

Introduction to Theory of Computation

Spring 2022

CMSC 303, Face to Face, Tu/Th 2:00-3:15pm Engr Hall West 101

Instructor

Daniel Cranston

Contact Information

dcranston@vcu.edu

Office Hours

3:15-4:15 Tuesday/Thursday and by appointment. I typically hold my office hours in the open area right outside of our classroom or (in nice weather) in the courtyard outside. The best way to get in touch with me is either to catch me before or after class or to message me on Discord. I will usually respond to your message within 48 hours.

Office Location

Engineering Hall East 4249

Course Catalog Description

Semester course; 3 lecture hours. 3 credits. Complexity classes, grammars, automata, formal languages, Turing machines, computability.

Course Prerequisite

[CMSC 302](#) or the equivalent with a grade of C or better.

Course Learning Objectives

Students will learn to apply computer science theory to produce computing-based solutions. They will achieve this through learning to do many specific tasks. For clearer organization, these can be grouped into the following categories.

1. State the formal definitions of different models of computation (deterministic finite automata, nondeterministic finite automata, regular expressions, context-free grammars, pushdown automata, Turing machines). Move easily between formal definitions of various types of automata and their corresponding state diagrams. Be able to paraphrase each of these definitions (in more informal language).
2. Given a hypothetical example of a certain model, determine whether it satisfies the required definition. Given an instance of one of the models above (often in the form of a state diagram) and an input string, apply the definitions above to decide whether the input string is accepted or not.
3. Given a language L that is described by a regular expression or a context-free grammar, construct a finite automata or pushdown finite automata that accepts L . Given a finite automata or pushdown finite automata, construct an equivalent regular expression or context-free grammar. Convert a context-free grammar to Chomsky Normal Form. Given a language L that is decidable, construct a Turing machine that decides it; write an implementation-level description first, and then convert it to a state diagram.
4. Apply the appropriate version of the pumping lemma to show that a language is not regular, or is not context-free. Construct a proof by contradiction to show that a language is undecidable. Use a reduction, specifically a mapping reduction, to show that a language is undecidable or that it is unrecognizable.
5. Simulate Turing machines, and explain the significance of the Church-Turing Thesis. Prove that a language is decidable or that it is recursively enumerable.

Keeping Up with the Course

It is important to keep up with the class content (watching lecture videos or reading the sections in the book) as well as attending class sections (and participating), completing homework assignments, and preparing for tests and exams. Check the course schedule regularly to familiarize yourself with the work and due dates.

Course Structure/Campus Requirements

- All meetings of this class will take place in person. However, much of the course content will be delivered through the online learning environment, Canvas. All homework assignments and portions of the tests will be submitted through Canvas.

- This is a 14-week course that will require participation and collaboration with fellow classmates. Be prepared to complete and upload assignments using Canvas.
- Follow the course schedule to be sure you are keeping up with discussion, activities and assignments. We also use a Discord server, which is where I post all class announcements, including tests and due dates, and which is a great place to ask questions outside of class times and office hours.

General Instructions

1. All assignments must be uploaded to Canvas on or before the due date specified. Only files submitted to Canvas on or before the due date will be considered for grading. Requests to re-grade assignments must be made within two weeks from the date the grade is posted in Canvas, requests after this time will be denied.
2. No assignments will be accepted late unless special permission has been given prior to the due date.
3. No makeup exams or tests will be given unless special permission has been given prior to the date of the test. Requests to adjust scores or re-grade exams or tests must be made the day in which the exam or test is returned. Requests after this time will be denied.
4. Students will not be able to communicate in any way during a test (or midterm or final). Any perceived communication will result in the removal of the exam or test from the students involved. This will result in a zero as the grade with the option of a different exam or test being administered at the convenience of the instructor.
5. Problem sets can be worked on collaboratively. They will be graded for completeness. This is an opportunity to refine and discuss the skills taught in class with other students. If the instructor realizes that answers are simply copied and not collaboratively worked on, this will be considered plagiarism.
6. Attendance is expected from all students in the course. To encourage attendance, the instructor will use periodic, short, in-class questions, which will be graded as either acceptable or non-acceptable. While the grade for 1 or 2 of these questions will be dropped from final calculation, a student will not be allowed to complete them after class, even in the case of a justified absence.
7. Do your own work. **Plagiarism applies to all assessments as with any other intellectual property. Plagiarism is a form of cheating and will be treated as such.**

Required Course Materials

The course textbook is *Introduction to Theory of Computation* (2nd or 3rd Edition), by Michael Sipser. A pdf of the book will be made available to you. It is not necessary to buy a hard copy.

Course Grading Policy

The grade ranges will be no higher than those listed below, but they may be lower.

Grade Scale

A = 90-100%

B = 80-89.9%

C = 70-79.9%

D = 60-69.9%

F = Less than 60%

Assignment Values

Tests 30%

Homework 10%

Classwork 10%

Midterm Exam 25%

Final Exam 25%

The tests, midterm, and final will be taken partly in person and partly online (as “quizzes” in Canvas). For the online portion of each test, you will need to bring a laptop with you to the test. The homework (problem sets) and classwork will also be submitted via Canvas, and they will be graded mainly for completion.

Our **final exam** will be **Thursday, May 5, 12:30-3:20pm**.

The date and time are [set by VCU](#).

Feedback and Grading Response Time

Assignments will typically be graded (with grades made available through Canvas) within 1 week of the date they are due. For homework, the grade will often be available sooner than 1 week. For exams, receiving grades may take a bit longer.

Course Policies:**Late/Missing Work Policy**

No late work will be accepted. Please review the course calendar to ensure you are aware of all due dates and that you plan accordingly. All due dates are in Eastern Standard Time. If you have reason for extended absence from your academic studies, such as hospitalization or incarceration, please contact me.

Accessibility Concerns

If you encounter any accessibility issues, please contact me and I will try to find an alternative.

Intellectual Property and Copyright

Intellectual property and copyrighted material that is presented in this course is not for redistribution.

Course Attendance and Participation

It is expected that you will spend 9-12 hours a week on this class watching lectures, attending class sessions, doing homework, and preparing for tests and exams. For every credit hour it is expected that students are putting in 3-4 hours of work. This is a 3 credit class, so you should expect to spend 9-12 hours per week on this class. In addition it is expected that you are logging into the Canvas site several times throughout the week to check for announcements, and that you will post any questions that you have to the relevant Discord discussion channel.

I reserve the right to use Entry Pass for this class.

Technology Requirements

- You will need a laptop (Mac or Windows) that you can bring with you to class. You will also need to access the internet for major amounts of time for this course.
- You will need a browser that is compatible with Canvas. To see if your browser is compatible with Canvas, visit this [webpage](#).
- You will need an account on Discord (free) and to join the class Discord server. A link to the Discord server is posted in the Announcements on Canvas.
- Your computer will need speakers to hear sound for videos and audio files.
- You will need access to word processing software such as Google Docs. Please note that any software that you use must be able to save files as PDF.
- You will need Adobe Acrobat Reader or an equivalent PDF reader.

If any student lacks access to a technology listed above, he or she must email the instructor by the end of the first week of class, so that we can discuss accommodations.

Technology Skills Required

- It is expected that you are able to use and check your official VCU email address daily.
- You should be able to upload documents to Canvas.

- You should be able to use word processing software.
- You will be expected to interact with me and your peers using Canvas tools. Instruction for the use of each tool will be given when the tool is introduced.

Technology Support

1. Clear your browser's cache.
2. Shutdown and restart your computer.
3. If your problems persist, contact the IT support center itsc@vcu.edu or 804-828-2227.

Institutional Policies

Accommodations for Students with Disabilities

- Disability Statement: If you are a student with a disability requesting reasonable accommodations in this course, please visit [Student Accessibility and Educational Opportunity](#). All requests for reasonable accommodations require [registration with SAEO](#) in advance of need. Faculty, students and DASS will work together regarding classroom accommodations. You are encouraged to discuss approved accommodations with your faculty.

Counseling Services

- Resources for online students can be found through the [Online Counseling Center](#).

Tutoring

- The [Campus Learning Center](#) offers appointment, drop-in and group tutoring in undergraduate courses across the disciplines.

Writing Center

- The [writing center](#) provides assistance at all stages of the writing process, from brainstorming to final draft.

Cheating and Plagiarism

- Plagiarism is stealing and passing off the ideas or words of another as one's own; it is using another's production without crediting the source. The best way to avoid plagiarism is to cite properly in any assignment information and concepts that are not your own originally. If a student is discovered to have plagiarized, that student will fail that particular assignment.
- Academic integrity is expected in all aspects at the university including this course. For more information: <https://students.vcu.edu/studentconduct/>

Students should visit <http://go.vcu.edu/syllabus> and review all syllabus statement information. The full university syllabus statement includes information on safety, registration, the VCU Honor Code, student conduct, withdrawal and more.

Technology Support

Engineering & VCU Resources:

- **Personal Computer Requirement:** For our current system requirements and recommendations, see: <https://egr.vcu.edu/admissions/accepted/computer-recommendations/>
- **Remote Access to Public Lab computers:** To provide remote access, we use the Citrix App2Go environment to provide full and exclusive control over "the next available" computer in the lab. See this link for more details: <https://wiki.vcu.edu/x/Oa0tBg>
- **VCU provides a lot of software available for students to download to their personal computers.** For a list of software and the specifics for each, see: <https://ts.vcu.edu/software-center/>. In particular, [Microsoft Office](#) is available free to students.
- **VCU has transitioned to Canvas.** See the Canvas Student Guide at this link: <https://community.canvaslms.com/t5/Student-Guide/tkb-p/student>
- **For IT help in the College of Engineering**, see our Wikipedia for "student" help at: <https://wiki.vcu.edu/display/EGRITHELP>
- **VCU's Technology Services (TS) provides support for "central IT" services.** If you have a technical issue with any of the following services, please submit a ticket with VCU Technology Services at <https://itsupport.vcu.edu/> or call (804) 828-2227. VCU TS maintains and supports these services and will be able to provide assistance to you.
 - VCU Cisco VPN
 - 2Factor or Dual Authentication (DUO)
 - Blackboard/Canvas
 - Gmail or other Google Apps
 - Zoom videoconferencing
 - VCU App2Go (Application server)
 - Resetting VCU password
- **For IT issues related to College of Engineering teaching and research,** email egrfixit@vcu.edu

For loaner Chromebooks for emergency purposes: See this link for more details:

<https://vcutsmpc.getconnect2.com/>