CPSC 450: Theory of Computation
Fall 2025

Dr. Anil M. Shende
365A Trexler Hall
Tel: 540-375-2341
email: shende@roanoke.edu

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

Office Hours: T: 10am - 11am; W: 9am -10am; 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 context-free 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 able to construct such machines for Turing computable problems.

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

Mechanics

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

Homework Assignments: There will be regular homework assignments. All homework should be typeset and submitted on Inquire as a PDF document. You are encouraged to use LaTeX to typeset your documents. You may use overleaf.com to typeset your LaTeX documents. Screenshots, photographs or scans of pages will not be accepted. Late submissions will not be accepted.

Quizzes: There will be regular quizzes in class. Unless announced otherwise, quizzes will be on Tuesdays at the beginning of class.

Tests: During the semester, there will be three tests in class on **Thursday, September 18, 2025, Thursday, October 9, 2025, and Thursday, November 13, 2025**.

Final Exam: The final exam is scheduled for **Monday, December 8, 2025, from 2pm to 5pm.**

All tests and the final exam will be open handwritten notes on one side of one 8.5" × 11" sheet of paper. Blue books will be provided to you to hand-write your answers to the questions.

Make-ups for the tests 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.

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	12%
Homework Assignments	24%
Tests	39%
Final	21%

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. If you miss a class, please get notes from someone in class and review the notes. After you have reviewed notes from class that you missed, if you need clarifications, I will be happy to help.

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/lab times), 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.

The use of any electronic device during a test, quiz and final exam is prohibited. Using such a device during a test, quiz or final exam will be considered a breach of academic integrity.

Academic Integrity

Students are expected to follow the Academic Integrity policy detailed in the handbook Academic Integrity at Roanoke College. Please contact me if you have questions about how these policies apply to our class. The bottom line is that all work you submit for a grade must be solely your own unless explicitly stated as group work.

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.

Generative AI:

Students are strongly encouraged *not to use* any generative AI for getting help with any work that is submitted. If I feel that a student's submission contains elements generated by AI, I will call the student to my office to explain the submitted work. If the student cannot satisfactorily explain every piece of his/her submission, I will treat that as a breach of academic integrity, and will follow up according to the Roanoke College Academic Integrity policies.

Writing Center & Subject Tutoring:

The Dr. Sandee McGlaun Writing Center and Subject Tutoring, located in the lower level of the Fintel Library (Room 5), offers free one-on-one support in writing, oral presentations, and course content such as Business, Economics, Mathematics, INQ 240, Modern Languages, Lab Sciences, and Social Sciences. Open Sunday–Thursday from 4–9 PM, students can stop by or schedule through Navigate by selecting "Schedule an Appointment" → "Writing Center and Subject Tutoring" → "Writing Support" or "Course Tutoring" → preferred date and tutor. Contact subject_tutoring@roanoke.edu or 540-375-2590 for more information.

Accessible Education Services:

Accessible Education Services (AES) is located on the first floor of the Bank Building. AES provides reasonable accommodations to students with documented disabilities. To register for services, students must self-identify to AES, complete the registration process, and provide current documentation of a disability along with recommendations from the qualified specialist. Please contact Dustin Persinger, Assistant Director of Academic Services for Accessible Education, at 540-375-2248 or by e-mail at aes@roanoke.edu to schedule an appointment. If you have registered with AES in the past and would like to receive academic accommodations for this semester, please contact Dustin Persinger at your earliest convenience to schedule an appointment and/or obtain your accommodation letter for the current semester. The testing center, also located on the first floor of the Bank Building, can be reached at 540-375-2247.

Student Health & Counseling Services:

Student Health & Counseling Services supports students through in-person health appointments, in-person counseling, 24/7 telehealth (TimelyCare), Therapy Assistance Online, as well as resources related to general wellness, LGBTQ+, sexual assault, substance abuse, and suicide prevention. Unmet health needs can negatively impact your performance in this course. Student Health & Coun-

seling Services can help. Please see https://www.roanoke.edu/shcs for more information and to access services.

Diversity:

I consider this classroom to be a place where you will be treated with respect, and I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability - and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming, and inclusive environment for every other member of the class.

Preferred Name/Pronoun:

I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so I can make appropriate changes to my records.

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