**DANA 320: Data Visualization**

**Catalog Course Description:** Introduction to data visualization concepts and techniques. Topics include principles of visualization design, visualization for a variety of data types, and practical experience communicating information using visualizations.

**Credit Hours:** 3

**Prerequisite:** CS 120 and MATH 181 or MATH 221 or MATH 320

**Course Objectives:** Upon successful completion of the course, students will be able to:

* Recognize traits of effective visualization
* Prepare data for visualization
* Select a visualization format that suits the data
* Create data visualizations using commonly available software packages
* Present data visualizations to communicate with audience

**Format:** A combination of lecture, discussion, and hands-on activities in a face-to-face, blended, or online format. The students will be expected to participate regularly in course activities during classroom meetings and/or online via the learning management system.

**Course Rationale:** Data visualization allows people to better understand data via visual perception. This course is designed to introduce students to the principles of effective visualization design, including basics of human perception, tailoring visualizations to the data at hand, and avoiding common visualization pitfalls. Course activities will give students practical experience designing visualizations to communicate information to their audiences.

**Course Content:**

* Basics of human perception and how/why we visualize
* Graphics components for data visualization, such as colors, geometric objects, and fonts
* Various data types for visualization (numerical, categorical, time series, statistical data, etc.)
* Spatial and temporal visualization with the grammar of graphics including coordinate systems, facets, and scale
* Graph/network visualization
* Interactive data visualization
* Data dashboards

**Student Learning Assessment**

* A combination of quizzes, exams, hands-on activities, projects, and presentations may be used to assess student learning outcomes.

**References**

Suggested textbooks

* Kieran Healy. *Data Visualization: A Practical Introduction*. Princeton University Press, 2018
* Kristen Sosulski. *Data Visualization Made Simple: Insights Into Becoming Visual*. Routledge, 2019

Suggested supplemental material for students:

* Hadley Wickham and Garrett Grolemund. *R for Data Science: Import, Tidy, Transform, Visualize, and Model Data*. O’Reilly, 2017 – self contained intro to R to enable students to use R ggplot package
* Jake VanderPlas. *Python Data Science Handbook: Essential Tools for Working with Data*, 1st Edition, O’Reilly, 2016 – covers Python numpy and matplotlib packages
* Kyran Dale. *Data Visualization with Python and JavaScript: Scrape, Clean, Explore & Transform Your Data,* 1st Edition, O’Reilly, 2016
* Kevin Jolly, *Hands-On Data Visualization with Bokeh: Interactive web plotting for Python using Bokeh*, Packt, 2018

Suggested instructor resources:

* Edward Tufte. *The Visual Display of Quantitative Information*. Graphics Press, 2nd Edition, 2001.
* Edward Tufte. *Visual Explanations: Images and Quantities, Evidence and Narrative*, Graphics Press, 1997.
* Edward Tufte. *Envisioning Information.* 4th Edition, Graphics Press, 1990
* Edward Tufte. *Beautiful Evidence*, Graphics Press, 2006.
* Leland Wilkinson. *The Grammar of Graphics.* 2nd Edition, Springer, 2005.
* Hadley Wickham. A layered grammar of graphics. *Journal of Computational Statistics* 19(1): 2-28, 2010.

**Evaluation of the Course:** The instruction of the course will be evaluated by the student and peer evaluations.