



B.Sc. (Honours) Statistics Degree Program/ B.Sc. Degree Program
Faculty of Applied Sciences
University of Sri Jayewardenepura

Course Title	Programming and Data Analysis with R
Course Code	STA 326 2.0
Credit Value	02
Status	Core for BSc (Honours) Statistics students/ Optional for others
Year/ Level	Year 3
Semester	1
Theory: Practical: Independent Learning	30 : 00 : 70
Other: Pre-requisite course/s	STA 114 2.0 Probability and Distribution Theory I, STA 123 2.0 Probability and Distribution Theory II, STA 124 1.5 Data Analysis I, STA 213 2.0 Statistical Inference, STA 226 1.5 Data Analysis II

Aims of the Course:

- To introduce how to program efficiently in R.
- To provide an in-depth and more advanced coverage of data wrangling, visualisation and analysis methods in the R programming environment.

Intended Learning Outcomes:

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

1. Use data classes, object attributes, data structures in R
2. Write user-defined functions in R to solve a given problem.
3. Apply control structures in R to control the flow of the program.
4. Apply the principles of tidyverse programming and organise complex, messy, data into the most convenient form for analysis or reporting.
5. Select effective visualisation and modelling approaches to understand relationships between variables, and make decisions with data.
6. Interpret the results of analysis and communicate these to a broad audience.

Course Content:

1. R programming basics: Objects in R, Data types, Operations, Installing packages, Control structures, Piping
2. Writing functions in R
3. Programming and Data analysis with the tidyverse
 - 3.1. Data import and export
 - 3.2. Data wrangling: Tidy data principles, Reshaping data into tidy form, Data transformation
 - 3.3. Data visualization: The grammar of graphics
 - 3.4. Statistical modelling and inference
 - 3.5. Communication: Dynamic reproducible reporting

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 R and R studio and R Programming basics	2	0	4	Lecture/ R programming practice questions		1
2	Data structures in R	2	0	4	Lecture		1
3	Functions in R	2	0	4	Lecture/ Flipped classroom/ R programming practice questions FA1: Cheat sheet-apply family functions	5% of Final Marks	1
4	Writing functions in R	2	0	4	Lecture/ R programming practice questions		2
5	Control structures	2	0	4	Lecture/ R programming practice questions		3
6	Introduction to the tidyverse data science workflow: Data import and export	2	0	5	Lecture/ R programming practice questions		4
7	Reproducible reporting with R Markdown	2	0	5	Lecture/ R programming practice questions/ Virtual Discussion Forum		4, 6
8	Data wrangling: Reshaping data	2	0	5	Lecture/ Virtual Discussion Forum/ R programming practice questions		4
9	Data wrangling: Data manipulation	2	0	5	Lecture/ R programming practice questions FA 2: Quiz	10% of Final Marks	4
10	The grammar of graphics	2	0	5	Lecture/ R programming practice questions FA3: Virtual discussion forum and individual project presentation	25% of Final Marks (5% Discussion Forum + 20% Individual project)	4, 5, 6
11	Regression Analysis with R	2	0	5	Lecture/ R programming practice questions		4, 5, 6
12	The inverse transform method and The method of Monte Carlo	2	0	5	Lecture/ R programming practice questions		5
13	Hypothesis testing	2	0	5	Lecture/ R programming practice questions		5, 6
14	Functionals	2	0	5	Lecture/ R programming practice questions		4, 5
15	Revision and ways to continue learning R no matter what you choose to be your next step	2	0	5	Lecture/ R programming journal article		1, 2, 3, 4, 5, 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

Program Outcomes: B.Sc. General degree

1. Demonstrate competency in theoretical knowledge and practical and/or technical skills in respective subject areas (statistics).
2. Communicate efficiently and effectively in the respective subject areas 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 based knowledge and skills creatively in making appropriate judgements in changing situations.
5. Integrate creativity and innovation to achieve entrepreneurial competencies.
6. Implement 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 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): FA1 5% + FA2 10% + FA3 25% = 40% of total marks

Summative Assessment (SA): End Semester Examination: 2-hour paper covering MCQs and or Short Questions, Structured Essay-type questions and Essay-type question = 60% of total marks

References:

- Talagala, T. S. (2020). Course website: STA 326 2.0 Programming and Data Analysis with R, *Course website*. <https://hellor.netlify.app/>
- Wickham, H., & Grolemund, G. (2019). *R for data science: import, tidy, transform, visualize, and model data*. O'Reilly Media, Inc. <https://r4ds.had.co.nz/>
- Grolemund, G. (2014). *Hands-on programming with R: write your own functions and simulations*. O'Reilly Media, Inc. <https://rstudio-education.github.io/hopr/>

Prepared by: Dr Thiyanga S. Talagala

email: ttalagala@sjp.ac.lk