

CS 6160: Theory of Computation (Grad) Fall 2018

Instructor: Mohammad Mahmoody

Credit Units: 3

Time and Location: Fridays 2pm-4:45pm, Olsson Hall 011

Instructor: Mohammad Mahmoody (Rice 511) mohammad@cs.virginia.edu

Office Hours:

- Always possible to be arranged by email. Default times: Weds 10:30am–11:45am and after class on Fridays.

Goals and Objectives: The goal of this course is to develop skills that allow formally arguing about computation; namely the nature of algorithms and resources used in computing. This involves knowing how to define the notion of algorithm in a formal way in various settings and how to use the right theoretical tools to argue about their validity and complexity.

Textbook: Two main sources, though we might use others as well:

- Introduction to the Theory of Computation by Michael Sipser (3rd Edition)
- Computational Complexity A Modern Approach, by Sanjeev Arora and Boaz Barak

Topics/Outline:

- Automata Theory: Finite automata, regular expressions, push-down automata, context free grammars, pumping lemmas.
- Computability: Turing machines and Church-Turing thesis, decidability, halting problem, reducibility.
- Computational Complexity: Time and space measures, hierarchy theorems, complexity classes (P, NP, P/poly PSPACE, etc.) and the P versus NP conjecture, quantifiers and games, relativized computation and oracles, probabilistic computation, interactive proof systems, Zero knowledge proof systems.

- Misc advanced topics (could be topic of your presentations if you choose to) : Quantum Computation, Complexity of knots, Connections to statistical physics.

Prerequisites: The key is to be comfortable with math concepts and proofs. However, no prerequisites are enforced, yet being familiar with concepts of CS 3102 (theory of computation), CS 2102 (Discrete Math), and Algorithms (CS 4102) will be helpful.

Grading: There will be a take-home final exam (25%) a take home midterm (25%), class participation and contribution (20%), and 2 assignments (30% = 15% each) done perhaps in groups with independent submissions. There will be an extra (20%) that can be obtained by giving a nice presentation on a relevant topic not covered in class.

Honor Policy: Collaboration for exams is not allowed, but doing so is allowed and even encouraged for assignments. However, you have to write the assignments on your own. Within that context, all are subject to the UVa's honor policy. <https://honor.virginia.edu/statement>

Course's Pages: Main page where you can find the suggested readings: <https://www.cs.virginia.edu/~mohammad/courses/toc/sp18/>

Collab page:

<https://collab.its.virginia.edu/portal/site/4b7d4f5e-4fe4-4683-aa13-af4f1b865664>

where you upload assignments and take-home exams.

Mailing list: theory-of-comp-spring-19@collab.its.virginia.edu

Disabilities accommodation. The University of Virginia strives to provide accessibility to all students. If you require an accommodation to fully access this course, please contact the Student Disability Access Center (SDAC) at (434) 243-5180 or sdac@virginia.edu. If you are unsure if you require an accommodation, or to learn more about their services, you may contact the SDAC at the number above or by visiting their website at <http://studenthealth.virginia.edu/student-disability-access-center/faculty-staff>

Sexual assault prevention. The University of Virginia is dedicated to providing a safe and equitable learning environment for all students. To that end, it is vital that you know two values that I and the University hold as critically important: (1) Power-based personal violence will not be tolerated. (2) Everyone has a responsibility to do their part to maintain a safe community on Grounds. If you or someone you know has been affected by power-based personal violence, I urge you to check this link that describes reporting options and resources available: <http://eocr.virginia.edu/>

Religious accommodation. It is the University's long-standing policy and practice to reasonably accommodate students so that they do not experience an adverse academic consequence when sincerely held religious beliefs or observances conflict with academic requirements. Students who wish to request academic accommodation for a religious observance should submit their request in writing directly to me (Mohammad) by email as far in advance as possible. Students and instructors who have questions or concerns about academic accommodations for religious observance or religious beliefs may contact the University's Office for Equal Opportunity and Civil Rights (EOCR) at UVAEOCR@virginia.edu or 434-924-3200. Accommodations do not relieve you of the responsibility for completion of any part of the coursework missed as the result of a religious observance.