CSCI 2670: Introduction to Theory of Computing

Fall, 2014

Instructor: Don Potter (potter@uga.edu)
Office: Boyd 113; **Hours:** TBA
Lecture Times and Locations:

9:05-9:55am	Mon	Life Sciences, C114
9:30-10:45am	Tues & Thurs	Life Sciences, C114

Brief Description: This is a first course on the theory of computing. Fundamental Topics include finite automata, regular expressions and languages, context-free grammars and languages, push-down automata, pumping lemmas for regular languages and for context-free grammars, the Chomsky hierarchy of language classes, Turing machines and computability, undecidability of the halting problem, reducibility among decision problems and languages, time complexity, and NP-completeness and tractability.

Prerequisites: CSCI/MATH 2610: Discrete Mathematics; or CSCI 2611: Discrete Mathematics for Engineers.

Course Objectives: This course introduces fundamental models relevant to most areas of computer science. At the end of the semester, all students will be able to do the following:

1. Given an NFA M, create a DFA or a regular expression that accepts $L(M)$.
2. Given a regular language L, create an NFA that accepts L.
3. Use pumping lemmas to prove a language is not regular or not context-free.
4. Given a description of a context-free language L, develop a context-free grammar (CFG) G such that $L(G) = L$.
5. Convert a CFG into Chomsky Normal Form (CNF).
6. Given a context-free grammar G in CNF and a string w, use the CYK algorithm to determine if G generates w.
7. Given a context-free grammar G, create a push-down automaton (PDA) that accepts $L(G)$.
8. Identify if a given language is regular, context-free but not regular, or neither.
9. Given a language L, create a Turing machine TM that accepts L.
10. Convert between different variations of the Turing machine model (e.g., multi-tape to single tape).
11. Create a Turing machine that performs a function.
12. Define decidability and demonstrate that a language is decidable.
13. Reduce one problem to another one.
14. Use reductions to prove a problem is undecidable.
15. Define P, NP and NP-complete.
16. Show a problem is in P and determine its computational complexity.
17. Write pseudo-code describing a non-deterministic Turing machine's steps to solve a problem.
18. Prove a problem is NP-complete.

Required Text: Michael Sipser. Introduction to the Theory of Computation (3rd Edition). ISBN-13: 978-1133187790

Course Website: Certain course materials, maybe grades, reading assignments, and homework might be posted to the course's eLearning Commons (eLC-New) website: `https://uga.view.usg.edu/`. Also, we may use my own course website: `http://www.cs.uga.edu/~potter/theory/`.

Lectures: Lectures will cover material from Chapters 0–7 of the textbook, excluding Chapter 6. Only limited material from certain chapters will be covered. Students are encouraged to attend each lecture. Lecture readings will be assigned beforehand, and students should finish these before class begins. Quizzes and other activities will take place during lecture periods.

Homework: Throughout the semester, homework dealing with material covered in the lectures will be assigned. Students must typeset and submit printed copies of their solutions during the due date lecture period (or beforehand). Late submissions will not be accepted.

Exams: There will be 3 in-class exams and a separate final exam. Tentative dates for each are given below.

In-class Exam 1:	Thursday, September 18.
In-class Exam 2:	Tuesday, October 21.
In-class Exam 3:	Thursday, November 20.
Final Exam:	8:00–11:00am, Thursday, December 11, 2014.

Makeup tests will not be given. However, if an in-class exam is missed due to an extreme and verified emergency, it might be excused by the instructor (students should bring documentation explaining the circumstances). If the absence is excused, then the average of the other in-class exams and the final exam will be counted for the missed exam. If the absence is not excused, then a grade of zero will be given.

Grade weights: Exam 1 (16%), Exam 2 (16%), Exam 3 (16%), Final Exam (25%), Homework (22%), Quizzes and other work (5%).

Final Letter Grades: Final letter grades will be determined according to the following scale:

A ≥ 93	92 ≥ A- ≥ 90	89 ≥ B+ ≥ 87	86 ≥ B ≥ 83	82 ≥ B- ≥ 80
79 ≥ C+ ≥ 77	76 ≥ C ≥ 73	72 ≥ C- ≥ 70	69 ≥ D ≥ 60	F < 60

The instructor reserves the right to curve grades. Under no circumstances will this lower a student's grade.

Electronic Devices: You likely will not want to use them unless necessary.

Email: Students must use their UGA email accounts when corresponding with the instructor and TAs on course-related matters, and all emails must include "CSCI 2670" in the subject line.

In-Class and Online Behavior: Students are expected to be courteous and respectful.

Academic Honesty: As a University of Georgia student, you have agreed to abide by the University's academic honesty policy, "A Culture of Honesty," and the Student Honor Code. All academic work must meet the standards described in "A Culture of Honesty" found at: `http://honesty.uga.edu/`. Lack of knowledge of the academic honesty policy is not a reasonable explanation for a violation. Questions related to course assignments and the academic honesty policy should be directed to the instructor.

In addition, students are expected to abide by the CS Academic Honesty policies below.

Academic honesty means that any work you submit is your own work.

Common forms of academic dishonesty against which students should guard are:

1. copying from another student's test paper or laboratory report, or allowing another student to copy from you;
2. fabricating data (computer, statistical) for an assignment;
3. helping another student to write a laboratory report or computer software code that the student will present as his own work, or accepting such help and presenting the work as your own;
4. turning in material from a public source such as a book or the Internet as your own work.

Three steps to help prevent academic dishonesty are:

1. Familiarize yourself with the regulations.
2. If you have any doubt about what constitutes academic dishonesty, ask your instructor or a staff member at the Office of Judicial Programs.
3. Refuse to assist students who want to cheat.

All faculty, staff and students are encouraged to report all suspected cases of academic dishonesty.

Class Accommodation: Students with a disability or health-related issue who need a class accommodation should make an appointment to speak with the instructor as soon as possible.

Syllabus Policy: Students are responsible for learning and following all policies stated in this syllabus. This course syllabus is a general plan for the course; deviations announced to the class by the instructor may be necessary.