**Week 1: Introduction and Logistics**

1. Logistics
   1. Software programs: R, RStudio, Tableau Public
   2. Collaboration platforms: setting up Github
2. Introduction
   1. Goals for visualization
   2. Steps for Visualizing Data
   3. Data Foundations
3. Basic of R and RStudio
   1. R, RStudio, and relevant packages
   2. R Markdown for communications

**Week 2: Review of Base R Programming**

1. Basics of R Programming
   1. Data types
   2. Control and loops
   3. User-defined functions
2. Base R Graphics
   1. Base R graphic functions
   2. Basic charts

**Week 3: Foundations of Data Visualization**

1. Key Aspects of Visualization
   1. Visualization Basics
   2. Pre-attentive Processing
   3. Gestalt Laws
   4. Marks and Channels (Visual Variable)
2. Designing Visualizations
   1. Characteristics of Visual Variables
   2. Visual encoding
   3. Color Schemes
   4. Good, bad, and weird visualization

**Week 4. Dana Management for Viz**

1. Important base R commands for data management
   1. Discretization – cut()
   2. Subsetting by rows – which(), `==`, `%in%`
   3. Data type conversion – as.xxx()
   4. String manipulation – str(), sprintf(), str\_pad() in {stringr}
2. Dyplr commands
   1. Subsetting data by selecting columns- select()
   2. Selecting rows – filter()
   3. Defining new variables – mutate()
   4. Summarizing statistics – summarise()
3. Tidy data
   1. Joining datasets – inner\_join(), left\_join(), right\_join(), outer\_join()
   2. Tidy code with %>%

**Week 5. Basic ggplot**

1. Basic ggplot()
   1. Components of ggplot()
   2. Aesthetic settings
   3. Geoms and layers
   4. Themes
   5. Annotations
2. Basic Statistical graphics with ggplot()
   1. Continuous variable
   2. Discrete variables
   3. Two variables

**Week 6: Interactive Charts with plotly**

1. Plotly package
   1. plot\_ly() syntax
2. Interactive statistical graphics
   1. Continuous variable
   2. Discrete variables
   3. Two variables
3. Plotly map – a simple example with plot\_geo()

**Week 7. Introduction to R Map**

1. Types of maps
   1. Choropleth maps
   2. Scatter maps
2. Fundamental Components of a map
   1. map shapefile from a GIS system
   2. open source basemaps from leaflet
3. Static and interactive maps - with ggplot
   1. Choropleth maps
   2. Scatter maps

**Week 8. Introduction to Tableau**

1. Getting started with Tableau Public
   1. Install Tableau Public or use Tableau Online
   2. Register an account with Tableau (public server)
   3. Features of Tableau
2. Basic Statical Charts
   1. Connecting to data sources
   2. Univariate charts
   3. Bivariate charts
3. Creating Maps for spatial patterns
4. Publishing tableau chart

**Week 9. Interactive Visualization with Tableau**

1. Dashboard
   1. Static dashboard
   2. Interactive/real-time dashboard

2. Visualizing temporal pattern

2.1. Animated charts

2.2. Advanced Mapping Techniques

**Week 10. Interactive Spatial Patterns - Advanced R Maps**

1. Leaflet Maps
2. Plotly Maps
3. Mapview maps
4. Tmap

**Week 11. Introduction to R Shiny**

1. Getting started with R shiny
   1. Shiny package, Rshinyapps.io
   2. HTML concepts
   3. Build R Shiny apps with Shiny Web App or R Markdown
2. R Shiny apps skeleton
   1. UI Design – layout options, input widgets
   2. Server function
   3. Sharing shiny applications
3. An understandable shiny app

**Week 12. Visual Exploratory Analysis with Shiny Apps**

1. Univariate data
   1. Density distributions
2. Bivariate data
   1. Association
3. Serial plots with Shiny apps

**Week 13. Basic reactivity in Shiny**

1. More on input widgets
2. Reactive shiny apps

**Week 13. Process Visualization**

**Week 14. Ethics of Visualization**

1. Shiny Apps
   1. What is an interactive visualization?
   2. Interactive maps with R leaflet()
   3. D3 related R package
2. Classroom Activity and Brief history
   1. Milestones in the history of thematic cartography, statistical graphics, and data visualization
   2. Using Data Visualization to Engage in Scientific Practices
   3. How to Pick the Best Data Visualization Format

**Part II. Probabilistic /Statistical Graphics with R**

1. Graphics and Data Visualization in R
   1. R basic plot function
   2. Graphical primitives data visualization with ggplot2 cheat sheets
2. Basic R plot facilities and graphic functions
   1. Some powerful graphical functions in base R
   2. Useful libraries for visualizations
3. Exploratory visualization with R
   1. Descriptive charts
   2. Inferential charts
4. Visualizing distributions and models
   1. Density plots
   2. Model diagnostic plot
   3. Marginal charts
5. Interactive visualization and animation with R
   1. Interactive visualization of spatial data with leaflet().
   2. R graphics devices for Animation

**Part III. Interactive Visualization with R Shiny**

1. Introduction to R Shiny
   1. Structure of Shiny App
   2. Best practices of Shiny App design
   3. Sharing R Shiny App - Shiny Server
   4. Case Study
2. Dashboard using R Shiny
   1. Types of Dashboards
   2. Key Features for Designing a Dashboard
   3. Principles of dashboard design
   4. Strategies of Dashboard Design
   5. Case Study

**Part IV. Introduction to Tableau (Public)**

1. Descriptive Visualization in Tableau
   1. Slicing data by dates
   2. Basic chart types – bars, lines, area charts, heat maps, tree-maps, etc.
   3. Creating hierarchy
   4. Creating grouping
2. Inferential Graphs and Features in Tableau
   1. Time series plots in Tableau
   2. Distributional charts (box plots, histogram, and Pareto chart).
   3. Relational plots – correlation and regression
   4. Table calculations
3. Types of Dashboards
   1. Operational Dashboard
   2. Strategic Dashboard
   3. Analytical Dashboard
4. Dashboard Design principles
   1. Why Dashboards?
   2. Key Features for Designing a Dashboard
   3. Principles of dashboard design
   4. Strategies of Dashboard Design

**Part V. Business Process and Workflow Visualization**

1. Business Process vs Workflow
   1. Differences and commonalities
   2. Types of business processes
   3. Business process optimization
2. Business Process Modeling
   1. Steps in business process modeling
   2. Identify types of the process
3. Business Process Visualization
   1. What do we mean by process visualization?
   2. Where process visualization is used?
   3. Why process is used? Tangible and intangible benefits.
4. Case Studies – Control Charting Methods
   1. Supply chain and value chain
   2. Change of initiatives
   3. Projects that go off track

**Part VI. Big Data Visualization**

1. Big Data Visualizations: Challenges
2. Data Volume
   1. Aggregation
   2. Sampling
3. High Dimensional Data
   1. 2D and 3D Scatter plots
   2. Matrix of Scatter plots
   3. Heat Maps
   4. Height Maps
   5. Multiple line graph
   6. Other uncommon methods
4. Design Constraints
   1. Too much to process
   2. Hidden information
   3. Streaming adds more challenge

**Part VIII. Visualization Ethics**

1. Ethical standards in professional communications
2. Ethical issues in data visualization
3. Deceptive data visualizations