INTERMEDIATE PLANNING INFORMATION SYSTEMS

URP 6275

3 CREDITS

FALL / 2022

** CLASS IS AVAILABLE ONLINE THROUGH E-LEARNING @ UF

INSTRUCTOR: *Katherine (Kate) Norris*

> *131C Architecture Building,*
> *knorris@ufl.edu*

OFFICE HOURS: Zoom (Mondays 11am-12pm) and *by appointment*

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 email to arrange a call or chat.

RECOMMENDED TEXT:

Class reading materials available as downloadable PDFs.
Class lecture slides available as downloadable PDFs.

ADDITIONAL RESOURCES:

Course Materials packet available for download through 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. Primarily using ArcGIS 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 appropriately apply for geospatial problem solving.
- 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 Spatial Analysis.
- Understand the difference between open source and proprietary GIS software, and the availability of each.

HOW THIS COURSE RELATES TO THE STUDENT LEARNING OUTCOMES IN THE URBAN AND REGIONAL PLANNING ONLINE MASTER'S PROGRAM:

Students taking this course will: through lectures, reading assignments, homework, essays, class participation, and a midterm and final examination 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 upon the department's student learning outcomes as those relate to urban spatial analysis.

TEACHING PHILOSOPHY:

I expect all graduate students should be able to accomplish the basic requirements for the course and attain a minimum "B" grad). 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.

INSTRUCTIONAL METHODS:

The concepts and techniques will be covered in lectures, videos, and hands-on class exercises. Student will learn and 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 student knowledge on 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 5% per day will occur 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. In the event that you have technical difficulties with e-Learning, please contact the UF Help Desk. If technical difficulties cause you to miss a due date, you MUST report the problem to Help Desk. Include the ticket number and an explanation of the issue based on consult with 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 night at 11:55pm), unless otherwise stated in the course schedule.

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

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: http://geoplan.ufl.edu/software/software.shtml

Accessing ArcGIS via UFApps

The ArcGIS software is available on UFApps (http://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 Citrix Receiver which is available from the UFApps website.

- Open your browser and navigate to http://info.apps.ufl.edu/.

- Scroll down to the First Time Use Questions section and

  o click on Access UFApps from a PC if you are using a PC,

  o click on Access UFApps from a Mac if using a Mac.

- The instructions will guide you through installing Citrix Receiver and logging in to UFApps.

COMPUTER REQUIREMENTS:

Students will need a 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 3.0 system requirements

Components	Specifications
CPU Speed	2.2 GHz minimum; Hyper-threading (HHT) or Multi-core recommended
Processor	Intel Pentium 4, Intel Core Duo, or Xeon Processors; SSE2 minimum
Memory/Ram	2 GB minimum
Display Properties	24 bit color depth
Screen Resolution	1024 x 768 recommended or higher at Normal size (96dpi)
Swap Space	Determined by the operating system, 500 MB minimum.
Disk Space	2.4 GB
Video/Graphics Adapter	64 MB RAM minimum, 256 MB RAM or higher recommended. NVIDIA, ATI, and Intel chipsets supported. 24-bit capable graphics accelerator OpenGL version 2.0 runtime minimum is required, and Shader Model 3.0 or higher is recommended. Be sure to use the latest available driver.
Networking Hardware	Simple TCP/IP, Network Card or Microsoft Loopback Adapter is required for the License Manager.
High Speed Internet Access	High speed internet access is highly recommended.

UF POLICIES:

UNIVERSITY POLICY ON ACCOMMODATING STUDENTS WITH DISABILITIES: Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting https://disability.ufl.edu/students/get-started/. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

UNIVERSITY POLICY ON ACADEMIC MISCONDUCT: Academic honesty and integrity are fundamental values of the University community. Students should be sure that they understand the UF Student Honor Code at

https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/

NETIQUETTE: COMMUNICATION COURTESY: All members of the class are expected to follow rules of common courtesy in all email messages, threaded discussions and chats. [Describe what is expected and what will occur as a result of improper behavior] http://teach.ufl.edu/wp-content/uploads/2012/08/NetiquetteGuideforOnlineCourses.pdf

UNIVERSITY STUDENT HONOR CODE:

In adopting this Honor Code, the students of the University of Florida recognize that academic honesty and integrity are fundamental values of the University community. Students who enroll at the University commit to holding themselves and their peers to the high standard of honor required by the Honor Code. Any individual who becomes aware of a violation of the Honor Code is bound by honor to take corrective action.

Student and faculty support are crucial to the success of the Honor Code. The quality of a University of Florida education is dependent upon the community acceptance and enforcement of the Honor Code (Links to an external site.).

> **The Honor Pledge:** We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity by abiding by the Honor Code.

On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment."

IN-CLASS RECORDING:

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A "class lecture" is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To "publish" means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

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: https://catalog.ufl.edu/UGRD/academic-regulations/ferpa-confidentiality-student-records/#:~:text=Each%20spring%20when%20the%20catalog,institution%20to%20amend%20the%20record.

CAMPUS RESOURCES:

Health and Wellness

- **U Matter, We Care:** If you or a friend is in distress, please contact umatter@ufl.edu or 352 392-1575 so that a team member can reach out to the student.
- **Counseling and Wellness Center:** https://counseling.ufl.edu, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.
- **Sexual Assault Recovery Services (SARS):** Student Health Care Center, 392-1161.
- **University Police Department** at 392-1111 (or 9-1-1 for emergencies), or https://police.ufl.edu/.

Academic Resources

- **E-learning technical suppor***t*, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.
- **Career Resource Center**, Reitz Union, 392-1601. Career assistance and counseling. https://www.crc.ufl.edu/.
- **Library Support**, https://uflib.ufl.edu/find/ask/. Various ways to receive assistance with respect to using the libraries or finding resources.
- **Teaching Center**, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/.
- **Writing Studio, 302 Tigert Hall***,* 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/.
- **Student Complaints Campus and On-Line***:* https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf. http://www.distance.ufl.edu/student-complaint-process.

GETTING HELP:

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

- Learning-support@ufl.edu

- (352) 392-HELP - select option 2

- https://helpdesk.ufl.edu/

** 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://distance.ufl.edu/getting-help/ 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://distance.ufl.edu/getting-help/student-complaint-process/to submit a complaint.

GRADING POLICIES:

COURSE GRADE SUMMARY:

Component	Percent of Grade
Homework Assignments (11)	30%
Exercises (19)	25%
Discussions (3)	5%
Quizzes (10)	31%
Final Project (1)	0%

- 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.

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 (Links to an external site.). It also contains the policies and procedures, course descriptions, colleges, departments, and program information for UF.

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:

There are two course schedules listed depending on semester length (14 weeks and 16 weeks). You schedule is based on your individual course's semester length. Usually Modules 1&2 are due at the same time before considered late, Modules 3&4 are due at the same time before considered late, Modules 5&6 are due at the same time before considered late, Modules 7&8 are due at the same time before considered late, and Module 9&10 are due during exams week.

14 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, Part 1 (Week-3)
Module 4: Working with Attribute Tables, Part 2 (Week-4)
Module 5: Geoprocessing and Analysis Tools (Week-5)
Module 6: Batch Processing, Model Builder, Python Scripting (Week-6)
Module 7: Imagery and Remote Sensing (Week-9)
Module 8: Spatial Analysis and Raster Data (Week-10)
Module 9: Spatial Statistics and Mapping Clusters (Week-11)
Module 10: Free and Open Source Software (QGIS) and Data (Week-13)

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, Part 1 (Week-4)
Module 4: Working with Attribute Tables, Part 2 (Week-5)
Module 5: Geoprocessing and Analysis Tools (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)
Module 10: Free and Open Source Software (QGIS) and Data (Week-14)

MODULE 1: GIS PROJECT AND DATA DESIGN

MODULE OVERVIEW

In this module, we take a step back from ArcGIS Pro analysis to explore various aspects of GIS data and projects that will help you succeed as a GIS professional. There are 7 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 your mapping or analysis. There is a focus on cutting down on wasted time by utilizing outside resources. In addition, when relevant you will be given information on where and how to get help on issues that 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 native data format, the GeoDatabase.
- Recognize common projection issues with a focus on datum transformations.

READINGS

- Modeling Our World (2010), Second Edition, by Michael Zeiler (Chapter 1).
- The True Size of Africa by Kai Krause
- Coordinate Systems: What's the Difference? by Heather Smith
- Map Projections: Which ones best suit your needs? by USGS

LECTURES

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

ASSIGNMENTS

- Exercise 1a - Working with the Geodatabase
- Exercise 1b - Projections
- Homework 1 - Create a map with multiple data sources
- Discussion 1 - Introduce yourself to your classmates.
- Quiz - Module 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

- 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 101 Parts 1 & 2

ASSIGNMENTS

- Exercise 2 - Recognizing Dirty Data
- Exercise 3 - Metadata Creation
- Homework 2 - Combining Land Use Data from Different Sources
- Discussion 2 - Dirty Data in Your Life
- Quiz – Module 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

- Turn Raw Data into a Feature Layer

LECTURES

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

ASSIGNMENTS

- Exercise 4 - Performing Queries with the Query Builder
- Exercise 5 - Adding Attachments and Create a Point Feature Class with Geotagged Photos
- Homework 3 - Relationship Classes
- Quiz – Module 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 than can be modified
- Recognize the differences in attribute values and data types when converting between file geodatabase and shapefile
- Recognize the limitations of the shapefile format
- Properly execute Python Functions in the Map Field Calculator

READINGS

- Calculate Field Examples by ESRI (Reference Materials)

LECTURES

- Field Calculator Python Basics
- Field Calculator Python Basics and Geometry Properties
- Field Calculator Python String Functions
- Field Calculator Python Number Functions
- Field Calculator Python Advanced

ASSIGNMENTS

- Exercise 6 - Introduction to Using Python as a Calculator
- Exercise 7 - Field Calculations
- Homework 4 - Clean Up a Dirty Dataset
- Quiz – Module 4

MODULE 5: GEOPROCESSING AND ANALYSIS TOOLS

MODULE OVERVIEW

This Module covers detailed techniques for working with large datasets, geocoding basics and locator creation, 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
- Create and use a Geocoding street locator
- Apply appropriate intermediate editing techniques
- Distinguish cartographic principles and apply best practices of map making

READINGS

- Making a Meaningful Map, 2011
- Make Maps People Want to Look At, 2012
- Using a Mapmaking Checklist for Map Design, 2012
- Map Makers Are Human: Comments on the Subjective in Maps by John K. Wright

LECTURES

- Working with Large Datasets
- Intermediate Geocoding Parts 1 & 2
- Intermediate Editing Tools & Techniques Parts 1 & 2
- Map Making Parts 1-3

ASSIGNMENTS

- Exercise 8 - Map Making in ArcGIS
- Exercise 9 - Basic Editing in ArcGIS
- Homework 5 - Geocoding - Building Locators for ArcGIS
- Quiz – Module 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 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 an ArcGIS Toolbox

READINGS

- None

LECTURES

- Automation Concepts
- Batch Processing
- Introduction to ModelBuilder
- Introduction to Python Scripting & ArcPy

ASSIGNMENTS

- Exercise 10 - Batch Tools
- Exercise 11 - Introduction to Model Builder
- Exercise 12 - Introduction to Python Scripting
- Homework 6 - Model Builder
- Quiz – Module 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

- URP6275 Module 7 - Imagery & Remote Sensing Course Materials
- Mapping and Modeling Lidar Data with ArcGIS Pro

LECTURES

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

ASSIGNMENTS

- Exercise 13 - Accessing Imagery
- Exercise 14 - Georeference an Image
- Homework 7 - Add and Visualize LiDAR Data
- Quiz – Module 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

- Make Maps That Get Value from Data
- Understanding Data Analysis Using 8 Scientific Tools
- Identifying the Most Valuable Parcels to Protect
- Visualizing Metadata: Design Principles for Thematic Maps by Joshua Comenetz
- Seeing Differently: Cartography for Subjective Maps Based on Dynamic Urban Data by Xiaoji Chen

LECTURES

- Introduction to Spatial Analysis Parts 1 & 2
- The ArcGIS Spatial Analyst Extension Parts 1 & 2
- Spatial Analysis & Raster Calculator Basics
- Understanding the Suitability Modeling Workflow

ASSIGNMENTS

- Exercise 15 - Environmental Settings
- Homework 8-1 - Suitability Modeling Workflow (Lessons 1 & 2)
- Homework 8-2 - Suitability Modeling Workflow (Lessons 3 & 4)
- Quiz Module 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 allows 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:

- Where are the clusters (hot spots and cold spots)?
- Where are incidents most dense?
- Where are the spatial outliers?
- Which features are most alike?
- How can we group these features so each group is the most dissimilar?
- How can we group these features so each zone is homogenous?

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
- Analysis 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?
- Best practices for selecting a fixed distance band value

LECTURES
- Introduction to Spatial Statistics
- ArcGIS Spatial Statistics Tools
- Performing Proper Density Analysis
- Analyzing Patterns and Performing Advanced Cluster Analysis
- Optimized Hot Spot Analysis Workflow

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
- Quiz - Module 9

MODULE 10: FREE AND OPEN SOURCE SOFTWARE (QGIS) AND DATA

MODULE OVERVIEW

GIS has long utilized the Free and Open Source Software (FOSS) model of development, with programs such as QGIS, GRASS GIS, and many other geospatial software products. The FOSS model helps to create an environment of collaborative development, with the goal of creating better software products and innovative tools for problem solving. Similarly, the growing availability of open data in both the public and private sectors is also leading to new ideas, methods, and opportunities for problem solving. In this module, you will learn about the fundamental concepts of free and open source software and open data, as well as their applications in the world of geospatial software. This module will also provide hands-on experience working with open data using QGIS Desktop.

LEARNING OBJECTIVES

Upon completion of this module, you should be able to:
- Recognize the major differences, advantages, and disadvantages of working with free and open source software as compared to proprietary software
- Find and download open data from an appropriate source
- Add and manipulate data in QGIS Desktop software
- Install third-party tools (plugins) in QGIS to enhance functionality and perform an analysis
- Create a map using QGIS to show results

READINGS

Complete the following assigned readings for this module:
- What is Free Software?
- The Open Source Definition
- A Short Guide to Open Source Licenses
- Americans Use More Public Data than they Think
- 27 Differences Between ArcGIS & QGIS
- At Least 10 Reasons you should be Using QGIS
- GRASS GIS - Geographic Resources Analysis Support System

LECTURES

- Free and Open Source Software
- Open Data and Open Data Formats
- Free and Open Source GIS, Libraries, and Database Software
- Intro to QGIS: Exploring the Interface & Adding Data
- Intro to QGIS: Project and Layer Coordinate Reference Systems in QGIS
- Intro to QGIS: Adding a Table Join
- Intro to QGIS: Making a Spatial Query and Selecting by Expression
- Intro to QGIS: Downloading and Installing Plugins
- Intro to QGIS: Map Symbology and Print Composer

ASSIGNMENTS

- Exercise 18: Getting Started with QGIS
- Exercise 19: Geocoding with the MMQGIS Plugin
- Homework 10: Heatmap Analysis with QGIS
- Quiz - Module 10

<u>Disclaimer:</u>

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.