Theory of Automata, Math4805A/5605F, Fall 2020

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Lectures: Tuesday, Thursday: 4:05pm - 5:25pm

Office hours: Tuesday, Thursday 2:30pm-3:30pm.

Textbook: "*Finite Automata*", by Mark V. Lawson (Chapman & Hall/CRC).

Other recommended books:

"*Formal Languages and their relation to Automata*" by John Hopcroft and Jeffery Ullman;

"*Introduction to the theory of computation*" by Michael Sipser;

"*An introduction to formal languages and automata*" by Peter Linz.

Resources available on the internet:

Marvin Nakayama's notes for CS 341
Introduction to Logic and Automata
Introduction to Theory of Computation

Prerequisites: MATH 3805 or MATH 3106 or MATH 3158 or permission of the School.

Evaluation: assignments 40%; midterm 20%; project 10%; final exam 30%.

Midterm Exam: The midterm exam (Nov. 3) worths 20 marks.

Assignments: Two assignments (20 marks each). Due dates: Oct. 22 and Dec 8.

Project: Use LaTex to typeset the course notes.

Final Examination: This is a three hour closed-book online exam scheduled by the University and will take place sometime during the examination

period.

Academic Accommodation Academic accommodation refers to educational practices, systems and support mechanisms designed to accommodate diversity and difference. The purpose of accommodation is to enable students to perform the essential requirements of their academic programs. At no time does academic accommodation undermine or compromise the learning objectives that are established by the academic authorities of the University.

Carleton is committed to providing academic accessibility for all individuals. Please review the processes for academic accommodation requests. Special arrangements include pregnancy obligation, religious obligation, students with disabilities, survivors of sexual violence, and accomodation for student activities. See https://students.carleton.ca/course-outline for more detail.

Academic accommodation related to COVID-19: Students should complete the self-declaration form available on the Registrars Office website to request academic accommodation for missed course work including exams and assignments.

List of Topics Covered: Regular languanges, finite state automata, nondeterminism, Kleene's Theorem, Pumping Lemma, Minimization and algorithmic problems. Additional topics that might be covered include: grammars, push down automata, context-free languages, transducers, the algebraic theory of automata, semigroups, Turing Machines, Schutzenberger's theorem. These topics are subject to change.

Tentative lecture schedule

Week	Dates	Topics
1	Sep. 9-11	Introduction, language and operations.
2	Sep. 14-18	Operations, machines, DFA. Counting with automata.
3	Sep. 21-25	Counting with automata; Recognizable languages. Build recognizable languages from old ones; Languages with 1 letter input alphabet.
4	Sep. 28 - Oct. 2	Classification of recognizable language with 1 input letter Pumping lemma; NFA.
5	Oct. 5-9	NFA and applications.
6	Oct. 12-16	Grammars; Right linear grammars Recognizable languages; ϵ-automata
7	Oct 19-23	Applications of ϵ-NFA; Monoid homomorphism Regular expressions and regular language. **Assign # 1 due on Oct. 22**
8	Oct. 26-30	Reading break, no class
9	Nov. 2-6	Kleene's theorem. Normalized generalized Automaton **Midterm (Nov. 3)**
10	Nov. 9-13	Follower sets and quotient automaton. Indistinguishable states and the minimal automaton.
11	Nov. 16-20	Algorithm to compute the minimal automaton. $RM(n)$. Languages recognized by monoids. Transition monoids.
12	Nov 23-27	Homomorphism of monoids revisited. Syntact monoids. Context free grammar in chomsky normal form.
13	Nov. 30- Dec. 4	Push down automaton and context free language. Pumping lemma for context free language.
14	Dec. 7-11	Pumping lemma; Automaton with output (transducers). Turing machines. **Assign # 2 due on Dec. 8**