NOTE: If you don’t have any prior experience with R, this course can be very challenging. You should consider taking the IST687 Intro to Data Science course before taking this course. You could also learn R by reading the Introduction to Data Science book by Jeff Stanton (particularly the first 10 chapters): https://ischool.syr.edu/media/documents/2012/3/DataScienceBook1_1.pdf

COURSE DESCRIPTION
This course will expose students to skills and techniques related to the visualization of large datasets. The skills-based course includes modules on data preparation, knowledge representation, identifying structural relationships within data and visual design principles. Conceptual themes will be presented along side technical aspects of data visualization. Students will use a suite of visualization tools, including Python, R and Adobe Illustrator, and work with real-world datasets. We will mainly focus on R, particularly the powerful ggplot2 package. Attention will be given to displaying data in response to audience needs.

OBJECTIVES
The learning objectives for this course are adapted from the American Library Association’s Visual Literacy Competency Standards (more information available at: http://www.ala.org/acrl/standards/visualliteracy). Visual literacy enables you to effectively find, interpret, use, create, and evaluate images and visual media. In the context of this course, you will be interpreting, critiquing and creating visual representations of a range of different types of data sets.

This course will enable you to:
• Identify and define user needs related to visual representation of large data sets
  o Articulate ways images can be used to communicate data and information
  o Identify discipline-specific conventions for visualization use
  o Recognize when more information about an image is needed, develop questions for further research, and conduct additional research as appropriate
  o Define and articulate goals of a data visualization, including purpose and evaluation criteria
• Interpret and analyze the meanings of data visualizations and information graphics
  o Explore choices made in the production of a visualization to construct meaning or influence interpretation
Describe the intended audience for a visualization

Describe graphic, and aesthetic elements of visualization (e.g., color, composition, line, shape, contrast, repetition, style)

Evaluate the effectiveness and reliability of visualizations

Make judgments about the reliability and accuracy of visualization sources

Design and create meaningful data visualizations

Use appropriate editing, presentation, communication, storage, and media tools and applications to prepare and work with data visualizations

Construct accurate and appropriate graphic representations of data and information

Use aesthetic and design choices deliberately to enhance effective communication and convey meaning

REQUIRED TEXTS

Visualize This: The FlowingData Guide to Design, Visualization, and Statistics

Data Points: Visualization That Means Something

ggplot2: Elegant Graphics for Data Analysis
By Hadley Wickham. Springer, 2009. [GG in schedule]

An Introduction to Data Science
By Jeff Stanton. Free iTunes download. [ DS in schedule ]
https://ischool.syr.edu/media/documents/2012/3/DataScienceBook1_1.pdf

RECOMMENDED BLOGS AND WEBSITES

http://www.manyeyes.com/
http://www.informationisbeautiful.net/
http://flowingdata.com/
http://visual.ly/
http://eagereyes.org/
http://colorbrewer2.com/

ADDITIONAL READING

The Visual Miscellaneum, 2nd Edition, By David McCandless


Beautiful Data: The Stories Behind Elegant Data Solutions, Edited by Toby Segaran and Jeff Hammerbacher. O'Reilly, 2009.

Beautiful Visualization: Looking at Data Through the Eyes of Experts, Edited by Julie Steele and Noah Iliinsky. O'Reilly, 2010.

COURSE STRUCTURE
This class will provide many opportunities to learn about data visualization through hands-on experimentation with tools, design concepts and real-world datasets.

Course material will be delivered as:

• Assigned readings introducing concepts and techniques
• Online group discussions focusing on assigned readings and real world examples of data visualizations
• Skill-based learning modules introducing graphic design principles, features of the R programming environment and features of Adobe Illustrator
• Student presentations (recorded videos)
• Critiques of student work

Creating effective visualizations requires both programming and design skills. This semester, we will be using the R programming environment combined with Adobe Illustrator in order to introduce the basic concepts of representing large data sets in a visual format.

TENTATIVE SCHEDULE
This is a preliminary schedule, subject to change.

<table>
<thead>
<tr>
<th>Week</th>
<th>Theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jan 18 What is data visualization? Observing, Interpreting, Communicating</td>
</tr>
<tr>
<td>2</td>
<td>Jan 25 Choosing Tools Intro to R</td>
</tr>
<tr>
<td>3</td>
<td>Feb 1 Asking questions and telling stories Extracting narratives from data Skill building Illustrator Tutorials</td>
</tr>
<tr>
<td>4</td>
<td>Feb 8 Aesthetics, persuasion and audience Graphic Design Principles</td>
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<tr>
<td>5</td>
<td>Feb 15 Introduction to Class Project Brainstorming project ideas</td>
</tr>
<tr>
<td>6</td>
<td>Feb 22 Graphic Design Principles (continued)</td>
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<tr>
<td>7</td>
<td>Feb 29 R ggplot2 Basics</td>
</tr>
<tr>
<td>8</td>
<td>Mar 7 R ggplot2 Data Transformation, Manipulation, plyr package</td>
</tr>
<tr>
<td></td>
<td>Mar 14 Spring Break</td>
</tr>
<tr>
<td>9</td>
<td>Mar 21 R ggplot2 Graphics</td>
</tr>
<tr>
<td>10</td>
<td>Mar 28 R ggplot2 Polish graphics</td>
</tr>
<tr>
<td>11</td>
<td>Mar 30 Pitch Day Final project concepts</td>
</tr>
<tr>
<td>12</td>
<td>Apr 4 Is a picture worth a thousand words? Evaluation and ethics</td>
</tr>
<tr>
<td>13</td>
<td>Apr 11 Advanced Topics Student Presentations</td>
</tr>
<tr>
<td>14</td>
<td>Apr 18 Final project Final project wrap-up</td>
</tr>
<tr>
<td>15</td>
<td>Apr 25 Virtual Open House Final project presentations</td>
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</tbody>
</table>
Our “class day” will be on **Mondays**, but this doesn’t mean you'll be required to log in at any particular time every Monday. This is an online class that is conducted asynchronously, so when I say “class day” I mean that the learning module for that week with lectures, readings, etc. will be posted on Mondays, and most homework assignments will be due on Mondays at 11:59pm. In other words, our virtual “week” starts on Mondays, but the class runs continuously and you should plan on checking the Blackboard website for the course **at least every 48 hours** for new material ([http://blackboard.syr.edu](http://blackboard.syr.edu)). I will also send e-mail notifications when there are relevant items that need a student’s attention.

**ASSIGNMENTS AND GRADING**

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Percentage of total grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contributing to class discussion board</td>
<td>20%</td>
</tr>
<tr>
<td>Advanced topic presentation</td>
<td>20%</td>
</tr>
<tr>
<td>Exercises and quizzes</td>
<td>30%</td>
</tr>
<tr>
<td>Final project</td>
<td>30%</td>
</tr>
</tbody>
</table>

**Grading and feedback**

Assignments will be given at least one week prior to when they are due. If you have any questions or concerns about completing an assignment it is your responsibility to ask questions well before the due date.

Every assignment will include a list of required items and a rubric that will be used to structure the evaluation of your work. Each project will receive a numeric grade and we will provide comments about how you can improve your work in the future.

If you simply meet the requirements for a given assignment, you will probably receive a B. In order to get an A, you will need to go above and beyond the basic requirements.

The following are grade expectations and divisions according to the grading policy of the School of Information Studies. An "A" means the student has the capability to independently create engaging information visualization. If a student had a bumpy start at the beginning of the semester but ended up finishing a very high-quality project, his or her project performance will be considered in the final adjustment of the grade. Grades will not be curved in this class.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Points</th>
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<tbody>
<tr>
<td>A</td>
<td>93-100</td>
</tr>
<tr>
<td>A-</td>
<td>90-92</td>
</tr>
<tr>
<td>B</td>
<td>83-86</td>
</tr>
<tr>
<td>B-</td>
<td>80-82</td>
</tr>
<tr>
<td>C</td>
<td>77-79</td>
</tr>
<tr>
<td>C-</td>
<td>70-72</td>
</tr>
<tr>
<td>D</td>
<td>73-76</td>
</tr>
<tr>
<td>F</td>
<td>0-59</td>
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</table>

**Weekly**

**EXERCISES AND ACTIVITIES:** Weekly assignments will involve readings, technical exercises and project-specific activities (such as identifying a real world data set that you would like to work with). You will be asked to make both formal and informal
presentations (via recorded videos) throughout the semester. You will also need to complete a series of quizzes posted throughout the semester. These will combine to make up 30% of your final grade.

Ongoing

CLASS DISCUSSION: Every week you are expected to add at least one entry and comment on at least two other posts on the discussion board on Blackboard. Use this as an opportunity to keep track of thoughts, ideas, questions and inspirations. This material will eventually help you to define the topic for your final project. This is worth 20% of your final grade.

ADVANCED TOPIC PRESENTATIONS: There are many other options available for creating visualizations. Examples of other visualization environments include (but are not limited to) C4, D3, Processing, Shiny, GapMinder, Sense.Us, Gephi, and iGraph. In order to give you a taste of these other options, each of you will be selecting and presenting an “advanced topic” to the class, highlighting a product or application of your choosing. Your advanced topic presentation will contribute 20% to your final grade.

FINAL PROJECT: The final project, including a video presentation, is worth 30% of your final grade. You will begin working on your final project since the beginning of the course, with key deliverables being due throughout the semester. These assignments will be graded separately from your final deliverable and will involve:

1. Picking and preparing a dataset
2. Defining an audience and requirements for your visualizations
3. Experimenting with different visual encoding and graphic design choices
4. Conducting user testing
5. Executing your visualization
6. Presenting your final product

Throughout the semester, use your posts, class discussions and exercises to explore topics or questions that you find compelling. Details about requirements for each stage of the final project will be provided at least one week before due dates.

CLASS POLICIES

Office hours
I will host a weekly Q&A session on Tuesday 12pm via Adobe Connect: https://webconference.syr.edu/ist719-meetup/. Additional office hours are by appointment. It is your responsibility to communicate with me if you have any questions about grading, evaluation and/or any aspect of your performance.

Homework Policy
Assignments are due by 11:59pm on the due date. Late assignments will be penalized. I will deduct 10% of the original grade for the first day of lateness plus 15% for every subsequent day. Assignments that are late for a week will no longer be accepted and graded. Don’t wait until the last minute to submit your work.

Your work will also be penalized if you do not follow the file naming convention specified on the assignment sheet. Generally, all assignment should be named as follows:
Future Use of Student Work

This course may use course participation and documents created by students for educational purposes. In compliance with the Federal Family Educational Rights and Privacy Act, works in all media produced by students as part of their course participation at Syracuse University may be used for educational purposes, provided that the course syllabus makes clear that such use may occur. It is understood that registration for and continued enrollment in a course where such use of student works is announced constitutes permission by the student. After such a course has been completed, any further use of student works will meet one of the following conditions: (1) the work will be rendered anonymous through the removal of all personal identification of the work’s creator/originator(s); or (2) the creator/originator(s)' written permission will be secured. As generally accepted practice, honors theses, graduate theses, graduate research projects, dissertations, or other exit projects submitted in partial fulfillment of degree requirements are placed in the library, University Archives, or academic departments for public reference.

Academic Integrity

Syracuse University’s Academic Integrity Policy holds students accountable for the integrity of the work they submit. Students should be familiar with the policy and know that it is their responsibility to learn about course-specific expectations, as well as about university policy. The university 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 written work in more than one class without receiving written authorization in advance from both instructors. The presumptive penalty for a first offense by an undergraduate student is course failure, accompanied by a transcript notation indicating that the failure resulted from a violation of Academic Integrity Policy. The standard sanction for a first offense by a graduate student is suspension or expulsion. For more information and the complete policy, see http://academicintegrity.syr.edu

Disability-Related Accommodations

If you believe that you need accommodations for a disability, please contact the Office of Disability Services(ODS), http://disabilityservices.syr.edu, located in Room 309 of 804 University Avenue, or call (315) 443-4498 for an appointment to discuss your needs and the process for requesting accommodations. ODS is responsible for coordinating disability-related accommodations and will issue students with documented Disabilities Accommodation Authorization Letters, as appropriate. Since accommodations may require early planning and generally are not provided retroactively, please contact ODS as soon as possible.

Religious Observances Policy

SU religious observances policy, found at http://supolicies.syr.edu/emp_ben/religious_observance.htm, recognizes the diversity of faiths represented among the campus community and protects the rights of students, faculty, and staff to observe religious holidays according to their tradition. Under the policy, students are provided an opportunity to make up any examination, study, or work
requirements that may be missed due to are religious observance provided they notify their instructors before the end of the second week of classes. For fall and spring semesters, an online notification process is available through MySlice/StudentServices/Enrollment/MyReligiousObservances from the first day of class until the end of the second week of class.