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|  | R Shiny for Operations and GIS |
| **Meeting Days, Times, Location:** [###] |
| **Semester:** [###]**, Year:** [ #### ] |
| **Units:** [#]**, Section(s):** [#] |

**Instructor information**

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| **Name** | Geoffrey Arnold |
| **Contact Info** | Email: |
| **Office location** |  |
| **Office hours** |  |

**TA Information [If applicable]**

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| **TA name** |  |
| **TA Contact Info** | [Include information for TA’s preferred method of contact here] |
| **Office location** | [Will the TA be located somewhere other than your office] |
| **Office hours** |  |

# **Course Description**

* This course will teach students to generate interactive websites including GIS maps and other data visualizations and reports using the R programming language. The course will focus on RStudio’s Shiny web application framework for creating interactive web applications, and the Leaflet library package for mobile-friendly interactive maps. This course builds directly from its prerequisite course, Programming R for Analytics course, and offers students a chance to build skills that will be marketable in both the public and the private sectors. Students will learn to load data from a variety of sources and formats for use in interactive web interfaces that can provide real-time information, including Rest APIs.
* Students should refresh or familiarize themselves with ggplot2 before the start of the first class.

# **Learning Objectives**

* Use R to generate interactive charts, maps, tables and graphs.
* How to create, customize and deploy R Shiny web applications.
* Customize the appearance of their Shiny applications using Shiny and CSS.
* Connect to Web API’s in order to handle getting data into R for analysis and visualization.

# **Learning Resources**

* Students will require a laptop capable of running R and R Studio for this course.
* Free user accounts for [GitHub](https://github.com/) and [shinyapps.io](http://www.shinyapps.io/).
* There is no required text for this course, but supplemental websites and materials will be provided in addition to course lectures.
  + <http://www.wprdc.org/>
  + <https://data.world/>
  + <https://www.data.gov/>
  + <https://www.census.gov/data.html>
  + <https://datasf.org/opendata/>
  + <https://data.cityofchicago.org/>

# **Assessments**

The final course grade will be calculated using the following categories:

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| **Assessment** | **Percentage of Final Grade** |
| HW 1: Building a basic UI | 10% |
| HW 2: Filtering a Plot | 10% |
| Project 1: Create a Dashboard | 30% |
| HW 3: API Calls | 10% |
| HW 4: Leaflet Map | 10% |
| Project 2: Interactive Map | 30% |

* HW1: Building a basic UI – Creating a basic UI is necessary to understanding how to organize shiny applications for users. Students are expected to choose one of the layouts discussed during the first week of class and create a basic layout using one of the generic datasets provided in some R packages (mtcars, diamonds, etc). The UI should have three (3) input elements and one (1) static plot or data table.
* HW 2: Filtering a Plot – Nearly every Shiny application requires you to translate user inputs to allow them to manipulate the data you visualize for them. Use ggplot2 and/or plotly to create three (3) different kinds of figures and one (1) data table. You may use the UI you developed for Homework 1 as your basis for the assignment, or create a new one.
* Project 1: Create a Dashboard – Creating multiple visuals from the same data is an important way to convey information to application users. Combining the information Students will create a Dashboard using a static download of an Open Data set provided from one of the resources listed in the learning resources section. Students may make their application in either flexdashboard or shinydashboard layouts. It must include three (3) filters, three (3) single numeric based boxes/gauges, one (1) datatable, and three (3) interactive and responsive charts.
* HW 3: API Calls – For many web applications it is important to pull information from somewhere else on the internet. For this assignment Students are expected to change their data source from a static file in their Dashboard application to a web resource.
* HW 4: Leaflet Map – Everyone loves maps, they like to zoom to where they live, where they’ve been, and it often places valuable context about their neighborhood, country and world. Students will create a series of leaflet maps with polygon, marker and raster data.
* Project 2: To bring the entire course together students will create an interactive map that includes one (1) interactive map, one (1) datatable, and one (1) interactive chart or graph that pulls from a web API. Applications should be deployed and working on [shinyapps.io](http://www.shinyapps.io/).

All assignments will be turned in by providing a link to the student’s GitHub repository of their work. This will allow the instructor to view how the student’s code evolved over time, for some Homework Assignments only a few commits may be necessary, but it is anticipated that the projects students complete will require numerous commits. The number of commits will not impact a student’s overall grade. Once you are done you should email the url of your github repo to {cmu email here}.

Assignments and projects are expected to follow [Google’s R Style Guide](https://google.github.io/styleguide/Rguide.xml).

Students will be assigned the following final letter grades, based on calculations coming from the course assessment section.

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| **Grade** | **Percentage Interval** |
| A | 90-100% |
| B | 80-89% |
| C | 70-79% |
| D | 60-69% |
| R (F) | < 69% |

# **Grading Policies**

* **Late-work policy**: Each day an assignment is late without a valid excuse (as outlined in the Make-up work policy) it loses one possible letter grade.
* **Make-up work policy**: If a student has an emergency of some kind they must notify the Professor within 24 hours of end of the emergency. Students are expected to provide some kind of basic documentation of the event.
* **Re-grade policy**: All Homework and Project grades are final.
* **Attendance and/or participation policy**: Attendance is not mandatory, so long as students show in their homework and projects that they have mastered the objectives of the course.

# **Course Policies**

* **Academic Integrity & Collaboration**: Students cannot work on any assignments in groups, for applications of this size multiple programmers would be overkill.
* **Late-work/Make-up work policy**: If a student has an emergency of some kind they must notify the Professor within 24 hours of end of the emergency. Students are expected to provide some kind of basic documentation of the event.
* **Accommodations for students with disabilities**: If you have a disability and require accommodations, please contact Catherine Getchell, Director of Disability Resources, 412-268-6121, getchell@cmu.edu. If you have an accommodations letter from the Disability Resources office, I encourage you to discuss your accommodations and needs with me as early in the semester as possible. I will work with you to ensure that accommodations are provided as appropriate.
* **Statement on student wellness**: As a student, you may experience a range of challenges that can interfere with learning, such as strained relationships, increased anxiety, substance use, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may diminish your academic performance and/or reduce your ability to participate in daily activities. CMU services are available, and treatment does work. You can learn more about confidential mental health services available on campus at: <http://www.cmu.edu/counseling/>. Support is always available (24/7) from Counseling and Psychological Services: 412-268-2922.
* **Mobile Devices**: So long as you are in class I expect you to stay away from the digital world. Please keep cell phones on vibrate, if you have to take a call please leave the classroom. No texting/tweeting on cellular you’re expected to have a laptop in class, so use that if you must.

# **Course Schedule**

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| **Date** | **Theme/Topic** | **Learning Outcomes Addressed** | **Assignments Due** |
| 1 | Basic Concepts of R and Shiny Apps | How to create, customize and deploy R Shiny web applications. | HW 1 |
| 2 | Inputs, Outputs, Filtering Reactive Functions and UI Updates | Use R to generate interactive charts, maps, tables and graphs. | HW 2 |
| 3 | Shiny & R Markdown | Use R to generate interactive charts, maps, tables and graphs. |  |
| 4 | Data Tables and Downloads | Use R to generate interactive charts, maps, tables and graphs. | Project 1 |
| 5 | Downloading from API’s & Course Evaluations | Methods for connecting to API’s in order to handle getting data into R for analysis and visualization. | HW 3 |
| 6 | Leaflet for R | Use R to generate interactive charts, maps, tables and graphs. | HW 4 |
| 7 | CSS Tricks and App Design | Customize the appearance of their Shiny applications using Shiny and CSS. |  |
| 8 | Finals Week – Work on Final Project |  | Project 2 |