

# **MATH 256 – Data Visualization and Communication– SYLLABUS**

Department of Mathematics  
Millersville University

## **Description**

This course is the continued exploration and application of data analysis techniques and programming that allows for the cleanup, analysis, interpretation, and presentation of business-related data. Includes skills and applications in pre-processing, preparing, reporting, and presenting data for further analysis. Students will be exposed to datasets created and managed by business organizations, and learn to ask salient strategic and operational questions based on the information contained within the datasets. Students will analyze statistical relations between variables, create visual depictions of the relations inherent in the data, and communicate their findings to broad audiences in oral and written formats.

## **Prerequisites**

MATH 235

## **Course Objectives**

Students will be able to

- Identify, analyze, and present data on a variety of business topics as appropriate to the target audience, task, and data.
- Formulate relevant business questions and respond using appropriate data visualization techniques.
- Design effective strategies for information presentation and decision making, individually and/or in groups.
- Apply the fundamentals of communication and alignment around concepts that are required for effective data presentation.
- Become competent in the use of data visualization software tools in business organizations.

## **Assessment**

Assessment of student achievement of the course objectives will vary from one instructor to another. Typical assessment will be made through work in class, homework, projects, and presentations administered in a traditional face-to-face classroom environment, in an online environment, or in a hybrid of face-to-face and online assessments.

## Use of Technology

Students will be well served by Microsoft Power BI on their own devices or through the Millersville Virtual Lab.

## Topics

1. Introduction
  - a) The importance of data analysis, communication, and visualization
  - b) Bad graphs are everywhere, and why they can be dangerous
  - c) Six guidelines to effective data communication
  - d) Why Power BI?
  - e) Downloading Power BI and getting it to run (both desktop (or Virtual Lab) and online versions)
2. Data Context
  - a) Understanding the importance of context
  - b) What to do before creating a presentation, report, etc.
  - c) Exploratory vs explanatory analysis
  - d) Understanding the Who, What, and How of explanatory analysis
  - e) The importance of using data correctly
  - f) Storyboarding
3. Visuals
  - a) The importance of good visuals
  - b) The breakdown of visual types (text-based (verbal system) visuals vs graphical (visual system) visuals)
  - c) How to make (in Power BI) and effectively use a host of different visuals (text, cards, tables, matrices, heatmaps, bar graphs, waterfall graphs, line graphs, scatterplots, etc.)
  - d) Graphical techniques to employ and techniques to avoid
4. Clutter
  - a) The importance of cognitive load and its effect on the audience
  - b) The importance of clutter and how it can affect audience perception of visuals
  - c) The Gestalt Principles of Visual Perception
  - d) Visual order (white space and alignment)
  - e) Contrast
  - f) How to use the various techniques to improve visuals
5. Focusing the Audience's Attention
  - a) The importance of audience focus and how to draw it
  - b) A review of iconic, short-term, and long-term memories
  - c) Preattentive attributes
  - d) Page positioning
  - e) How to use the various techniques to focus audience attention
6. Thinking Like a Designer
  - a) The importance of affordances, accessibility, and aesthetics

- b) How to use affordances to improve visuals
  - c) How to make graphs accessible to diverse audiences
  - d) How to make aesthetically pleasing visuals and reports
7. Storytelling
- a) The importance of storytelling
  - b) How to tie together visuals to create a story based on a dataset
8. Power BI Techniques
- a) Power BI techniques will be interwoven into the creation of various visuals and reports.
  - b) These techniques include
    - Loading data
    - The structure of data and variables
    - Filtering
    - Deleting Entries
    - Creating various visuals
    - Slicer manipulation
    - Data highlighting
    - Adding custom visuals
    - Conditional formatting
    - Adding data measures
    - Adding groups
    - Transforming data
    - Importing data from a website
    - Formatting visuals (changing color, text, data labels, etc.)
    - Formatting a report (Changing theme, color, reshaping visuals, etc.)
    - Basic DAX techniques
    - Exporting, publishing, and sharing reports
    - How to include reports in PowerPoint

## Recently Used Textbooks

- *Storytelling with Data: A Data Visualization Guide for Business Professionals*, 1<sup>st</sup> edition, Cole Nussbaumer Knaflic, Wiley (2015).