CPSC 450: Theory of Computation

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Class Meetings: TTh: 1:10pm - 2:40pm, Trexler 363

Office Hours: M: 2pm - 3pm; T: 10:30am -11:30am; W: 10:30am - 11:30am; and by appointment

Syllabus

Course Description: This course deals with the study of formal models of computation. Topics include formal languages, automata theory, Turing machines, undecidability, and an introduction to computational complexity.

Text: *An Introduction to the Theory of Computer Science, Languages and Machines*, 3rd edition, by Thomas A. Sudkamp

Prerequisites: CPSC 170 and MATH 131.

Intended Learning Outcomes

By the end of the course, successful students will have the following abilities:

1. Students will be able to use various proof techniques, e.g., proof by contradiction and mathematical induction, in proving properties of formal languages, e.g., regular and context-free.

2. Students will understand the formalisms of finite state automata and pushdown automata and their relationship with regular languages and contextfree languages, respectively. Students will be able to construct, when possible, such automata to prove a given language to be of a certain type (regular, context-free).

3. Students will understand the formalism of a Turing machine and be ableto construct such machines for Turing computable problems.

4. Students will understand the notion of undecidability and be able to proveproblems to be undecidable.

Mechanics

The course will meet in class for 3 hours during the week. There will be weekly quizzes, weekly homework, one midterm exam and one final exam. The quizzes

will be in class. The homeworks, midterm and final will all be takehome. The midterm will be due by **5pm on Wednesday, October 6, 2021**. <mark>The final exam is scheduled for Monday, December 13, 2021 from 2:00pm to 5:00pm; your take-home final submission will be due by</mark> **5:00pm on Monday, December 13, 2021**.

You are required to submit a PDF file, preferably from a LaTeX processed document, for the homeworks, midterm and final. Screenshots, photographs or scans of pages will not be accepted.

Make-ups for quizzes, the midterm and the final will be available only in case of documented medical emergencies.

This course expects you to spend at least 12 hours of work each week inside and outside of class.

Quizzes: Quizzes will be in class every Tuesday at the beginning of class.

Homework: Homework will be assigned every week, and will be due by 10pm on the Saturday at the end of the week. All homework assignments must be handed in typed (either in LaTeX or your choice of typesetting software). The course website has a tutorial on LaTeX. Late home works will not be accepted.

Co-curricular Requirement: Besides the quizzes, homeworks and exams, there is a co-curricular requirement. The Mathematics, Computer Science and Physics department offers a series of discussions that appeal to a broad range of interests related to these fields of study. These co-curricular sessions will engage the community to think about ongoing research, novel applications and other issues that face these disciplines. Each student is required to attend at least three of these sessions, and turn in a short paper describing the contents of the session, and his/her critical reflections about the topic and content. These papers are due in class within a week of the session. A paper submitted beyond a week from the event being discussed in the paper will not be accepted. The MCSP Conversation Series website has the schedule of talks in the series.

Grading

The weights for the various components will be:

Co-curricular	4%
Quizzes	20%
Homeworks	40%
Midterm	16%
Final	20%

The final letter grade will be computed according to the following scale:

< 60	60 – 62	63 – 65	66 – 69	70 – 72	73 – 75	76 – 79
F	D-	D	D+	C-	C	C+

80 – 82	83 – 85	86 – 89	90 – 92	> 92
B-	B	B+	A-	A

Class Attendance and Policies

Regular attendance in class is highly recommended. Regardless of attendance, students are responsible for all material covered or assigned in class.

Cell phones should be kept in your backpacks or pockets (essentially, out of sight), and turned to the silent mode throughout the duration of the class. Please do not remove your cell phones until you are outside the classroom/lab. Similarly, during office consultations or consultations in the lab (even when it is not during regular class time), your cell phones should be out of sight and in the silent mode.

If you use an electronic device such as a tablet or a laptop for note-taking or to read the textbook, the content that is open on the screen should be strictly restricted to documents and pages of relevance to the class. For example, you should not have any social media websites open in your browser window, even if it is in a tab that is not currently in focus.

Academic Integrity

Students are expected to adhere to the Academic Integrity policies of Roanoke College. All work submitted for a grade is to be strictly the work of the student unless otherwise specified by the instructor. The policies as outlined in the Academic Integrity handbook will be enforced in the course.

Graded programs are subject to the Roanoke College Academic Integrity policies. Copying a program or a portion of a program (even a single line) or reading another person's program to obtain ideas for solving a problem is plagiarism. Other examples of integrity violation include writing code for someone else, using code written by someone else, telling someone else how to solve a problem or having someone tell you how to solve a problem (and using his/her method). These cases apply to any work that is handed in for a grade under the instructor's assumption that the work is your own. Unless specified otherwise by the instructor, discussion among students should be limited to general discussion of concepts and language details, not specific aspects of a solution to the assigned problem.

COVID-19 Related Requirements and Exceptions

Covid-19 Policy If you have a temperature of $100.4°$ F or higher or other coronavirus symptoms, don't come to class. Call Health Services IMMEDIATELY. Do not come to class or go to any public area on campus. Do keep up with all readings, assignments, and deadlines. In order for your absence to be excused, you must give Health Services permission to notify me that you have consulted them about coronavirus symptoms. If Health Services informs you that you should isolate and not attend class for multiple days or weeks, inform me so that we can make a plan to keep you current in the course. All absences caused by consultation

with Health Services about coronavirus symptoms or isolation ordered by Health Services will be excused, but you will need to do the work and graded assignments.

Masks : The College has issued a mask mandate for the start of the semester that requires masks to be worn in indoor common spaces such as our classroom. *In this class, we will wear masks when indoors throughout the semester.* If you arrive without a mask, you will not be allowed to stay and may lose credit for attendance or in-class work. The Bookstore sells masks if you need to make a quick purchase.

Please do not bring any food or drinks into the classroom.

If the college goes online mid-semester, we will continue meeting synchronously, at our usual class time, via zoom. I will work with you on an individual basis to make sure that you have all the appropriate software, etc. to complete all the assigned work. I will also make every effort to accommodate any logistical or personal difficulties you may have in case we go online; please let me know of your difficulties, and I will work with you on an individual basis to resolve them.

If I need to make modifications to the syllabus during the semester I will make the changes only after discussing them with the class.