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	2018/2019
Semester Start Date	01/27/2019
Semester End Date	05/23/2019
Class Schedule (Days & Time)	02:30 PM - 04:00 PM | Sun Wed

Instructor(s)

Name	Email	Phone	Office Location	Office Hours
Malek Smaoui	Malek.Smaoui@KAUST.EDU.SA	+966128080331	4303, 1, Al-Khawarizmi (bldg. 1)	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: 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	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 01/27/2019 Wed 01/30/2019	Regular languages, finite-state machines undeterminisitic finite-state machines
2	Sun 02/03/2019 Wed 02/06/2019	Regular expressions. Regular languages vs non-regular languages
3	Sun 02/10/2019 Wed 02/13/2019	Non-regular languages, Context-free grammars and push-down automata
4	Sun 02/17/2019 Wed 02/20/2019	Turing machines
5	Sun 02/24/2019 Wed 02/27/2019	Decidable languages
6	Sun 03/03/2019 Wed 03/06/2019	Universal Turing machine
7	Sun 03/10/2019 Wed 03/13/2019	Countability Diagonalization
8	Sun 03/17/2019 Wed 03/20/2019	Midterm
9	Sun 03/24/2019 Wed 03/27/2019	Spring Break
10	Sun 03/31/2019 Wed 04/03/2019	Undecidable languages
11	Sun 04/07/2019 Wed 04/10/2019	Undecidable languages
12	Sun 04/14/2019 Wed 04/17/2019	Reductions
13	Sun 04/21/2019 Wed 04/24/2019	Reductions
14	Sun 04/28/2019 Wed 05/01/2019	Computability
15	Sun 05/05/2019 Wed 05/08/2019	P, NP and polynomial time reductions NP-completeness
16	Sun 05/12/2019 Wed 05/15/2019	Final
17	Sun 05/19/2019 Wed 05/22/2019	Final Exam Week

Note

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