Instructor: Jeff Hemsley   Phone: 315.443.3409

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Office Hours: Wednesdays 1:30 to 2:30   Term: Spring 2021

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Course Description:

A broad introduction to data visualization for information professionals. Students will develop a portfolio of resources, demonstrations, recipes, and examples of various data visualization techniques. Additional work required for graduate students

Stay Safe Pledge
Syracuse University's Stay Safe Pledge reflects the high value that we, as a university community, place on the well-being of our community members. This pledge defines norms for behavior that will promote community health and wellbeing. Classroom expectations include the following: wearing a mask that covers the nose and mouth at all times, maintaining a distance of six feet from others, and staying away from class if you feel unwell. Students who do not follow these norms will not be allowed to continue in face-to-face classes; repeated violations will be treated as violations of the Code of Student Conduct and may result in disciplinary action.

Additional Course Description:

Introduction to skills and techniques related to information visualization, through the R programming language, Adobe illustrator. These skills include data cleaning techniques, control of the R graphics environment, develop custom plots, visually explore data, use design concepts to visually communicate the story in the data, and discuss issues related to the ethics of data visualization. Conceptual themes will be presented alongside technical aspects of data visualization. Additional work and higher grading expected of graduate students.

Prerequisite / Co-requisite:

687 or equivalent programming courses (Python, Java, SQL, C, C++, etc.)
Audience:

Students interested in data analytics and data science, with a focus on data/information visualization.

Credits:

3

Course Fees and/or Costs:

Learning Objectives:
After taking this course, the students will be able to:
1. Perform basic data cleaning and preparation on a wide range of data sets using R
2. Identify stories in data sets through visual data exploration
3. Create rich visual artefacts that communicate data stories

Texts / Supplies – Required:

Visualize This: The Flowing Data Guide to Design, Visualization, and Statistics, by Nathan Yau. Wiley Publishing, 2011. [VT in schedule]

Data Points: Visualization That Means Something, by Nathan Yau. Wiley Publishing, 2013 [DP in schedule]

Texts / Supplies– Additional:

Additional readings will be provided as PDFs

Course Requirements and Expectations:

In order to meet the goals of the class (see above), we will use a combination of lectures to introduce topics and concepts, hands-on-labs to introduce skills, group exercises and student presentations to enable peer-to-peer learning, and homework assignments to practice skills and gain deeper knowledge of course content. These are detailed below.

Grading:

Describe the grading scheme, including grades or percentages for specific work or exams. Provide information to indicate how a student's grade is determined. Update the grading table below with the appropriate percentage ranges or total points.

Grading Tables

Letter Grade	Grade points /credit	Percentage Range
A	4.000	96%-100%
A-	3.667	93%-95.9%
B+	3.333	90%-92.9%
B	3.000	87%-89.9%
B-	2.667	84%-86.9%
C+	2.333	81%-83.9%

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Letter Grade	Grade points /credit	Percentage Range
C	2.000	78%-80.9%
C-	1.667	75%-77.9%
F	0	

University Attendance Policy:

Attendance in classes is expected in all courses at Syracuse University. Students are expected to arrive on campus in time to attend the first meeting of all classes for which they are registered. Students who do not attend classes starting with the first scheduled meeting may be academically withdrawn as not making progress toward degree by failure to attend. Instructors set course-specific policies for absences from scheduled class meetings in their syllabi.

It is a federal requirement that students who do not attend, or cease to attend, a class to be reported at the time of determination by the faculty. Faculty should use "ESPR" and "MSPR" in Orange Success to alert the Office of the Registrar and the Office of Financial Aid. A grade of NA is posted to any student for whom the Never Attended flag is raised in Orange SUccess. More information regarding Orange SUccess can be found here, at:
http://orangesuccess.syr.edu/getting-started-2/
Students should also review the University's religious observance policy and make the required arrangements at the beginning of each semester.

Course Specific Policies:

Note that these point values vary from class to class as new opportunities present themselves. Thus, the numbers are approximate.

Assignment	Points
In-Class Labs	10 to 15
Home and Lab Quizzes	35 to 40
Homework	20 to 30
Group Reports & Feedback	5 to 10
Advanced Topic Presentation	5 to 10
Final Project	25
Total	100 - 120

Because of the dynamic nature of the labs, the total points possible may be a few points higher or lower.

In Class Labs:
In the real world of data visualization people work both alone and in teams to meet near and far deadlines. In this class we work in a lab setting to learn R and Adobe Illustrator skills and students are encouraged to work together to solve problems. Labs are between 1 and 3 points. Labs are also dynamic. The nature of what we turn in at the end of the lab will depend on how fast we go and what questions students ask. Because of the nature of this work, I do not allow for makeups of labs.

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Lab Quizzes:
These are typically one or two question quizzes that are intended to reinforce something I talked about in the last class. These won't be announced in advance.

Homework & Quizzes:
These will be extensions of what we did in class or assignments out of the book. Homework may be in the form of quizzes on Blackboard, visualizations you create or some of the other assignments listed below. Quizzes often lean heavily on the reading and students who do not keep up with the readings, often do not do well on the quizzes. Homework and quizzes are usually due by 9:00am at the start of the next class. You can turn in assignments late, but there are consequences. First, 1 point will be automatically deducted. Second, late assignments may not be graded till the end of the semester.

Important: you may not receive credit if you do not follow the file naming convention specified on the assignment sheet. You may not receive credit if your file is of the wrong type. Unless otherwise specified, you will always turn in plots as .pdf files and R scripts as .R files.

Advanced Topic Presentations:
While this class is focused on creating visualizations using R, many other tools exist. Examples include D3, Tableau, and Gephi. In order to give students exposure to these and many other options, students will select, research and present on an "advanced topic". Graduate students will work individually, while undergraduates may work in groups of two.

Final Project:
The final project, including poster session, is worth a large percentage of your final grade. The final poster project leverages skills developed throughout the semester, including cleaning data, exploring data with visualization techniques, data aggregation, simple design and information organization skills, and quality graphic presentation of data visualizations. Key deliverables leading up to the final project will be due throughout the semester to help the students stay on track for this major deliverable.

Poster Session:
You **must** be present at the poster session at the end of the semester, with your poster, in order to get credit for your poster. The exact time and date of the poster session will be announced within the first few classes. Note that the requirements for posters change each semester. Past examples on Blackboard are provided for your reference.

How to Succeed in This Course:
To succeed in this class, just show up to the labs and do the assignments. The biggest difference between people who got a B and an A is that the A students did the work and also did all the readings. The quizzes, which lean on the readings, seem to make the difference between the B and A students.

Syracuse University Policies:

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Syracuse University has a variety of other policies designed to guarantee that students live and study in a community respectful of their needs and those of fellow students. Some of the most important of these concerns:

Diversity and Disability (ensuring that students are aware of their rights and responsibilities in a diverse, inclusive, accessible, bias-free campus community) can be found here, at https://www.syracuse.edu/life/accessibilitydiversity/

Religious Observances Notification and Policy (steps to follow to request accommodations for the observance of religious holidays) can be found here, at: http://supolicies.syr.edu/studs/religious_observance.htm

Orange Success (tools to access a variety of SU resources, including ways to communicate with advisors and faculty) can be found here at: http://orangesuccess.syr.edu/getting-started-2

Disability-Related Accommodations

Syracuse University values diversity and inclusion; we are committed to a climate of mutual respect and full participation. There may be aspects of the instruction or design of this course that result in barriers to your inclusion and full participation in this course. I invite any student to meet with me to discuss strategies and/or accommodations (academic adjustments) that may be essential to your success and to collaborate with the Office of Disability Services (ODS) in this process.

If you would like to discuss disability-accommodations or register with ODS, please visit their website at http://disabilityservices.syr.edu/ Please call (315) 443-4498 or email disabilityservices@syr.edu for more detailed information.

ODS is responsible for coordinating disability-related academic accommodations and will work with the student to develop an access plan. Since academic accommodations may require early planning and generally are not provided retroactively, please contact ODS as soon as possible to begin this process.

Academic Integrity Policy

Syracuse University's Academic Integrity Policy reflects the high value that we, as a university community, place on honesty in academic work. The policy defines our expectations for academic honesty and holds students accountable for the integrity of all work they submit. Students should understand that it is their responsibility to learn about course-specific expectations, as well as about university-wide academic integrity expectations. The policy governs appropriate citation and use of sources, the integrity of work submitted in exams and assignments, and the veracity of signatures on attendance sheets and other verification of participation in class activities. The policy also prohibits students from submitting the same work in more than one class without receiving written authorization in advance from both

instructors. Under the policy, students found in violation are subject to grade sanctions determined by the course instructor and non-grade sanctions determined by the School or College where the course is offered as described in the Violation and Sanction Classification Rubric. SU students are required to read an online summary of the University's academic integrity expectations and provide an electronic signature agreeing to abide by them twice a year during pre-term check-in on MySlice.

Educational Use of Student Work

Student work prepared for University courses in any media may be used for educational purposes, if the course syllabus makes clear that such use may occur. You grant permission to have your work used in this manner by registering for, and by continuing to be enrolled in, courses where such use of student work is announced in the course syllabus.

Discrimination or Harassment

The University does not discriminate and prohibits harassment or discrimination related to any protected category including creed, ethnicity, citizenship, sexual orientation, national origin, sex, gender, pregnancy, disability, marital status, age, race, color, veteran status, military status, religion, sexual orientation, domestic violence status, genetic information, gender identity, gender expression or perceived gender.

Any complaint of discrimination or harassment related to any of these protected bases should be reported to Sheila Johnson-Willis, the University's Chief Equal Opportunity & Title IX Officer. She is responsible for coordinating compliance efforts under various laws including Titles VI, VII, IX and Section 504 of the Rehabilitation Act. She can be contacted at Equal Opportunity, Inclusion, and Resolution Services, 005 Steele Hall, Syracuse University, Syracuse, NY 13244-1120; by email: titleix@syr.edu; or by telephone: 315-443-0211.

I will seek to keep information you share with me private to the greatest extent possible, but, as a professor, I have mandatory reporting responsibilities to share information regarding sexual misconduct, harassment, and crimes I learn about, to help make our campus a safer place for all.

Course Feedback:

At the end of the term, the iSchool will ask you to share course feedback through EvaluationKIT [https://coursefeedback.syr.edu]. Log in to EvaluationKIT using your NetID and password. Please take the time to share your feedback about this course and your experience in it; all ratings and comments are completely anonymous. The iSchool carefully reviews your feedback. Our instructors use this feedback to fine tune course delivery and instruction; our professors of record use this feedback to fine tune course content and assignments. All feedback is factored into iSchool decisions about course, program and instructor development.

Learning Management System

This course involves the use of Syracuse University's 2SU system as an online tool. The environment is composed of a number of elements that will help you be successful in both your

current coursework and your lifelong learning opportunities. To access the 2SU system [https://2su.ischoolonline.syr.edu/login] use your Syracuse University email address & Password. This specific course will appear in your course list.

If you have problems logging in or need assistance with the 2SU platform, please contact Student Support at studentsupport@ischoolonline.syr.edu or call 1-844-797-4478.

Course Schedule:
subject to change
Week/ lecture, topic for the week/lecture, and required readings are in the columns below.

Note, some topics and assignments may shift depending on semester schedule.

Week/ Lecture	Topic	Required Readings/ Assignments
1	**What is data visualization? What is R?** ***Learning Outcomes*** - Students will be able to: • Differentiate between Information Visualization and other prominent forms of visualization • Describe the two main purposes of Information Visualization: exploration and communication • Describe the 7 basic steps of visualization • Describe the purpose of the 4 windows of RStudio • Create variables in R • Create simple single variable plots in R, such as pie and bar charts, histograms Use R's help system to lookup the available parameters for plotting functions	***Lab 1***: R and Basic Plots ***Readings***: • VT: Chapters 1 and 2 • DS: Chapters 1 and 2 • Ben Fry, Visualizing Data ***Quiz 1***: covers readings and lecture
2	**Data and R** ***Learning Outcomes*** – Students will be able to: • List sources of freely available data • Describe the process of data exploration	***Lab 2***: Exploring Data in R ***Readings***: • DP: Chapter 1 • DS: Chapter 3

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Week/ Lecture	Topic	Required Readings/ Assignments
	• Discuss the role of context markers in visualization • Differentiate between common data types • Open data files • Use R functions to explore and clean data • Use R to retype, suset and filter data Create rough data exploration plots	• VT: Chapters 3 and 4 *Homework 1*: Reproduce Figures in VT Chapter 4
3	**Using Data Libraries and visualizing multi-dimensional data** *Learning Outcomes* – Students will be able to: • Find datasets from online data libraries such as Data Planet • Describe ways to make comparisons with visualizations • Describe ways to identify and show relationships in data • Differentiate between single and multi dimension plots • Use R to make simple multi-dimensional plots Identify the appropriate plot type for a given set of data	Lab 3: Visualizing multi-dimensional data Assignment: Find a dataset and be prepared to describe/discuss it in class
4	**Beginning to find and tell the story in the data & Illustrator Intro** *Learning Outcomes* - Students will be able to: • Describe a dataset • Identify questions that might be answered with the data • Identify elements of a visual artifact that make it compelling • Interpret the meaning(s) of a data visualization • Use illustrator to modify R plots • Add context elements to a data visualization • Use Illustrator to modify plot colors, type face and layout Explain the difference between raster and vector graphics	Lab 4: Illustrator Intro Quiz 2: Optimal visual encoding of data Readings: • DP: Chapters 2 and 3 • Few: Chapter 3 • VT: Chapter 4 (Illustrator parts) Homework 2: Illustrator portions of VT Ch 4 plots

Week/ Lecture	Topic	Required Readings/ Assignments
5	**Graphic Design Principles: Color, tools and R color functions** *Learning Outcomes* – Students will be able to: • Describe the use of contrasting and harmonious color in visualization • Describe how hue, saturation and value combine to make a color • Use online tools to choose and create color schemes • Use R's color setting and transformation functions Use color to provide visual cues in visualizations	*Lab 5*: Working with color *Reading*: • DP: Chapter 4 *Homework 3*: Visualize your data: creating a visual report of your dataset
6	**Graphic Design Principles: Type Face & Layout, R plot area control** *Learning Outcomes* – Students will be able to: • Describe how type face and layout work together to create a visual hierarchy • Describe how visual hierarchies direct viewers attention • Explain how lines, gutters, grids and colors can be used to highlight visual elements Critically assess example posters and discuss useful and detracting design elements	*Reading*s: • DS: Chapter 5 • VT: Chapter 6 • Few: Chapter 4 *Homework 4*: Create plots in VT, chapter 6 *Quiz 3*: Design supported comparisons
7	**Advanced Plots & Posters in Illustrator** *Learning Outcomes* – Students will be able to: • Prepare geographic based data for plotting • Create national, regional and world map plots in R • Enhance cognitive apprehension of complex maps through the use of design elements • Use Illustrator to merge 2 or more plots and incorporate context text and design elements Create poster sized, high quality vector graphic ready for printing	*Lab 6*: Maps and posters *Readings*: • DS: Chapter 7 • VT: Chapter 7 *Quiz 4*: The right plot of the data

Week/ Lecture	Topic	Required Readings/ Assignments
8	R's ggplot package and its graphical language *Learning Outcomes* – Students will be able to: • Load packages that extend R • Create plots of 3 or more dimensions using ggplot • Create complex multi-plot layouts Explain the concept of a graphical language as implemented by ggplot	*Quiz 5*: Sub-setting data in R and the graphical language of ggplot
9	Ethics and Project Group Feedback *Learning Outcomes* – Students will be able to: • Critically assess visualizations • Identify the audience for a visual artifact • Identify visual credibility markers Discuss the ethical concerns around visual artifacts	Readings: • DS: Chapter 8 • VT: Chapter 8 Quiz 6: The right plot for the data
10	**Advanced Topics, Student Presentations & Discussion** *Learning Outcomes* – Students will be able to: • Describe advanced visualization tools used in the market place • Have knowledge of a range of additional R packages used in data cleaning and visualization not otherwise covered in class • Apply design skills learned in class to slide deck creation	
11	**Advanced Topics, Student Presentations & Discussion** *Learning Outcomes* – Students will be able to: • Describe advanced visualization tools used in the market place • Have knowledge of a range of additional R packages used in data cleaning and visualization not otherwise covered in class	

Week/ Lecture	Topic	Required Readings/ Assignments
	• Apply design skills learned in class to slide deck creation	
12	**Viz-a-thon** *Students are given a new dataset and must work together in small groups to explore the data to find the story, then create a mini-poster using R and Illustrator* *Learning Outcomes* – Students will be able to: • Demonstrate knowledge of the process of creating a visual artifact Work in a group to create a mini-poster from an unknown dataset	
13	**Interactivity in R Plotting: Shiny** *Learning Outcomes* – Students will be able to: Create an online interactive visualization portfolio	Lab: Shiny
14	**Final Project Poster Session** *Students present a poster they created themselves at the all-iSchool poster session*	