Data-driven Web Applications
INFO 3300; CS 3300; INFO 5100

Instructor: Prof. Jeff Rzeszotarski, jeffrz [at] cornell.edu

Time & Location: M/W/F 11:20-12:10 in Klarman Hall KG70
Synchronous remote activities via Zoom

Course Prerequisites: CS 2110 & INFO 2300 (or prof. permission)

Course Website: https://jeffrz.com/info3300/
Canvas: https://canvas.cornell.edu/courses/44865/
Course Announcements Q&A: https://edstem.org/us/courses/25946/discussion/
Classroom Discussion: Discord
Assignment Submission: CMS

Graduate TAs:
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Ru Jie Zhao         (rjz46 [at] cornell.edu)

Re-grade requests go to: info3300staff [at] gmail.com

Course Office Hours: See directory pinned on Ed Discussions & Canvas

Contacts: Prof. Rzeszotarski for course administration
          info3300staff [at] gmail.com for Prof+Grad TAs
          Post content questions to ED or Discord
Course Description

The web has become an outstanding environment for telling stories with data. This course will cover technologies for representing, modeling and displaying data in the context of interactive web pages. Practical skills for building web pages will be mixed with data mining algorithms and visualization design theory. We will use the D3 Javascript library to develop both static and dynamic visualizations, learn more about programming in Javascript, and explore web scalable vector graphics (SVG). Through design critique and formal study, we will identify the techniques visualization developers employ to create the “right” visualization for a given use case. This course introduces a number of popular data mining models and algorithms which we will incorporate into web visualizations.

Learning Objectives

- Develop competency in client-side visualization development
- Create static and interactive web visualizations using a visualization library
- Learn trade-offs and best practices for matching data to visual elements
- Get practical experience gathering and visualizing real-world data

Structure

This class contains lectures on visualization design concepts (30%) and live coding demonstrations (70%). You will complete 10 homework assignments over the course of the term, which will involve both development and design content. All students will complete two group projects in teams of 3. Group projects will have milestones to check progress and solicit feedback. There are no assigned readings for this course.

All lectures, unless otherwise marked, are held in-person in a synchronous session. At several points during the term the class will not meet in-person and will instead gather via Zoom to conduct design activities. One key aspect of design learning is sketching and brainstorming as a group. While these activities do not work in an auditorium with fixed seating and 300 students, the affordances of web meetings allow for small group interactions. For this reason, activities will be held online. For these sessions (indicated on the class schedule), please be sure to attend via the Zoom link posted on Canvas prior to class. Bring materials for sketching your ideas or install a drawing app onto a tablet in order to be prepared to complete these activities.

Please be sure to follow all campus restrictions when attending class in-person. At the time this syllabus was updated, wearing masks during the class is heavily encouraged but is not required by Cornell University policy.
Attending class is important to your overall success in the class and is required. While lecture slides will be posted to the course web site so that students can follow along during lectures, they tend to be spare on text and might be hard to interpret without the context gained from attending class. Similarly, while all code will be published as reference for you throughout the term, it may be hard to parse without attending lectures and following along. Course staff will endeavor to provide video recordings of lectures via Canvas, however the auditorium is not configured for this. As a result, recordings may not capture all material covered or bugs may prevent some sessions from being recorded.

Instead of taking attendance in-class, starting in the second week of classes and for each week after, there will be a short quiz which covers material discussed in lectures and activities. Quizzes are intended to be straightforward and simple to complete for those who have attended the weekly lecture content.

All coding demonstrations will make use of the course repository on Github. When recordings are released, both prompts and notes will be posted to the course repository. You are encouraged to clone the repository on your own computer at the start of class so that you can follow along and edit the prompt as the recording runs.

Students enrolled in INFO5100 will complete a third, more substantial group project. All others will have a take-home exam. There is no prelim for this course. All slides will be removed from the course web site prior to the final examination. Source code from demonstrations will remain in the repository for the final exam.

**Course Attendance & Absences**

Attendance will be taken through an online quiz. Each week a quiz will be released on Friday, to be completed before 12:00PM on the following Monday. Quizzes are not intended to be challenging - if you have followed along with weekly content, you should be able to answer all questions in under 5 minutes.

**Assignments & Late Work**

Homework assignments will be posted to CMS on Monday mornings and are generally due at 11:59PM ET on the following Wednesday (~10 days later). Please refer to the course schedule for exact homework posting and due dates. At times you may not immediately be able to complete all sections of a homework when it is assigned. All content in the homework will be covered during its week of classes. You are not expected to work on homework or projects during university breaks; due dates and assignments are already adjusted to accommodate this. Submit homework using CMS.
Any late work will receive a 0 score. Submissions that cannot be decompressed, contain incorrect files, or are missing key files will receive a 0 without exception. This includes cases where you believe you submitted correct files but in fact forgot a file or submitted a previous assignment. To avoid receiving a 0 score, please re-download your submissions on CMS to verify them.

As the late policy is harsh, you will receive a total of 5 slip days for use as deadline extensions (see below in document). We will also drop the lowest two homework scores when computing final class grades (including 0 grades).

**Getting Help**

Please make use of the following channels of communication:

- The course web site and policy documentation for basic procedures and rules
- Office hours for individual help on assignments (see here for a schedule)
- Posting on course Discord for quick clarifications in-class and peer support
- Posting on the course discussion forum for longer, more involved questions - please search for similar questions before you post a new one
- For personal concerns, use the course email info3300staff@gmail.com
- Do not email the TAs or instructor unless they reach out to you directly
- Do not email about late homework or absences.

**Grading**

This year we will be offering **two grading options**. Your final grade will be computed automatically based on the **better of these two options**:

<table>
<thead>
<tr>
<th></th>
<th>Exam Bias</th>
<th>HW Bias</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class Attendance Quizzes</td>
<td>8%</td>
<td>8%</td>
</tr>
<tr>
<td>Weekly Homework</td>
<td>32%</td>
<td>40%</td>
</tr>
<tr>
<td>Project 1 &amp; 2</td>
<td>30%</td>
<td>30%</td>
</tr>
<tr>
<td>Project 3 OR Take-home Exam</td>
<td>30%</td>
<td>22%</td>
</tr>
</tbody>
</table>

Letter grades will be assigned using the **integer part of your final %**. For example, 96.01 and 96.99 both resolve to 96%, which would be an A- on the grade scale.
Note that we will be using an adjusted grade point scale for this course. Due to the large amount of extra credit that you can earn, it is entirely possible for your final grade to total higher than 100%.

<table>
<thead>
<tr>
<th>Percentage Range</th>
<th>Grade</th>
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<tbody>
<tr>
<td>&gt;=100%</td>
<td>A+</td>
</tr>
<tr>
<td>97.0%-100%</td>
<td>A</td>
</tr>
<tr>
<td>93.0%-96.9%</td>
<td>A-</td>
</tr>
<tr>
<td>90.0%-92.9%</td>
<td>B+</td>
</tr>
<tr>
<td>87.0%-89.9%</td>
<td>B</td>
</tr>
<tr>
<td>83.0%-86.9%</td>
<td>B-</td>
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<tr>
<td>80.0%-82.9%</td>
<td>C+</td>
</tr>
<tr>
<td>77.0%-79.9%</td>
<td>C</td>
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<tr>
<td>73.0%-76.9%</td>
<td>C-</td>
</tr>
<tr>
<td>70.0%-72.9%</td>
<td>D+</td>
</tr>
<tr>
<td>66.0%-69.9%</td>
<td>D</td>
</tr>
<tr>
<td>60.0%-65.9%</td>
<td>D-</td>
</tr>
</tbody>
</table>

**Extra Credit**

There are several opportunities for extra credit this term. A 1% bonus will be offered to students who post a neat visualization example from the web to the “Visualization Examples” tag on Ed Discussions. Alternatively, you can post an interesting dataset to the “Datasets” tag (no Kaggle or other major data repositories). If 75% of the class completes the mid-semester survey, then the entire class will receive a 0.5% bonus to their grade. No duplicates allowed, so do this earlier rather than later. 2% can be earned via SONA credits (see below for more details). Each remaining slip-day at the end of the term will earn 0.4% of extra credit (up to 2%). Additional extra credit opportunities may be offered at the discretion of course staff.

**Academic Integrity**

All students are expected to abide by the University’s Code of Academic Integrity. Each term there are cases where students receive a failing grade because they duplicate in-class demo code or plagiarize the work of other students. Please do not do this. Additional details are provided in the policy document.

**In-class work**

Class will often involve a programming problem that we will work on together. You are allowed to bring a laptop to class, but please sit on the left and right sides of the auditorium if you choose to use it during lectures. Cell phone use is not permitted. Please do not take photographs or recordings of lecture content without explicit permission. Any technological or behavioral disruptions will result in grade penalties.
Graduate Requirements for INFO5100

Students in INFO5100 have additional expectations in the course:

- INFO5100 homework will at times be graded against a more stringent rubric.
- INFO5100 students will be grouped together for all course projects.
- Project rubric line items have more stringent criteria for INFO5100 students.
- INFO5100 students will complete a rigorous final group project in lieu of the shorter take-home final exam for INFO3300 students.
Additional course policies:

Most if not all items in this document are based on events in class or student emails concerning rule adherence. The Instructor advises students that while it is their right to argue about small rule deviations with course staff, it is rarely in their best interest to do so when fractions of a percent of a grade are on the line. Take note that sea lawyers were often the first to be thrown overboard during a 19th century nautical mutiny, and many Dungeons & Dragons sessions have been ruined by battles over rules instead of against fictional monsters. When possible, obey the “reasonable person principle”.

Academic Integrity

All students are expected to abide by the University’s Code of Academic Integrity. Instructors are required to conduct Academic Integrity hearings should any violation of this Code occur. Please refer to the linked document for the policy and procedures which course staff will follow in the event of an AI violation.

Citing Sources

This section is based on an excellent citation guide created by Prof. Kyle Harms. We will largely be following these guidelines.

Any code that you did not write specifically for this class is considered to be external code. This includes example code from class, code from other classes at Cornell you wrote, and external code from web sites (e.g. StackOverflow). All code submitted for projects and homework assignments, unless otherwise indicated, must be your own. No external code will be permitted unless specifically identified to you by the instructor as an exception, and must be isolated from your submission in a separate file which is imported separately from your code. This includes importing helper libraries like jQuery. Integrating external example code directly into your submissions is an Academic Integrity violation.

Late or Missing Work

[The following rules apply under normal circumstances. If you have experienced a personal crisis or a medical condition contact the Instructor as soon as possible. The earlier we hear from you, the more we can help. We can only provide assistance if we are made aware of the problem in a timely fashion. Do not wait until the end of term to disclose issues which might have affected your grades.]
If you do not submit work before the stated deadline, then we will record a zero. There will be no exceptions. This policy is harsh, but it is necessary for a class of this size. All assignment deadlines are known in advance. For most students with accommodations, you should plan ahead and complete your assignment before the deadline.

Submitted files will be graded as-is and absolutely no excuses for mistaken submissions will be accepted. Verify on CMS that you have provided the correct files after submission. Any archive files must be in a format that can be opened by recent Windows and Apple OS X computers. Unopenable submissions will receive no credit. It is your duty to submit the correct files in a timely manner and verify that CMS has properly stored your submission before the deadline.

In the very unlikely event that CMS is down or you experience computer problems, you may email submissions to the course staff email address using your Cornell email account. You must email the file to the course staff email address before the homework due date - screenshots, file metadata, and git commit logs are too easy to modify.

**Slip Days / Extending Deadlines**

You can spend slip days in order to extend the deadline for a specific homework assignment. Slip days are specifically intended for legitimate reasons for needing an extension. This includes accommodations (e.g. medical issues, family emergencies, religious observance, athletic participation, etc.).

Each slip day will allow you to submit a homework assignment 24 hours after the deadline. You can use up to 3 slip days for an assignment, delaying submission for a total of 72 hours.

<table>
<thead>
<tr>
<th>1 slip day</th>
<th>2 slip days</th>
<th>3 slip days</th>
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</thead>
<tbody>
<tr>
<td>Extra 24 hours</td>
<td>Extra 48 hours</td>
<td>Extra 72 hours</td>
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</table>

Slip days will be automatically used when assignments are graded. It is your responsibility to tracking your current slip day usage. If you have insufficient slip days to cover a late submission, it will receive a 0 but no slip days will be consumed. Should you run out of slip days, any late assignments will automatically receive a 0.

Here are several example scenarios: A) You submit a homework 25 hours after the deadline. Our automatic script deducts 2 slip days from your total, leaving you with 3 days left. B) You currently have 2 slip days and decide to submit a homework 52 hours
late. This would require 3 slip days, which you do not have. As a result, you receive a 0 and keep your current 2 slip days for future use.

Please do not notify the instructor if you intend to use slip days. Course staff use an automated script to compute and maintain slip day usage. **Staff may supply CMS comments explaining your current slip day usage, but ultimately it is your job to track your use of slip days.**

### Regrade Requests

You may request a regrade, which will be granted on a case-by-case basis. Regrades requests must be submitted by email to the staff email address. **Please refer to the specific instructions on the form available here. Include the relevant fields in your email.** No new files will be accepted. As the instructions indicate, please wait 24 hours before submitting a regrade after receiving new grades. Requests received prior to that point will be discarded.

We want to give grades that accurately represent our assessment of your learning. Hence, if you are given a lower score than you should have received, you should absolutely bring it to our attention via the mechanism just described. However, we must explicitly mention an additional consequence of the importance of grade accuracy: if we notice that you have been assigned more points than you should have been, we are duty-bound to correct such scores downward to the correct value.

Regrades must be submitted within one week of the time in which homework was returned (no exceptions). For example, if homework was marked as "Graded" on Canvas at noon on Thursday, then regrades must be emailed before noon on Thursday of the following week. No late regrade requests will be accepted.

### On Decorum

Though it should go without saying, please observe respectful behavior while in class lectures. This includes following campus health rules, avoiding noise and interruptions during lectures, making appropriate comments in course chat, answering questions posed to the class, and refraining from leaving during the middle of the lecture.

Should you have issues with an undergraduate or graduate teaching assistant, please reach out to the Instructor directly.

### Note on Inclusivity

This course involves both self-directed assignments as well as in-class exercises. It is possible that in the course of this class you will encounter datasets, visualizations,
arguments that do not match your worldview or perhaps might even be upsetting. Course staff cannot guarantee such events will not occur, and do not want to hamstring the potential projects that teams can complete with a set of content requirements. Students must be respectful throughout the critique process and in-class activities, acknowledging that at times discussion can be fraught or argumentative. Course staff will not tolerate intentional displays of disrespect or marginalization during class time and out of class project work. Penalties will range from loss of participation grade to failure of projects/assignments to referral to university officials on a case-by-case basis.

Having experienced environments lacking in tolerance and inclusivity earlier in life, the Instructor will try their best to be mindful of potential issues with course content throughout the term. However, they might miss something objectionable, inadvertently encounter an instance of implicit bias, or misspeak. If during the semester you have concerns about the way the course is going or are having a negative experience, please reach out to the Instructor directly.

**Special Accommodations**

We will make every effort possible to ensure that the class works for all students. Students who have self-identified to Cornell SDS as needing special accommodations in the classroom should contact the professor at the time of enrollment or during the first two weeks of class so that any course materials can be adapted, and other appropriate arrangements made. Failure to do so may prevent us from making the proper accommodations. Lectures will not be recorded unless SDS requires it. If there is a specific event that you are concerned about (such as an exam), please inform us at least two weeks in advance so that we have time to make arrangements.

**SONA Credits**

Many researchers on campus need participants for user studies and other types of experiments. The SONA system allows you to register for studies. You will receive 0.5% extra credit for each SONA credit, up to a maximum of 2.0% for the term. Participating in studies is a great way to find out what real research looks like. To register, please visit: [https://cornell-comm.sona-systems.com](https://cornell-comm.sona-systems.com)

Note: The COMM SONA pool is different from the PSYCH SONA pool. Please verify that the URL of the pool you are using matches the one listed above. No credit can be awarded from participation in the PSYCH pool.
Example schedule. (NOT OFFICIAL FA22 SCHEDULE):

Week 0  Introduction
27-Aug  Introduction

Week 1  JS Basics
30-Aug  Javascript (coerced into a snafu)          HW1 assigned
1-Sep    JS Events & Functions
3-Sep    Visual Channels

Week 2  Drawing & Visual Analytics
6-Sep    -No class-
8-Sep    Intro to SVG          HW1 due &
10-Sep   Brief history of datavis          HW2 assigned

Week 3  Hello, Chart
13-Sep   Intro to d3          HW3 assigned
15-Sep   d3 simple bar chart (scales in d3)          HW2 due
17-Sep   Color theory + models          P1 assigned

Week 4  Scatterplots
20-Sep   d3 basic scatterplot (importing data)          HW4 assigned
22-Sep   d3 fancy scatterplot (labels & hover)          HW3 due
24-Sep   Activity - Visualization Brainstorming

Week 5  Joins and Shapes
27-Sep   d3 joins (old & new style)          HW5 assigned
29-Sep   d3 line plots          HW4 due
1-Oct    Visual Perception

Week 6  Advanced Joins
4-Oct    d3 interactive bar chart
6-Oct    d3 lollipop chart          HW5 due
8-Oct    Activity - Project Critique          P1 due

Week 7  Geo Data
11-Oct   -No class-
13-Oct   d3 choropleth (hooray geoJSON)          HW6 assigned
15-Oct   Geographic visualizations          P1 late deadline
### Week 8

**Choropleth Maps**

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Notes</th>
</tr>
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<tbody>
<tr>
<td>18-Oct</td>
<td>d3 choropleth (adding data)</td>
<td></td>
</tr>
<tr>
<td>20-Oct</td>
<td>d3 choropleth (more dots)</td>
<td>HW6 due</td>
</tr>
<tr>
<td>22-Oct</td>
<td>Human-Visualization Interaction</td>
<td>HW7 assigned</td>
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### Week 9

**Adding Interactivity**

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<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Notes</th>
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<tbody>
<tr>
<td>25-Oct</td>
<td>d3 pan+zoom</td>
<td>HW8 assigned</td>
</tr>
<tr>
<td>27-Oct</td>
<td>d3 raster vis</td>
<td>HW7 due</td>
</tr>
<tr>
<td>29-Oct</td>
<td>Activity - Interaction Brainstorm</td>
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### Week 10

**Network Diagrams**

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<tr>
<th>Date</th>
<th>Topic</th>
<th>Notes</th>
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</thead>
<tbody>
<tr>
<td>1-Nov</td>
<td>Network Layouts</td>
<td>HW9 assigned</td>
</tr>
<tr>
<td>3-Nov</td>
<td>d3 emergent layouts</td>
<td>HW8 due</td>
</tr>
<tr>
<td>5-Nov</td>
<td>d3 network layouts</td>
<td></td>
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### Week 11

**Recreating Homefinder**

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<tr>
<th>Date</th>
<th>Topic</th>
<th>Notes</th>
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<tbody>
<tr>
<td>8-Nov</td>
<td>client-server patterns</td>
<td></td>
</tr>
<tr>
<td>10-Nov</td>
<td>d3 homefinder (query manip)</td>
<td>HW9 due</td>
</tr>
<tr>
<td>12-Nov</td>
<td>d3 homefinder (direct manip)</td>
<td></td>
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### Week 12

**Multivariate Visualizations**

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<tr>
<th>Date</th>
<th>Topic</th>
<th>Notes</th>
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</thead>
<tbody>
<tr>
<td>15-Nov</td>
<td>d3 density vis (contour, density)</td>
<td>P3 assigned (5100 students)</td>
</tr>
<tr>
<td>17-Nov</td>
<td>3D d3 day (a.k.a. 3-don't)</td>
<td>P2 due</td>
</tr>
<tr>
<td>19-Nov</td>
<td>Activity - Project Critique</td>
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</tbody>
</table>

### Week 13

**Animation**

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<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Notes</th>
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</thead>
<tbody>
<tr>
<td>22-Nov</td>
<td>Animations &amp; narrative</td>
<td></td>
</tr>
<tr>
<td>24-Nov</td>
<td>-No class-</td>
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<tr>
<td>26-Nov</td>
<td>-No class-</td>
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### Week 14

**Challenging Visualizations / Make-up days**

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Notes</th>
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</thead>
<tbody>
<tr>
<td>29-Nov</td>
<td>d3 chord diagrams</td>
<td></td>
</tr>
<tr>
<td>1-Dec</td>
<td>d3 text vis</td>
<td></td>
</tr>
<tr>
<td>3-Dec</td>
<td>Activity - Designing Under Constraints</td>
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</tbody>
</table>

### Week 15

**Wrap up**
6-Dec  Physicalization & Access

Final Exam/Project Submission
For students in INFO/CS 3300  Final take-home exam
For students in INFO 5100  Complete Project 3