Course Description

Instructor. Prof. Richard Chang `<chang@umbc.edu>`

  Office Hours: Tu & Th 3pm - 4:30pm ITE 326

         Wed 1:30pm - 3:00pm online

Grader. Saurabh Dewangan `<saurabd1@umbc.edu>`

Course Web Page. <u>http://umbc.edu/~chang/cs451</u>

Time & Place. Tue & Thu 1:00pm – 2:15pm, Sondheim 112

Textbook. *Introduction to the Theory of Computation* (third edition), Michael Sipser, Cenage Learning 2013 (ISBN: 978-1-133-18779-0).

Prerequisites. The formal prerequisites for this course are CMSC 202 Computer Science II and CMSC 203 Discrete Structures. Preparation in discrete mathematics is especially important. You should be prepared to read and write proofs using proof by contradiction and proof by induction.

Objectives.   There are two objectives for this course: 1) to introduce the student to the concepts in automata theory and formal languages, which form the foundations of theoretical computer science; and 2) to continue the development of the student's skills in reading, writing and understanding mathematical proofs.

Grading. Grades will be based upon the following distribution

    Homework 36%

    Quizzes   40%

    Final Exam 24%

The planned schedule has 12 homework assignments and 5 quizzes. However, if a homework assignment or quizz is canceled and not made up — e.g., because UMBC is closed for an extended period — the proportion of your grade from homework, quizzes and the final exam will remain the same. That is, homework will still count for 36% of your grade and quizzes 40% of your grade (each homework or quiz would have greater weight).

The final letter grade is based on the standard formula:

$$0 \le F < 60, \quad 60 \le D < 70, \quad 70 \le C < 80, \quad 80 \le B < 90, \quad 90 \le A \le 100$$

Depending upon the final distribution of grades in the class, there may be a curve in your favor, but under no circumstances will grades be curved downward.

Grades are given for work done during the semester; incomplete grades will only be given for medical illness or other such dire circumstances.

Quizzes. In-class quizzes are scheduled for Tuesday 2/28, 3/14, 4/4, 4/18 and 5/2. The quizzes are *in-person*, closed-book and closed-notes. Please make every effort to attend — unexcused absences will result in a grade of zero for that quiz. Each quiz will be held during the last 30 minutes of the class period. The quiz will consist of one or two questions (possibly with multiple parts) on a pre-announced topic.

Lectures & Reading. Lectures provide a unique opportunity for students to ask questions while we are all physically gathered in one location at the same time. The purpose of the lectures is to explain the parts of the reading that are difficult to understand. *Lectures do not replace reading.* The ability to read and understand the language of mathematics is a skill that you develop by practice.

Final Exam. The final exam is scheduled for Tuesday May 23, 1:00pm - 3:00pm. There will not be an option to take the final exam early, so make your travel plans accordingly.

Homework Submission. Homework will be submitted online in PDF. You have several options for preparing your responses. You can write on paper and convert to PDF using a smartphone app. This is the recommended method. Please do not just use your phone's camera app and take a picture of your work. Use one of many free scanner apps and adjust the settings so that your submission is legible.

You could also use LaTeX (or equivalent) to prepare a document. (Although drawing diagrams could be quite challenging.) If you have a tablet or a 2-in-1 laptop *and* you have some skill with a stylus, you can use one of those. Microsoft Word and Powerpoint are not recommended since they are terrible with math notation.

In any case, *please* use letter size paper (8.5x11 inches) and leave a good margin.

Late Homework. Homework assignments are due by 11:59pm on Thursdays. Unexcused late homework will be penalized as follows:

1 day late (by Friday 11:59pm)	-5%
2 days late (by Saturday 11:59pm)	-10%
3 days late (by Sunday 11:59pm)	-20%
4 days late (by Monday 11:59pm)	-40%
before next class (by Tuesday 1pm)	-100%

Late homework will not be accepted after the start of the next lecture. This allows for timely grading and discussion.

Three times during the semester, you will be allowed to submit a late homework assignment without excuse and without penalty one lecture late (e.g., homework due on Thursday may be submitted on Tuesday without penalty). One full-credit unexcused late assignment will be accepted for Homework 1-4, one for Homework 5-8 and another for Homework 9-12. You do not accrue any credit for submitting homework assignments on time. For example, if you submitted all of Homework 1-8 on time, you can still only turn in one of Homework 9-12 late for full credit.

Homework Policy. You are permitted to work with other students on the homework problems. Collaborators and reference materials must be acknowledged at the top of each homework assignment. However, homework solutions must be written up *independently*. A student who is looking at someone else's solution or notes, whether in print or in electronic form, while writing up his or her own solution is considered to be cheating. All cases of cheating will be reported to the Academic Conduct Committee, this is standard practice.

Finally, looking up the solutions to homework problems completely defeats the purpose of homework assignments, which is to train a student's mind to think. Students who bypass this training will do poorly on the quizzes. The primary purpose of doing homework isn't to obtain the correct solution — it is to practice thinking. Once you see a solution without thinking about the problem, you have lost the learning opportunity.

University Policies & Resources

UMBC's academic integrity policy is available at: <https://tinyurl.com/yd26tx2d>

UMBC Policies on Accessibility & Disability Accommodations; Sexual Assault, Sexual Harassment, Gender Based Violence & Discrimination; Pregnancy and Parenting; Religious Observances & Accommodations; and Hate, Bias Discrimination & Harassment are described at the Office of Equity & Inclusion's website.

Retriever Essentials is a faculty, staff, and student-led partnership that addresses food insecurity in the UMBC community. They offer free groceries, toiletries, baby items, and meal swipes, and have opportunities to engage and volunteer. Pick up items from their pantry, The Essential Space, located in RAC 235 or get a pre-assembled bag of non-perishable food items and personal care products at one of their Food Zones. Email retrieveressentials@umbc.edu about their meal swipe program or to find out how to volunteer with them.

Spring 2023 CMSC 451 Automata Theory, Class Schedule

	Lecture topics	Quizzes	Textbook Reading	HW Assigned	HW Due
Tue Jan 31	Introduction		0.1--0.4		
Thu Feb 02	Deterministic Finite Automata (DFA)		1.1	HW1	
Tue Feb 07	Nondeterministic Finitie Automata (NFA)		1.2		
Thu Feb 09	Equivalence of DFA & NFA			HW2	HW1
Tue Feb 14	Regular Expressions		1.3		
Thu Feb 16	Equivalence of Regular Expressions			HW3	HW2
Tue Feb 21	Pumping Lemma for Regular Languages		1.4		
Thu Feb 23	Context-Free Grammars (CFG)		2.1	HW4	HW3
Tue Feb 28	Context-Free Grammars (CFG)	Quiz 1			
Thu Mar 02	Chomsky Normal Form			HW5	HW4
Tue Mar 07	Pushdown Automata (PDA)		2.2		
Thu Mar 09	PDAs for CFGs			HW6	HW5
Tue Mar 14	CFGs for PDAs	Quiz 2			
Thu Mar 16	Pumping Lemma for Context-Free Languages		2.3		HW6
Tue Mar 21	*Spring break*				
Thu Mar 23	*Spring break*				
Tue Mar 28	Deterministic Context-Free Languages		2.4		
Thu Mar 30	Turing Machines		3.1	HW7	
Tue Apr 04	Turing Machines	Quiz 3			
Thu Apr 06	Deciding Properties of Regular Languages		4.1	HW8	HW7
Tue Apr 11	Deciding Properties of Context-Free Languages				
Thu Apr 13	The Halting Problem		4.2	HW9	HW8
Tue Apr 18	Undecidability	Quiz 4	5.1--5.2		
Thu Apr 20	Undecidability			HW10	HW9
Tue Apr 25	Reductions		5.3		
Thu Apr 27	P vs NP		7.1--7.3	HW11	HW10
Tue May 02	NP-completeness	Quiz 5	7.4		
Thu May 04	NP-completeness		7.5	HW12	HW11
Tue May 09	Advanced Topic TBA				
Thu May 11	Advanced Topic TBA				HW12
Tue May 16	Review				
Tue May 23	**1:00pm - 3:00pm Final Exam**				