جامعة الملك عبدالله
للعلوم والتقنية
King Abdullah University of
Science and Technology

Course Syllabus: Programming with Matlab and Mathematica - AMCS 107

Division	Computer, Electrical and Mathematical Sciences & Engineering
Course Number	AMCS 107
Course Title	Programming with Matlab and Mathematica
Academic Semester	Fall
Academic Year	2019/2020
Semester Start Date	08/25/2019
Semester End Date	12/10/2019
Class Schedule (Days & Time)	01:00 PM - 02:30 PM | Sun Wed

Instructor(s)

Name	Email	Phone	Office Location	Office Hours
Maria Alexandra Gomes	Alexandra.Gomes@KAUST.EDU.SA	+966128080652		Available to students anytime I am in my office and/or e-mail for an appointment.

Teaching Assistant(s)

Name	Email

Course Information

Comprehensive Course Description	This course teaches three different programming languages, Matlab, Mathematica and R, and one typesetting system, LaTeX. We assume the audience has had beginner or intermediate experience in computer programming. The course starts with Matlab and procedural programming. Matlab efficiency with array-like objects is well suited for solving science and engineering problems. We write script files and function files that carry out calculations with polynomials, curve fitting and interpolation, optimization, numerical integration, and differential equations. We then consider Matlab add-ons and packages to solve the same problems. In the second part of the course, we introduce functional and rule-based programming with Mathematica. We start with pattern-matching, rule substitution and expression evaluation to perform list manipulation. Then, we use functions and pure functions to write more efficient programs. The course follows with basic programming and debugging in R. In particular, we learn how to read data into R, access and manipulate R packages, and write R functions. Finally, we use LaTeX to produce scientific documents and presentations, with emphasis on mathematical formulae and the bibTeX tool.
Course Description from Program Guide	This course gives an introduction to MATLAB and Mathematica. It is designed to give students fluency in these two (2) mathematical software. The course consists of interactive lectures with students doing sample programming problems in real time.
Goals and Objectives	The course targets engineers and scientists aiming to develop their coding skills from an application perpective. It will teach procedural progamming with Matlab, functional programming with Matlab and Mathematica, rule-based programming with Mathematica, and basic programming in R and LaTeX. At the end of the course, the audience will be able to choose the best language for the scientif problem at hand and be able to code the algothrim that efficiently solves the problem. Also, the student will be capable of producing a scientific paper, report or presentation with LaTeX.
Required Knowledge	Beginner level in coding in any language and basic knowledge in Linear algebra and Vector Calculus is recommended.

Reference Texts	- Matlab: A Pratical Introduction to Programming and Problem Solving. Stormy Attaway, Butterworth-Heinemann, 2012 (available online at library@kaust); - Mathematica: https://www.wolfram.com/language/elementary-introduction/2nd-ed/; - R: The R book, Michael J. Crawley, Wiley, 2007, (available online at library@kaust); - LaTeX: https://tobi.oetiker.ch/lshort/lshort.pdf.
Method of evaluation	**60.00**% - Course Project(s) **40.00**% - Quiz(zes)
Nature of the assignments	The evalution is based on in-class quizzes and 3 projects, one for each of the 3 programming languages worth 20% of the final grade.
Course Policies	Students are expected to attend all classes. Absences should be notified in advance and should comply with the university policies. Students that do not show up for a quiz should expect a zero in that assessment except in exceptional cases (such as sick leave or other university/advisor approved activities).
Additional Information	

Tentative Course Schedule

(Time, topic/emphasis & resources)

Week	Lectures	Topic
1	Sun 08/25/2019 Wed 08/28/2019	Course presentation. LaTeX.
2	Sun 09/01/2019 Wed 09/04/2019	Matlab: mathematical operations with arrays; relational and logic operators, conditional statements, loops and nested loops.
3	Sun 09/08/2019 Wed 09/11/2019	Applications to Numerical Analysis with Matlab: polynomial manipulation, curve fitting and interpolation; solving non-linear equations and finding minimum/maximum of a function.
4	Sun 09/15/2019 Wed 09/18/2019	Applications to Numerical Analysis with Matlab: numerical integration and solving ordinary differential equations. Matlab add-ons and packages.
5	Sun 09/22/2019 Wed 09/25/2019	University holiday. Mathematica: expressions and list manipulation.
6	Sun 09/29/2019 Wed 10/02/2019	Matlab: projects presentation. Mathematica: functions and pure functions;
7	Sun 10/06/2019 Wed 10/09/2019	Mathematica: pattern matching and rule substitution.
8	Sun 10/13/2019 Wed 10/16/2019	Mathematica: more on pattern matching and rule substitution; associations.
9	Sun 10/20/2019 Wed 10/23/2019	Mathematica: case studies.
10	Sun 10/27/2019 Wed 10/30/2019	Mid-semester break. Mathematica: projects presentations.
11	Sun 11/03/2019 Wed 11/06/2019	R: data types, reading and writing data.
12	Sun 11/10/2019 Wed 11/13/2019	R: control structures and functions.
13	Sun 11/17/2019 Wed 11/20/2019	R: loop functions and debugging.
14	Sun 11/24/2019 Wed 11/27/2019	R: simulating data and profiling.
15	Sun 12/01/2019 Wed 12/04/2019	R: projects presentation.
16	Sun 12/08/2019	.

Note

The instructor reserves the right to make changes to this syllabus as necessary.