



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	2017/2018
Semester Start Date	01/28/2018
Semester End Date	05/24/2018
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		Sun, Mon, Wed, Thu, 9:00 to 12:00, by appointment. Please email for appointment one day earlier.

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: <ol style="list-style-type: none"> 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, basic discrete math

Reference Texts	<p>Required Textbook:</p> <ul style="list-style-type: none"> -Introduction to the Theory of Computation, Michael Sipser, 3rd edition, Cengage Learning, 2012. <p>Additional references:</p> <ul style="list-style-type: none"> -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	<p>30.00% - Final exam 20.00% - Homework /Assignments 50.00% - Quiz(zes)</p>
Nature of the assignments	<p>Prior to each session:</p> <ul style="list-style-type: none"> - Viewing video of lecture - Reading corresponding sections from textbook <p>During session:</p> <ul style="list-style-type: none"> - Summary of lecture material - Solving corresponding exercises <p>After session:</p> <ul style="list-style-type: none"> - Solving short problem set (2-3 exercises)
Course Policies	<p>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.</p>
Additional Information	<p>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.</p> <p>The course may seem very "theoretical". It's main purpose is to cultivate problem solving skills.</p>

Tentative Course Schedule

(Time, topic/emphasis & resources)

Week	Lectures	Topic
1	Sun 01/28/2018 Wed 01/31/2018	Regular languages, finite-state machines undeterministic finite-state machines
2	Sun 02/04/2018 Wed 02/07/2018	Regular expressions. Regular languages vs non-regular languages
3	Sun 02/11/2018 Wed 02/14/2018	Non-regular languages, Context-free grammars and push-down automata
4	Sun 02/18/2018 Wed 02/21/2018	Turing machines
5	Sun 02/25/2018 Wed 02/28/2018	Decidable languages
6	Sun 03/04/2018 Wed 03/07/2018	Universal Turing machine
7	Sun 03/11/2018 Wed 03/14/2018	Countability Diagonalization
8	Sun 03/18/2018 Wed 03/21/2018	Midterm
9	Sun 03/25/2018 Wed 03/28/2018	The halting problem
10	Sun 04/01/2018 Wed 04/04/2018	Spring break
11	Sun 04/08/2018 Wed 04/11/2018	Undecidable languages
12	Sun 04/15/2018 Wed 04/18/2018	Reductions
13	Sun 04/22/2018 Wed 04/25/2018	Reductions
14	Sun 04/29/2018 Wed 05/02/2018	Computability
15	Sun 05/06/2018 Wed 05/09/2018	P, NP and polynomial time reductions NP-completeness
16	Sun 05/13/2018 Wed 05/16/2018	Final
17	Sun 05/20/2018 Wed 05/23/2018	
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Note

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