



Course Syllabus: Data Structure and Algorithms - CS 204

Division	Computer, Electrical and Mathematical Sciences & Engineering
Course Number	CS 204
Course Title	Data Structure and Algorithms
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
Malek Smaoui	Malek.Smaoui@KAUST.EDU. SA	+966128080331	4304, 1, Al-Khawarizmi (bldg. 1)	By appointment, in the mornings from 9:00 to 12:00. Please email for appointments the day before at latest.

Teaching Assistant(s)	
Name	Email

Course Information	
Comprehensive Course Description	In this course, we start by an overview of the major data structures including linear data structures, trees, graphs, sets and dictionaries. Then, we move on to setting the basics of algorithm analysis, mainly time complexity estimation. Then, we move through the different algorithm design techniques starting from brute force and exhaustive search algorithms, through divide and conquer and space-time trade-off techniques, and finally we touchbase on dynamic programming and greedy algorithms. These algorithm design techniques are showcased via a wide range of common problems and famous algorithms including searching, sorting, graph problems, tree problems, string processing, combinatorial and numerical problems.
Course Description from Program Guide	This course teaches basic and advanced data structures such as linked lists, search trees, heaps, hash tables, etc. It also covers algorithm design techniques like divide and conquer, transform and conquer, dynamic programming and greedy approaches. These techniques are applied to a variety of problems including sorting, graph problems, numerical problems, string processing,
Goals and Objectives	At the end of the course, the student should: <ul style="list-style-type: none"> - be able to assess the performance of a given algorithm - be able to design algorithms to solve common problems and similar, using strategies like divide and conquer, dynamic programming or greedy algorithms. - master the use and implementation of basic data structures like linked lists, stacks, queues, trees, ... - master the basic graph algorithms like BFS, DFS, connected components, shortest path, ...
Required Knowledge	Calculus, basic programming skills
Reference Texts	Textbook: Introduction to the design and analysis of algorithms, Anany Levitin, Pearson, 3rd edition, 2011, ISBN 978-0-13-231681-1 Additional reference: Introduction to Algorithms, Tomas H. Cormen et al., MIT press, 3rd edition, 2009, ISBN 978-0262033848.

Method of evaluation	20.00% - Final exam 40.00% - Homework /Assignments 20.00% - Exam 2 20.00% - Exam 1
Nature of the assignments	<ul style="list-style-type: none"> - Assignments can be paper and pen questions and/or programming exercises. - Programs can be written in C/C++, java or python. Sometimes, a code skeleton is given to allow for uniform testing of the code. - Exam 1 and 2 cover last few weeks of material. - The final exam is comprehensive
Course Policies	<ul style="list-style-type: none"> - Late assignment submission will be penalized by 5 pts for each day. - Plagiarism will be detected and sanctioned: cooperation on assignments must be restricted to oral discussions.
Additional Information	<ul style="list-style-type: none"> - If non-CS major, student need to seek instructor approval to register in the course. Approval depends on verification of basic programming skills. - CS student do not earn credit from the course and get an S/U grade.

Tentative Course Schedule

(Time, topic/emphasis & resources)

Week	Lectures	Topic
1	Sun 08/25/2019 Wed 08/28/2019	Introduction and data structures overview Data structures - continued
2	Sun 09/01/2019 Wed 09/04/2019	Data structures - continued Algorithm analysis framework
3	Sun 09/08/2019 Wed 09/11/2019	Algorithm analysis framework - cont Analysis of non-recursive algorithms, Analysis of recursive algorithms
4	Sun 09/15/2019 Wed 09/18/2019	Analysis of recursive algorithms Review session
5	Sun 09/22/2019 Wed 09/25/2019	University holiday Midterm 1
6	Sun 09/29/2019 Wed 10/02/2019	Brute force and exhaustive search Decrease and conquer
7	Sun 10/06/2019 Wed 10/09/2019	Depth-first search and breadth first search
8	Sun 10/13/2019 Wed 10/16/2019	Divide and conquer algorithms
9	Sun 10/20/2019 Wed 10/23/2019	More divide and conquer algorithms
10	Sun 10/27/2019 Wed 10/30/2019	Review session Exam 2
11	Sun 11/03/2019 Wed 11/06/2019	Instance simplification, representation change, problem reduction
12	Sun 11/10/2019 Wed 11/13/2019	Space-time trade-offs
13	Sun 11/17/2019 Wed 11/20/2019	Dynamic Programming
14	Sun 11/24/2019 Wed 11/27/2019	Greedy algorithms
15	Sun 12/01/2019 Wed 12/04/2019	Review session Final exam
16	Sun 12/08/2019	Exams

Note

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