercise 6 - Introduction to Using Python as a Calculator
- Exercise 7 - Performing Attribute Table Restructuring and Field Calculator Techniques in Map
- Homework 4 - Clean Up a Dirty Dataset: Building a Roads Reference Dataset from US Census Tiger Edge Data
- Discussion - Modules 3 and 4 Big Picture Applications
- Quiz 4

MODULE 5: GEOPROCESSING AND ANALYSIS TOOLS, TECHNIQUES, AND BEST PRACTICES

MODULE OVERVIEW

This Module covers detailed techniques for working with large datasets and US Census data, editing tools, and finally, how to implement the Five Primary Design Principles for Cartography in your maps. Through this module, you will learn best practices for working with large datasets, proper workflows, and the steps needed to produce high-quality data and map products.

LEARNING OBJECTIVES

Upon completion of this module, you should be able to:

- Identify and implement best practices when working with large geospatial datasets
- Identify and implement best practices when working with US Census Data
- Apply appropriate intermediate editing techniques
- Distinguish cartographic principles and apply best practices of map-making

READINGS

Complete the following assigned readings for this module:

- Map Makers Are Human: Comments on the Subjective in Maps by John K. Wright
- Using a Mapmaking Checklist for Map Design, 2012

LECTURES

- Working with Large Datasets
- Introduction to Census Data Part 1, 2 & 3
- Intermediate Editing Tools & Techniques Part 1 & 2
- Map Making Part 1, 2 & 3

ASSIGNMENTS

- Exercise 8 - Map Making in ArcGIS
- Exercise 9 - Basic Editing in ArcGIS: Updating Utah's Zion National Park GIS Data
- Homework 5 – Census Data: Building and Using Indexes in ArcGIS
- Quiz 5

MODULE 6: BATCH PROCESSING, MODEL BUILDER, PYTHON SCRIPTING

MODULE OVERVIEW

This module covers Geoprocessing Automation, which is the process of running a set of geoprocessing tools repeatedly and automatically. Through the implementation of batch tools, models, and scripts, your GIS projects will benefit by becoming more efficient, accurate, repeatable, and transferable. Automation will increase your work capacity, positively affect your process documentation, and strengthen your final data products. This module will cover ArcGIS Batch Processing with Tools, Model Builder, and introduce you to Python Scripting through customized ArcGIS Toolbox tools and external Arcpy scripts.

LEARNING OBJECTIVES

Upon completion of this module, you should be able to:

- Describe the basic concepts of automation and batch processing
- Distinguish use case scenarios for the automation of geo-processing tasks
- Execute batch commands for geoprocessing
- Create and execute models in Model Builder
- Describe the uses for Python scripting
- Create and launch Python scripts through ArcToolbox

READINGS

Complete the following assigned readings for this module:

- No Readings

LECTURES

- Automation Concepts
- Automating in ArcGIS (Batch Processing)
- Introduction to ModelBuilder Part 1 & 2
- Introduction to Python Scripting & ArcPy

ASSIGNMENTS

- Exercise 10 - Batch Geoprocessing: Clipping with the Batch Mode
- Exercise 11 - Introduction to ModelBuilder: Clipping with the Iterate Feature Classes Tool
- Exercise 12 - Introduction to Python Scripting
- Homework 6 - Bald Eagle Active Nesting Sites Monitoring: Using ModelBuilder to Perform a Repetitive Geoprocessing Task
- Discussion - Modules 5 and 6 Big Picture Applications
- Quiz 6

MODULE 7: IMAGERY AND REMOTE SENSING

MODULE OVERVIEW

As you learned in the Intro to GIS course, raster data is comprised of a matrix of cells, referred to as pixels or cells. Data in this format is a simple structure that allows for advanced spatial operations that might otherwise be impossible or time-prohibitive with vector data. Despite its simple structure, raster operations can become quite complex. In this module, we will explore different raster formats and how to utilize them to improve the performance and look of your GIS project. You will learn the history and fundamentals of imagery and remote sensing, how to perform image analyses and techniques, display optimization, as well as the best practices of raster data management.

LEARNING OBJECTIVES

Upon completion of this module, you should be able to:

- Define remote sensing and describe basic remote sensing concepts
- Identify data portals through which to acquire imagery and remote sensing data
- Perform Remote Sensing Analysis on Satellite Imagery
- Geo-reference an image (assign a coordinate system to an image)
- Define and describe LiDAR data, LAS files, and LiDAR-derived products
- Identify where to acquire LiDAR Data
- Identify and apply basic data management and data manipulation techniques for LiDAR data

READINGS

Complete the following assigned readings for this module:

- "URP6275 Module 7 - Imagery & Remote Sensing Course Materials"
    - (RECOMMENDED: REQUIRED INFORMATION COVERED IN LECTURE MATERIALS)
- Mapping and Modeling Lidar Data with ArcGIS Pro

LECTURES

- Introduction to Imagery & Remote Sensing Part 1 & 2
- Imagery & Remote Sensing: Data Types, Sources & Portals Part 1 & 2
- Image Analysis: Accessing and Using Satellite and Elevation Data
- Introduction to GeoAI
- Georeferencing Basics
- Introduction to LiDAR

ASSIGNMENTS

- Exercise 13 - Accessing Imagery and Using GeoAI to Extract Information from Imagery
- Exercise 14 - Georeference A Historic Map Image
- Homework 7 - Add and Visualize LiDAR Data
- Quiz 7

MODULE 8: SPATIAL ANALYSIS AND RASTER DATA

MODULE OVERVIEW

Spatial Analysis is the heart of GIS. It goes beyond simple mapping and visualization of locations and allows you to analyze a multitude of relationships between and around locations. Spatial Analysis allows you to solve complex spatial questions by combining information from a variety of sources to derive new insights. In this module, you will learn about how Spatial Analysis allows you to better Understand Places, Determine Relationships, Find Locations, Detect Patterns, and Make Predictions. We will cover some ArcGIS extensions and tools for performing spatial operations and analytics to assist with complex problem-solving. This module will also provide hands-on experience by stepping through an advanced suitability model workflow.

LEARNING OBJECTIVES

Upon completion of this module, you should be able to:

- Define spatial analysis and describe basic spatial analysis methods
- Identify and apply appropriate environmental settings for raster data analysis
- Apply appropriate spatial analysis technique(s) to solve a variety of spatial problems
- Perform advanced calculations using the raster calculator
- Execute the suitability model workflow

READINGS

Complete the following assigned readings for this module:

- Make Maps That Get Value from Data
- Identifying the Most Valuable Parcels to Protect
- Seeing Differently: Cartography for Subjective Maps Based on Dynamic Urban Data by Xiaoji Chen

LECTURES

- Introduction to Spatial Analysis
- The ArcGIS Spatial Analyst Extension Part 1, 2 & 3
- Spatial Analysis & Raster Calculator Basics Part 1 & 2
- Understanding the Suitability Modeling Workflow Part 1 & 2
- Understanding Cost Distance Analysis

ASSIGNMENTS

- Exercise 15 - Minimizing the Environmental Impact of Wind Farm Installation (Env. Settings)
- Homework 8-1 - Wildlife Conservation Planning: Bobcat Suitability Modeling Workflow (Lessons 1 & 2)
- Homework 8-2 - Wildlife Conservation Planning: Propose Wildlife Regions & Corridors from the Bobcat Suitability Model Results (Lessons 3 & 4)
- Quiz 8

MODULE 9: SPATIAL STATISTICS AND MAPPING CLUSTERS

MODULE OVERVIEW

Spatial Statistics allows you to analyzing spatial distributions, patterns, processes, and relationships. You can use spatial statistics to map clusters through the cluster analysis tools, these tools allow the user to identify the locations of statistically significant hot spots, cold spots, spatial outliers, and similar features or zones. In this module, you will learn about how the Mapping Clusters tools allow visualization of the cluster locations and extent, which can help answer the following questions, and more:

- Where are the clusters (hot spots and cold spots)?
- Where are incidents most dense?
- Where are the spatial outliers?
- Which features are most alike?

We will cover some statistical concepts and ArcGIS tools for performing spatial statistical operations and analytics to assist with complex problem-solving. This module will also provide hands-on experience by stepping through an advanced Optimized Hot Spot Analysis Workflow.

LEARNING OBJECTIVES

Upon completion of this module, you should be able to:

- Define spatial statistics vocabulary and describe basic spatial statistics analysis methods
- Identify and apply appropriate spatial statistics settings for hot spots, cold spots, and outlier data analysis
- Apply appropriate spatial statistics analysis technique(s) to solve a variety of spatial problems
- Analyze patterns and perform advanced cluster analysis using spatial statistics tools
- Execute the Optimized Hot Spot Analysis Workflow

READINGS

Complete the following assigned readings for this module:

- What is a z-score? What is a p-value?
- How Shoddy Data Becomes Sensational Research

LECTURES

- Introduction to Spatial Statistics: Measuring Geographic Distributions
- Introduction to Spatial Statistics: Performing Proper Density Analysis
- Introduction to Spatial Statistics: Analyzing Patterns
- Introduction to Spatial Statistics Mapping Clusters Part 1 & 2
- Optimized Hot Spot Analysis Workflow
- Introduction to Space-Time Analysis

ASSIGNMENTS

- Exercise 16 - Where Are Tornado Occurrences Intense: From Heat Maps to Hot Spots, Cold Spots, and Outliers
- Exercise 17 - Analyzing Crime with Spatial Statistics
- Homework 9 - Analyzing Traffic Accidents in Space and Time
- Discussion 3 - The Subjectivity of Maps
- Discussion - Modules 7, 8, and 9 Big Picture Applications
- Quiz 9