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

Course Syllabus: Data Structure and Algorithms - CS 160

Division	Computer, Electrical and Mathematical Sciences & Engineering
Course Number	CS 160
Course Title	Data Structure and Algorithms
Academic Semester	Fall
Academic Year	2018/2019
Semester Start Date	08/26/2018
Semester End Date	12/11/2018
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		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 techniques for the design and analysis of efficient algorithms, emphasizing methods useful in practice. Topics covered include: sorting; search trees; heaps; hashing; divide-and-conquer; dynamic programming; amortized analysis; graph algorithms; shortest paths; network flow; computational geometry; number-theoretic algorithms; polynomial and matrix calculations; caching; and parallel computing.
Goals and Objectives	At the end of the course, the student should: - 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 algrithms. - 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
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**% - Exam 1 **20.00**% - Exam 2 **40.00**% - Homework /Assignments **20.00**% - Final exam
Nature of the assignments	- 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 few weeks of material. - The final exam is comprehensive
Course Policies	- Pass or Fail with 70% threshold - 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	

Tentative Course Schedule

(Time, topic/emphasis & resources)

Week	Lectures	Topic
1	Sun 08/26/2018 Wed 08/29/2018	Introduction, Data structures overview
2	Sun 09/02/2018 Wed 09/05/2018	Algorithm analysis framework
3	Sun 09/09/2018 Wed 09/12/2018	Analysis of non-recursive algorithms Analysis of recursive algorithms
4	Sun 09/16/2018 Wed 09/19/2018	Review session and exam 1
5	Sun 09/23/2018 Wed 09/26/2018	Brute force and exhaustive search
6	Sun 09/30/2018 Wed 10/03/2018	Decrease and conquer
7	Sun 10/07/2018 Wed 10/10/2018	Depth-first search and breadth first search
8	Sun 10/14/2018 Wed 10/17/2018	Divide and conquer
9	Sun 10/21/2018 Wed 10/24/2018	Review session and exam 2
10	Sun 10/28/2018 Wed 10/31/2018	Divide and conquer
11	Sun 11/04/2018 Wed 11/07/2018	Instance simplification, representation change, problem reduction
12	Sun 11/11/2018 Wed 11/14/2018	Space-time trade-offs
13	Sun 11/18/2018 Wed 11/21/2018	Dynamic Programming
14	Sun 11/25/2018 Wed 11/28/2018	Greedy algorithms
15	Sun 12/02/2018 Wed 12/05/2018	Final exam
16	Sun 12/09/2018	
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Note

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