

**KUWAIT UNIVERSITY
FACULTY OF SCIENCE
DEPARTMENT OF STATISTICS & OPERATIONS RESEARCH**

Course Number: Stat 160: Introduction to Statistical Computing

Pre-requisite: Math 101 and Stat 101 (or Stat 102, 103, 201)

Course Description: To teach students to write efficient and transparent programs in R and to interface it with Statistics and Operations Research software and data bases. To acquaint students with techniques for managing data, exchanging data between different solvers and packages, and using graphs to visually describe data and draw valid inferences about potential appropriate statistical models that might describe the data.

Textbook: J. Maindonald and J. Braun. Data Analysis and Graphics Using R: An example based approach. Cambridge Press, latest edition.

Introduction to R (upon downloading R).

References: R. M. Heiberger and B. Holland. Statistical analysis and data display: An intermediate course with examples in S-Plus, R, and SAS.

P. Dalgaard. Introductory Statistics with R.

Topics to be covered

1. Working with data 10 h
 - Choosing the best data structures (vectors, matrices, arrays, lists, data frames, etc) and studying the impact of this choice on subsequent use of the data
 - Selecting the appropriate data types: numeric, logical, character, factor, dates, etc.
 - Testing different methods of importing/exporting data
 - Experimenting with data trimming and its impact on the validity of models.
 - Entering, editing, saving, viewing, formatting, and manipulating data.
2. Graphics 10 h
 - Plotting and saving low level plot functions for one, two, and multiple dimensional data
 - Plotting and saving high level plot functions
3. Writing Statistical and Operations Research macros and programs 15 h
 - Manipulating essential tools such as operators, conditional structures, assignment statements, and loops, functions and subroutines
 - Using existing macros for statistical functions and subroutines of existing optimization heuristics
 - Generating pseudo random numbers and discussing their statistical characteristics and their impact on the validity of statistical inferences drawn based on the use of those numbers
 - Discussing the impact of round-off, truncation, and computational errors
4. Importing/exporting data and interfacing it with Operational Research and statistical packages 10 h
 - Reading and writing in specific formats
 - Supported file types for importing from and exporting to data files and ODBC's
 - Interfacing an R code with solvers and packages with R calling external procedures or being called from an external procedure

Evaluation

- Homework / Quizzes 10%
- Midterm Exams 40%
- Project 10%
- Final exam 40%

Goals

To provide students with the basic tools for Statistical and Operations Research computing using R/S-Plus

Objectives

To teach students to

1. Work with data
2. Plot and save plot functions
3. Work with Statistical and Operations Research macros
4. Interface R codes with external procedures

Learning outcomes

Students should be able to

- 1.1. Work with data structures
 - 1.2. Select appropriate data type
 - 1.3. Import/export data
 - 1.4. Manipulate data
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2. Plot and save low and high level plot functions
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- 3.1. Write and use Statistical and Operations Research macros
 - 3.2. Use available Statistical and Operations Research macros
 - 3.3. Generate and work with pseudo random numbers
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- 4.1. Interface data with Statistical and Operations Research packages
 - 4.2. Call external procedures in R
 - 4.3. Call R from an external procedure