B.Sc. Honours Degree Program
Faculty of Applied Sciences
University of Sri Jayewardenepura

Course Title	**Data Visualisation**
Course Code	**ASP 460 2.0**
Credit Value	02
Status	Optional
Year/ Level	Year 4
Semester	1
Theory: Practical: Independent Learning	30 : 00 : 70
Other: Pre-requisite course/s	STA 113 2.0 Descriptive Statistics, STA 124 2.0 Data Analysis I, STA 226 1.0 Data Analysis II, STA 326 2.0 Programming and Data Analysis with R

Aims of the Course:

- To introduce data visualisation principles, theories, and techniques.
- To introduce how to better understand your data, present findings, and tell engaging data stories that clearly depict the points you want to make all through data graphics.

Intended Learning Outcomes:

On the successful completion of this course, the student should be able to:

1. Define principles of good visualisation design.
2. Identify appropriate data visualisation techniques.
3. Create data graphics using the ggplot2 package.
4. Design and create data visualisations for your target audience and task.
5. Develop dynamic visualisations that allow others to interact with data.
6. Critique existing visualisations based on data visualisation theory and principles and revise data visualisations using appropriate design principles.

Course Content:

1. Introduction to data visualisation
   1.1. History of data visualisation
   1.2. Design principles
   1.3. Visualisation design process
2. Scientific design choices in data visualisation
   2.1. Encoding and decoding
   2.2. Encoding objects
   2.3. Value-encoding attributes
3. The grammar of graphics
   3.1. Data, Aesthetics, Geometrics, Facets, Statistics, Coordinates, Theme, Scale

4. Higher-dimensional displays and special structures
   4.1. Scatterplot matrices
   4.2. Parallel coordinates
   4.3. Mosaic plots
   4.4. Small multiples and trellis displays
   4.5. Networks and trees
5. Visualisation of high-dimensional data
   5.1. Techniques for reducing the dimensionality
   5.2. Principal component analysis
6. Visualisation of multivariate data, time series data and spatial data
   6.1. Time series graphics
   6.2. Choropleth map, Heat map, Hexagonal binning, Dot map, Cluster map Bubble map, Cartogram map
   6.3. Visualising maps, Faceting, Small multiples
7. Linked data views for visual exploration

Scope and Schedule of Teaching - Learning Activities:

Topic No.	Topic/Sub Topic	No. of Hrs			Teaching Method	Assessment Criteria	ILO Alignment
		T	P	IL			
1	Introduction to data visualisation: History of data visualisation, Design principles, Visualisation design process	2	0	4	Lecture/ Handout **FA1: Individual assignment**	10% of Final Marks	1
2	Scientific design choices in data visualisation: Encoding and decoding, Encoding objects, Value-encoding attributes	2	0	4	Lecture/ Practice questions		1, 2
3	The grammar of graphics: Introduction to the grammar of graphics	2	0	4	Lecture/ Virtual Discussion Forum/ Flipped classroom		1,2
4	The grammar of graphics extensions	2	0	4	Lecture/ Virtual Discussion Forum/ Practice questions		2 , 3
5	Introduction to the ggplot2 package	2	0	4	Lecture/ Virtual Discussion Forum		3
6	Coordinate systems and axes	2	0	5	Lecture/ Virtual Discussion Forum/ Practice questions		3
7	Creating different types of static graphic	2	0	5	Lecture/ Virtual Discussion Forum/ Practice questions		3

cont.

Scope and Schedule of Teaching - Learning Activities (cont.):

Topic No.	Topic/Sub Topic	No. of Hrs			Teaching Method	Assessment Criteria	ILO Alignment
		T	P	IL			
8	Higher-dimensional displays and special structures: Scatterplot matrices, Parallel coordinates, Mosaic plots, Small multiples and trellis displays	2	0	5	Lecture/ Virtual Discussion Forum **FA2: Quiz**	10% of Final Marks	4
9	Visualisation of high-dimensional data: Techniques for reducing the dimensionality, Principal component analysis	2	0	5	Lecture/ Virtual Discussion Forum		4
10	Visualisation of multivariate data, time series data and spatial data: Visualisation of multivariate data	2	0	5	Lecture/ Practice questions/ Virtual Discussion Forum		4
11	Visualisation of multivariate data, time series data and spatial data: Visualisation of time series data	2	0	5	Lecture/ Virtual Discussion Forum/ Analysis case study		4
12	Visualisation of multivariate data, time series data and spatial data: Visualisation of spatial data	2	0	5	Lecture/ Virtual Discussion Forum/ Practice questions **FA3: Individual Project**	20% of Final Marks	4
13	Linked data views for visual exploration: Linked data views for visual exploration	2	0	5	Lecture/Practice questions/ Virtual Discussion Forum		5, 6
14	Linked data views for visual exploration: Dashboards, interactive and animated displays	2	0	5	Lecture/ Virtual discussion forum		5, 6
15	A recapitulation	2	0	5	Lecture/ Practice questions/ Virtual Discussion Forum		6
	Total	30	00	70			

Linking Program Outcomes with ILOs:

Program Outcomes: B.Sc. Honours degree

1. Demonstrate competency in theoretical knowledge and practical and/or technical skills in the respective field of specialization (statistics).
2. Communicate efficiently and effectively in the respective field of specialization using written, oral, visual and/or electronic forms.
3. Facilitate and participate as an empathetic and emotionally intelligent team player with leadership qualities, in a group, diverse team or organization.
4. Apply subject-specific knowledge and skills creatively to solve real-world problems by making context-specific operational decisions while adapting to changing environments.
5. Integrate creativity, innovation, and entrepreneurial and managerial proficiencies to build values.

6. Implement subject-based solutions in keeping with ethical, societal and environmental norms and need for sustainable development.
7. Secure life goals through lifelong learning with the aim of scholarly advancement and/or strengthening professional skills, and ensuring the betterment of the community.

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7
ILO 1	***	*		*	*		*
ILO 2	***	**		**	*		*
ILO 3	**	**			**		*
ILO 4	***	***		***	**		***
ILO 5	***	***		***	***		***
ILO 6	***	***	***	***	***	***	***

*** - Strongly linked; ** - Medium linked; * - Weekly linked

Mode of Assessment:

Formative Assessment (FA): Maximum of {FA1, FA2} 10% + FA3 20% = 30% of total marks

Summative Assessment (SA): End of Semester Examination: 2 hours paper covering Structured/ Essay type questions = 70% of the total marks

References:

- Talagala, T. S. (2024). Course website: STA 492 2.0/ASP 460 2.0 Data Visualisation, *Course website.* https://thiyangt.github.io/datavisualisation/
- Chen, C. H., Hardle, W. K., & Unwin, A. (2007). *Handbook of data visualization.* Springer Science & Business Media.
- Wickham, H., & Grolemund, G. (2019). *R for data science: import, tidy, transform, visualize, and model data.* O'Reilly Media, Inc.
- Grolemund, G., & Wickham, H. (2014). A cognitive interpretation of data analysis. *International Statistical Review*, 82(2), 184-204.