COMP 455: Models of Languages and Computation

Official Description

Introduction to the theory of computation. Finite automata, regular languages, pushdown automata, context-free languages, and Turing machines. Undecidable problems.

General Information

Term:	Spring 2019
Course Number:	COMP 455-002
Time:	Monday and Wednesday, 9:05-10:20 AM
Location:	FB007
Website:	`https://cs.unc.edu/~otternes/comp455`

Instructor Information

Name:	Nathan Otterness
Office:	SN119
Email:	otternes@cs.unc.edu
Office Hours:	Tuesday 10:00 AM-12:00 PM, Thursday 2:00-4:00 PM

Textbooks and Resources

Readings will be assigned from *Introduction to Automata Theory, Languages, and Computation*, 3^{rd} edition, by Hopcraft, Motwani, and Ullman. Lecture slides, reading assignments, and homework assignments will be posted on the course website.

Course Description

This course introduces the theoretical foundations of computer science. We will discuss how to formally reason about algorithms using models such as finite automata and Turing machines. The later portions of the course will focus the concepts of computability and NP-completeness.

Topics covered in this course include:

- Finite Automata
- Pushdown Automata
- Inductive Proofs
- Decidability
- Regular Expressions
- Context-Free Grammars
- Turing Machines
- NP-Completeness

This course is intended for students interested in understanding the *science* in "computer science." This includes those who wish to study formal verification or to gain a deeper understanding of famous topics in computer science such as the halting problem or the open P-vs-NP question. It also has direct applications to text processing, and will be especially useful for students wishing to take a course in compilers such as COMP 520.

Prerequisites

The official prerequisites are COMP 110 or 401, and COMP 283 or MATH 381. Students are assumed to be able to write computer programs, understand basic set theory, and have a MATH 381 (or equivalent) level of familiarity with formal proofs.

Goals and Key Learning Objectives

Students will learn to recognize the capabilities of different models of computation and how the models apply to real-world programming problems. Students will learn to work with state machines, regular expressions, and parsers. By the end of the course, students should be comfortable with basic inductive proofs.

Grading

In-class quizzes:	5%
Homework:	30%
Midterms:	35%
Final exam:	30%

Quizzes. In order to encourage attendance and finishing reading assignments, I will give 6-8 short pop quizzes at the start of class. Quizzes will contain around 10 multiple choice questions, and will be based on prior material, including the previous reading assignment. I will drop the lowest quiz grade.

Homework. Homework will be assigned once per textbook chapter, or approximately every two weeks. Homework assignments *must be individual efforts*. Any attempts to get help from materials other than me, the textbook, or other materials I've approved in advance will be considered an honor code violation. Homework assignments are due in class on the due date. No late assignments will be accepted. You must include a signed honor code statement at the end of every submitted homework assignment saying that the work was your own. Your lowest homework grade will be dropped from your final average.

Exams. Midterms will be administered in class and last for an hour and 15 minutes. Be sure to attend on time! The final exam will be administered during the University-mandated exam slot, cover material from the entire course, and last for three hours. Exams are closed-book, but you are allowed to bring up to a single 8.5x11-inch sheet of paper with notes written on both sides to exams.

Class Etiquette

You are expected to maintain proper etiquette in class. This means arriving on time, not leaving early, and not conducting conversations apart from class discussion. Using laptops or cell phones in class is prohibited. Please notify me in advance if you know that you will need to miss a class or leave early.

Class discussion and participation makes the class more enjoyable for everybody. I reserve the right to adjust final grades up by up to half of a letter grade for class participation, or to adjust grades negatively in the case of disruptive behavior.

Important Dates

January 9	First class
January 21	Martin Luther King Jr. Day (no class)
March 11 and 13	Spring Break (no class)
April 24	Last class
May 6	Final exam at 8:00 AM