



**Lahore University of Management Sciences**  
**ngraBIO 232 - R programming**  
Summer 2021

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Course URL (if any)	

**Course Teaching Methodology**

- Teaching Methodology: Synchronous with class notes uploaded on LMS.
- Lecture details: 100% live interaction lectures

**Course Basics**

Credit Hours	3			
Lecture(s)	Nbr of Lec(s) Per Week	5	Duration	1hr 50 mins
Recitation (per week)	Nbr of Rec (s) Per Week		Duration	
Lab (if any ) per week	Nbr of Session(s) Per Week		Duration	
Tutorial (per week)	Nbr of Tut(s) Per Week		Duration	

**Course Distribution**

Core	
Elective	Yes
Open for Student Category	Any
Closed for Student Category	

**COURSE DESCRIPTION**

This hands-on course aims to teach students how to program in R and use it for effective data analysis. Starting from basis including installation and software configuration, this course will teach the students generic programming concepts which are typically used in a high-level statistical language. Specific topics include basic programming in R, reading/write data from text files, functions, and using R packages. Practical examples from biology will be used to demonstrate the use of R for data analysis.

**COURSE PREREQUISITE(S)**

<ul style="list-style-type: none"><li>•</li><li>•</li></ul>	None
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**COURSE OBJECTIVES**

<ul style="list-style-type: none"><li>•</li><li>•</li><li>•</li></ul>	To provide an introduction to programming in R To introduce students to generic programming concepts typically used in high level statistical language To enable students to program in R to solve basic problems in biology
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**Learning Outcomes**



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<ul style="list-style-type: none"> <li>•</li> <li>•</li> <li>•</li> </ul>	After the course, the student should: <ul style="list-style-type: none"> <li>Be able to understand basic programming constructs</li> <li>Be able to programme in R</li> <li>Be able to perform moderately complex data analysis in R</li> </ul>
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### Grading Breakup and Policy

Assignment(s): 20% (2 Assignments, equal weightage) Quiz(s): 20% (4 Quizzes, equal weightage) Attendance: Midterm Examination: 25% Final Examination: 35%
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### Examination Detail

Midterm Exam	Yes/No: Yes Combine Separate: Combine Duration: 2 hrs Preferred Date: Exam Specifications:
Final Exam	Yes/No: Yes Combine Separate: Combine Duration: 2 hrs Exam Specifications:

### COURSE OVERVIEW

Week/ Lecture/ Module	Topics	Recommended Readings	Objectives/ Application
1.1	History of R, installing R, Introduction to R (writing code in R, Getting Help)		
1.2	Data types: R objects, vectors and lists, matrices, factors, data frames		
1.3	Generating sequential/random data in R, vectorized operations, missing values		
1.4	Subsetting in R: Basics, subsetting in lists and matrices, subsetting a range, subset function		
1.5	Arrays and matrices: indexing, extracting subsections of array, matrix transpose, matrix manipulation, cbind, rbind		
2.1	Reading/writing in R: reading/writing tabular data, reading/writing textual data		
2.2	Control structures: If-else, for and while loops		
2.3	Functions in R I: writing simple functions, arguments		
2.4	Functions in R II: recursion, nested function		
2.5	Scoping in R		
3.1	Date, time and other useful R utility functions		
3.2	Loop functions: lapply, apply, mapply, tapply, split		
3.3	Graphics in R: plotting in R, partitioning a graphic, graphical parameters		



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3.4	String searching, regular expressions in R		
3.5	Using packages in R		
4.1	Statistical analysis in R I: probability distributions, one-sample vs two-sample tests, power analysis		
4.2	Statistical analysis in R II: Statistical models		
4.3	Running simulations in R		
4.4	Writing complex R code, running R programmes		
4.5	Calling external programmes in R		
<b>Final Exam</b>			

### Textbook(s)/Supplementary Readings

- An Introduction to R, R Manual, <https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf>
- R Programming for Data Science, <https://bookdown.org/rdpeng/rprogdatascience/>
- Handouts