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

Course Syllabus: Theory of Computer Science - CS 161

Division	Computer, Electrical and Mathematical Sciences & Engineering
Course Number	CS 161
Course Title	Theory of Computer Science
Academic Semester	Spring
Academic Year	2016/2017
Semester Start Date	01/22/2017
Semester End Date	05/18/2017
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 8080331		Mon - Wed, 10:30 to 12:00

Teaching Assistant(s)

Name	Email

Course Information

Comprehensive Course Description	Part one: computational models, including Finite State Automata and regular expressions, Push down-automata and context-free grammars, and Turing machines. Part two: decidability, Church-Turing thesis, Universal Turing Machine and the Halting problem, unrecognizable languages. Part three: reductions, computable functions, complexity, P and NP, NP completeness.
Course Description from Program Guide	The course will progress through finite automata, circuits and decision trees, Turing machines and computability, efficient algorithms, reducibility, the P versus NP problem, NP-completeness, the power of randomness, and computational learning theory. It examines the classes of problems that can and cannot be solved by various kinds of machines. It tries to explain the key differences between computational models that affect their power.
Goals and Objectives	At the end of this course, students should: 1. Use different computational models to recognize or generate languages. 2. Understand language classification according to computational modelization. 3. Understand the relation between languages and general computational problems 4. Prove a language is decidable/undecidable. 5. Prove a language is recognizable/unrecognizable. 6. Prove a language is P, NP or NP-complete
Required Knowledge	Basic calculus

Reference Texts	Required Textbook: -Introduction to the Theory of Computation, Michael Sipser, 3rd edition, Cengage Learning, 2012. Additional references: -Concise Guide to Computation Theory. Akira Maruoka, Springer London, 2011. -Elements of Computation Theory. Arindama Singh, Springer London, 2009. -Computational complexity: a modern approach. Sanjeev Arora, Boaz Barak, Cambridge University Press, 2009 -Computability and Complexity Theory. Steven Homer, Alan L. Selman, Springer US, 2011
Method of evaluation	**50.00**% - Quiz(zes) **20.00**% - Homework /Assignments **30.00**% - Final exam
Nature of the assignments	Prior to each session: - Viewing video of lecture - Reading corresponding sections from textbook During session: - Summary of lecture material - Solving corresponding exercises After session: - Solving short problem set (2-3 exercises)
Course Policies	All homework assignments, quizzes, and exams are required. Students who do not show up for a Quiz or an exam should expect a grade of zero on that exam. Problem set solutions should be turned in no later than 10 min after the beginning of the session or will be refused.
Additional Information	This course will help the student learn "how to learn". The student should discover the material on his/her own through recorded video lectures and text reading. Class time will be focused on how to use the acquired knowledge to solve problems. The course may seem very "theoretical". It's main purpose is to cultivate problem solving skills.

Tentative Course Schedule *(Time, topic/emphasis & resources)*		
Week	**Lectures**	**Topic**
1	Sun 01/22/2017 Wed 01/25/2017	Regular languages, finite-state machines and undeterminisitic finite-state machines
2	Sun 01/29/2017 Wed 02/01/2017	Regular expressions. Regular languages vs non-regular languages
3	Sun 02/05/2017 Wed 02/08/2017	Non-regular languages, Context-free grammars and push-down automata
4	Sun 02/12/2017 Wed 02/15/2017	Turing machines
5	Sun 02/19/2017 Wed 02/22/2017	Decidable languages
6	Sun 02/26/2017 Wed 03/01/2017	Universal Turing machine
7	Sun 03/05/2017 Wed 03/08/2017	Countability, diagonaliazation
8	Sun 03/12/2017 Wed 03/15/2017	The halting problem
9	Sun 03/19/2017 Wed 03/22/2017	Undecidable languages
10	Sun 03/26/2017 Wed 03/29/2017	Reductions
11	Sun 04/02/2017 Wed 04/05/2017	Reductions
12	Sun 04/09/2017 Wed 04/12/2017	Function computatbility
13	Sun 04/16/2017 Wed 04/19/2017	P, NP and polynomial time reductions
14	Sun 04/23/2017 Wed 04/26/2017	NP-completeness
15	Sun 04/30/2017 Wed 05/03/2017	
16	Sun 05/07/2017 Wed 05/10/2017	
17	Sun 05/14/2017 Wed 05/17/2017	
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Note

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