CS 3102 - Theory of Computation: Syllabus

Dimitris Diochnos
Department of Computer Science, University of Virginia

FALL 2018

Time and Location

Mondays & Wednesdays, 3:30pm-4:45pm, Ruffner Hall G008

Website: http://www.cs.virginia.edu/diochnos/teaching/

Collab: The Collab website will be used in order to distribute homework assignments and potentially other reading materials.

Instructor

Dimitris Diochnos, 532 Rice Hall, diochnos@virginia.edu.

Teaching Assistants

The Master’s students (listed alphabetically by last name) Karthik Chinnathambi (kc4bf), Tanya Frank (tf7xy), Keshav Narayan (kkk4nd), as well as the undergraduate students (again listed alphabetically by last name) Siddharth Ghatti (sg4ff), Adam Klein (awk3bf), and Max Rifkin (mfr3ds).

Office Hours

Teaching assistants hold their office hours in 436 Rice Hall. I hold my office hours in 414 Rice Hall on Mondays and 514 Rice Hall on Wednesdays.

Monday. We have

• Karthik Chinnathambi (kc4bf), 10am-2pm at 436 Rice Hall.
• Dimitris Diochnos (dd7rq), 5pm-6pm at 414 Rice Hall.

Tuesday. We have

• Max Rifkin (mfr3ds), 10am-12pm at 436 Rice Hall.
• Adam Klein (awk3bf), 3.30pm-5.30pm at 436 Rice Hall.

Wednesday. We have

• Dimitris Diochnos (dd7rq), 11am-1pm at 514 Rice Hall.

Thursday. We have

September 11, 2018
• Keshav Narayan (kkk4nd), **10am-12pm** at 436 Rice Hall.
• Tanya Frank (tf7xy), **4pm-6pm** at 436 Rice Hall.

**Friday.** We have

• Keshav Narayan (kkk4nd), **10am-2pm** at 436 Rice Hall.
• Siddharth Ghatti (sg4ff), **2pm-4pm** at 436 Rice Hall.
• Tanya Frank (tf7xy), **4.30pm-6.30pm** at 436 Rice Hall.

**Remark.** The last day that office hours will be held is on Wednesday, December 5. In other words, there will be **no office hours** held in the interval after the last class and until the final exam; that is, **between Thursday, December 6 and Saturday, December 15.**

**Prerequisite Background**

The official prerequisites for CS3102 are CS2102 (Discrete Mathematics) and CS2110 (Software Development Methods) both with grades of C- or higher. Students entering CS3102 are expected to be comfortable with proof techniques involving first order predicate logic and induction, reasoning about finite and infinite sets, recursive definitions and problem solving, and programming. Students are also expected to have had some previous exposure to asymptotic notation and algorithm analysis (from either CS1120 or CS2220). If you do not satisfy the prerequisites, you should meet with me to discuss whether you should take the class.

**Topics and Course Description**

(As listed in the undergraduate catalog:) Introduces computation theory including grammars, finite state machines, pushdown automata, and Turing machines.

**Schedule of Classes**

The syllabus is continuously updated and subject to change. We will cover the material at a pace that is comfortable. Our **first meeting** is on **Wednesday, August 29, 2018** and our **last meeting** is on **Wednesday, December 5, 2018**.

We will cover most of the Chapters 0-5 and Chapter 7 of Sipser’s book well as some topics not covered in the book. A **rough outline** for the course, which is subject to change slightly depending on our pace, is:

- Classes 1-7: Proof techniques, finite automata, nondeterminism, regular languages (Chapters 0-1 of Sipser).
- Classes 8-11: Pushdown automata, context-free languages, grammars (Chapter 2).
- Class 12 (**Wed, Oct 10**; after reading days): **Midterm**; covering Chapters 0, 1 and 2 from Sipser’s book.
- Classes 13-18: Turing machines, computability (Chapters 3-5).
- Class 19 (**Mon, Nov 5**): **Second midterm** covering Chapters 0-5; most likely with emphasis on the chapters after the first midterm. Note that depending on our pace, we may have to push back by a week this particular midterm.
- Classes 20-24: Complexity, NP-completeness (Chapter 7).
• Classes 25-27: Time permitting, examine other interesting topics such as PSPACE, L, NL, Kolmogorov complexity, or other advanced topics.

The final exam is in-class on Saturday, December 15, 2018 between 2:00pm and 5:00pm.

This course is a theory course and our primary focus is on abstract, theoretical ideas, though we may touch on relevant applications at various points (and especially in the topics discussed in the end)

No Classes. No classes on the following days:

• Reading days: Saturday, October 6 - Tuesday, October 9.
• Thanksgiving recess: Wednesday, November 21 - Sunday, November 25.
• Elections are on November 6, but they will not affect our schedule as we have no meetings that day.

Textbook, Notes and Related Reading Materials

Textbook. The textbook for the course is Introduction to the Theory of Computation (2nd Edition), by Michael Sipser [8].

Other Books of Interest.

• Computability and Unsolvability, by Martin Davis [1].
• Computational Complexity, by Christos Papadimitriou [6].

Another book of interest, which can be inspiring providing patterns for problem-solving strategies, is the one by George Pólya,

• How to Solve It: A New Aspect of Mathematical Method [7].

There are also two interesting books by Leslie Valiant that give a good flavor of the other course that I am teaching in computational learning theory and to some extent show connections between the theory of machine learning and artificial intelligence on one hand, and the theory of computation on the other hand. These two books are,

• Probably Approximately Correct: Nature’s Algorithms for Learning and Prospering in a Complex World [9],
• Circuits of the Mind [10].

Finally, due to the close interaction of modern mathematics and complexity theory, other fun books that revolve around mathematics, or the history of mathematics, also come to mind and one can enjoy in their free time.

• Logicomix: An epic search for truth, by Apostolos Doxiadis and Christos Papadimitriou [3].
• The Parrot’s Theorem: A Novel, by Denis Guedj [5].
• Uncle Petros and Goldbach’s Conjecture: A Novel of Mathematical Obsession, by Apostolos Doxiadis [2].
Grading

Grading will be based on the following:

- 50% homework assignments,
- 30% midterm exams (15% each midterm),
- 20% final exam.

Grades may also be adjusted slightly upward or downward depending on class participation. This is the first time that I am teaching the course, therefore my estimates may be slightly off. However, I expect grading to be along the lines shown in the table below:

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<td>A+</td>
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<td>≥ 93%</td>
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<td>≥ 86%</td>
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Examinations

We will have two midterm exams; at least one will be in-class.

The final exam is in-class on Saturday, December 15, 2018 between 2:00pm and 5:00pm.

In-class exams will be closed-book written exams.

- However you are allowed to bring one sheet of paper, with letterpaper size, and thus use one page in the front and one page in the back of that paper for your personal notes.

Homework Assignments

There will be 5 or 6 homework assignments.

The assignments will be weighted roughly evenly. In other words the contribution for the 50% of your grade based on homework assignments will be computed by adding up all the grades that you receive from the individual assignments and then dividing by the maximum amount of grades that you could gather from all these assignments.
Collaboration Policy

Students may form groups of up to 5 people and work together on the homework assignments.

- Collaborators (in case you form a group) must be named (together with their university IDs) at the top of every assignment.

- The study groups are intended to foster collaborations, encourage brainstorming, create excitement, and make the learning process more fun. Each study group should meet regularly (say once or twice per week throughout the semester). Everyone in the study group should contribute fairly to the overall group effort. Ideally, equal group effort should be put by everyone in the group in each assignment. Please form your study groups early in the semester (by the second week) and meet regularly.

- Students are allowed to leave the initial group where they were members of, but can not form or join a different group. Therefore, from the point in time where one leaves from the initial group they were members of, then they will deliver the solutions to the homework assignments alone until the end of the course. An exception to this rule is if you are asked by a TA or an instructor to change to a different group; but most likely this will not happen to any one of you during the course.

General Remarks. Please note the following two.

- If you are unsure if something is permitted, consult with me before doing it.

- For exams (whether midterms or final), students are required to work alone and follow the stated rules exactly.

Honor Code

I trust every student in this course to fully comply with all of the provisions of the University’s Honor Code. By enrolling in this course, you have agreed to abide by and uphold the Honor System of the University of Virginia, as well as the following policies specific to this course.

- All graded assignments must be pledged.

- All suspected violations will be forwarded to the Honor Committee, and you may, at my discretion, receive an immediate zero on that assignment regardless of any action taken by the Honor Committee.

- Please let me know if you have any questions regarding the course Honor policy. If you believe you may have committed an Honor Offense, you may wish to file a Conscientious Retraction by calling the Honor Offices at (434) 924-7602. For your retraction to be considered valid, it must, among other things, be filed with the Honor Committee before you are aware that the act in question has come under suspicion by anyone. More information can be found at honor.virginia.edu.

- Your Honor representatives can be found at: honor.virginia.edu/representatives.

Cheating

Cheating and/or plagiarism is strictly prohibited, including under the UVa Honor Code (see the previous section as well as honor.virginia.edu for more details). Violators will be subject to serious penalties, including receiving a failing grade on an exam or even in the entire course, as well as possible referral to the UVa Honor Committee (which could lead to expulsion from the University).

Some examples of cheating / plagiarism include:
• Copying of solutions from other people or sources (including downloading from Web sites).
• Sharing of solutions with other people (including uploading to Web sites).
• Cutting-and-pasting from other people’s work and/or text.
• Posting to Web sites or to blogs questions from the course (problem sets, exams, homeworks, etc).
• Copying article/book/video/movie reviews from anyone (including from Web sites).
• Having other people solve entire problems for you with little effort on your part.
• Providing other people with verbatim solutions to problems with little effort on their part.
• Providing solutions on an exam or assignment that you cannot explain in person.

The list above contains only some selected examples of bad behavior and is definitely not exhaustive. It isn’t feasible to enumerate all the possible ways to cheat, so please don’t exploit “loop holes” in this policy, and instead please respect its spirit and positive intent. If you are in doubt as to whether any particular behavior violates the cheating policy or Honor Code, please ask any of the TAs or me. We reserve the right to ask you in person any of your answers on any exam / homework / submission (and we will do this at our discretion). If you can’t clearly explain in person one of your answers, we will consider this to be cheating. Similarly, if we find one of your answers on the Web verbatim (or near-verbatim), we will consider this to be cheating also.

Remember that this is a course in “computer science theory” and “problem solving”, and not a course in “Google searching”, nor a course in “copying-and-pasting”. The readings in this course are not a substitute for learning about the theory of computation, but rather they are designed to ignite your intellectual curiosity, expose you a lot of interesting and cool ideas, help you become a better problem-solver, and elevate the grades of those who diligently study and learn.

Also, “cramming” and procrastination are highly correlated with cheating, so start working on your homework assignments early! Additional damage caused by cheaters include creating unnecessary stress and wasted time for your fellow students and course administrators, and it also demoralizes your professors and TAs over time and forces them to become more suspicious and act more strictly and sternly with students. For example, past cheating behavior in this course (by other instructors) has already forced them to dedicate a big chunk of their syllabus to address cheating-related issues and as you can see this syllabus as well.

We would like to encourage honest collaborations, brainstorming, and study groups, but we prefer to not play “gotcha” with well-meaning people, so please don’t play “gotcha” with us. We sincerely ask for your help in creating a more positive learning experience for everyone.

Late Work Policy

Nothing can be turned in late.

We will be using an electronic system (Collab) for the students’ submissions and therefore it is your responsibility to turn in your homework (or an exam, should this be the case) on time. You are allowed to upload multiple copies of your work, so always make sure that you have submitted something. We will not accept homework (or exams) to be turned in late.

General Policies by the University of Virginia

UVA is committed to creating a learning environment that meets the needs of its diverse student body. If you anticipate or experience any barriers to learning in this course, please feel welcome to discuss your concerns with me.
Disability Accommodations. If you have a disability, or think you may have a disability, you may also want to meet with the Student Disability Access Center (SDAC), to request an official accommodation. You can find more information about SDAC, including how to apply online, through their website which can be found online at sdac.studenthealth.virginia.edu. If you have already been approved for accommodations through SDAC, please make sure to send me your accommodation letter and meet with me so we can develop an implementation plan together.

Religious Accommodations. 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 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.

Violence and 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, more information can be found on the UVA Sexual Violence website that describes reporting options and resources available; please see www.virginia.edu/sexualviolence.

As your professor and as a person, know that I care about you and your well-being and stand ready to provide support and resources as I can. As a faculty member, I am a responsible employee, which means that I am required by University policy and federal law to report what you tell me to the University’s Title IX Coordinator. The Title IX Coordinator’s job is to ensure that the reporting student receives the resources and support that they need, while also reviewing the information presented to determine whether further action is necessary to ensure survivor safety and the safety of the University community. If you would rather keep this information confidential, there are Confidential Employees you can talk to on Grounds (See www.virginia.edu/justreportit/confidential_resources.pdf). The worst possible situation would be for you or your friend to remain silent when there are so many here willing and able to help.

Add/Drop/Withdrawal Deadlines. The School of Engineering has the following deadlines:

Add: September 11
Drop without penalty (course removed from transcript): October 16
Drop with W: October 23

References


