Course Syllabus

COMP 455 – Models of Languages and Computation

Fall 2010

Meeting Place: SN011
Meeting Time: 9:30 – 10:45, TuTh
Course Web Page: http://www.cs.unc.edu/~anderson/teach/comp455

Instructor: Prof. Jim Anderson
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Office Hours: 11:00am-11:30am on MW, 12:30pm-1:00pm on TuTh

Grader: Jeremy Erickson
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E-mail: jerickso@cs.unc.edu
As Jeremy is only a grader, and not a TA, please only contact him about grading issues.

Goals of the Course: The primary goal is study various computational models and how they relate to each other. A secondary goal is to become unafraid of formal proofs.

Required Text: *Introduction to Automata Theory, Languages, and Computation*, Hopcroft, Motwani, and Ullman, Third Edition, Addison-Wesley, 2006.

Prerequisites: MATH 381 (Discrete Mathematics) and COMP 110 or 121 (Introduction to Programming or Introduction to Functional Programming).

Grading:

Several unannounced in-class quizzes:	5%
Homework:	25%
Two Midterm Exams:	35%
Final Exam:	35%

In-class quizzes will be 10 to 15 minutes in duration. The purpose of these quizzes is to check whether students are keeping up and understanding the material (and to encourage students to attend class and arrive on time). Four or five quizzes will be given during the semester. In determining your final grade, your lowest quiz score will be dropped.

Homework assignments will be given approximately once per chapter, which should translate to about once every two weeks. This will be a fairly homework-intensive class. These assignments are *expected to be individual efforts*. Any attempts to get help from any resource other than the instructor, TA, or resources indicated as appropriate by the instructor will be considered cheating and referred to the student attorney general. Inappropriate resources include (but are not limited to) classmates, solution sets of friends who have taken the course previously, and solutions found on the Internet. *You must include a signed honor statement with each submission explicitly stating that all submitted work is the result of your own effort only.* A more comprehensive honor code policy will be distributed with the first homework.

Homework assignments are due *in class* on the due date given. *No late homeworks will be accepted*. However, in calculating your homework average, your lowest score will be dropped.

Each midterm exam will be 1 hour and 15 minutes in duration. The final exam will be 3 hours in duration. The final exam will cover the entire course. Each of these exams will be administered in class.

Class Etiquette: You are expected to maintain proper etiquette in class. This includes:

- not making a habit of arriving late, or leaving in the midst of class,

- not talking, sleeping, reading newspapers, eating, etc. in class,
- keeping cellphones, pagers, etc. off,
- and not using your laptop to browse the web

Class Participation: This class will be far more enjoyable for everyone if all students come to class ready and willing to discuss the material to be covered. I plan to reward those who participate in class by increasing their final grade by up to half a letter grade. I also reserve the right to add a similar negative "reward" for those who do not observe appropriate etiquette in class.

I intend to grade both undergraduate and graduate students (if any) on the same scale. I will use an undergraduate scale (A,B,C,D,F). To determine course grades for graduate students, I will translate A to H, B to P, C to L, and D and F to F. Plus and minus grades will be given if warranted.

If you are entitled to extra accommodation for any reason (such as a disability), we make every reasonable attempt to accommodate you. However, it is your responsibility to discuss this with the instructor during the first week of the course.

Topics: The list of topics I plan to cover is given below. The chapters and sections mentioned are from the course textbook.

Topics Covered	Classes
Chapter 1: Preliminaries	1
1.2 and 1.3: Brief review of formal proof techniques	
1.4: Inductive proofs	
1.5: Alphabets, strings, languages, and problems	
Other useful definitions: graphs and trees, set notation, and relations	
On your own: Section 1.1	
Chapter 2: Finite Automata	2
2.2: Deterministic finite automata	
2.3: Nondeterministic finite automata	
2.5: Finite automata with epsilon-transitions	
On your own: Sections 2.1 and 2.4	
Chapter 3: Regular Expressions and Languages	1
3.1: Regular expressions	
3.2: Finite automata and regular expressions	
On your own: Section 3.3	
Chapter 4: Properties of Regular Languages	3
4.1: Proving languages not to be regular	
4.2: Closure properties of regular languages	
4.3: Decision properties of regular languages	
Chapter 5: Context-Free Grammars and Languages	2
5.1: Context-free grammars	
5.2: Parse trees	
5.4: Ambiguity in Grammers and Languages	

On your own: Section 5.3 (we'll cover parsing in a little detail later, if we have time)	
Chapter 6: Pushdown Automata	3
6.1: Definition of the PDA	
6.2: The languages of a PDA	
6.3: Equivalence of PDAs and CFGs	
6.4: Deterministic PDA	
Chapter 7: Properties of Context-Free Languages	4
7.1: Normal forms for CFGs	
7.2: The pumping lemma for CFLs	
7.3: Closure properties of CFLs	
7.4: Decision properties of CFLs	
Deterministic CFLs and Parsing (if time)	1
3.6 of Lewis and Papadimitriou text (will be handed out in class)	
Chapter 8: Introduction to Turing Machines	3
8.2: The Turing Machine	
8.3: Programming techniques for TMs	
8.4: Extensions to the basic TM	
8.5: Restricted TMs (if time)	
8.6: TMs and computers	
On your own: Section 8.1	
Chapter 9: Undecidability	4
9.1: A language that is not RE	
9.2: An undecidable problem that is RE	
9.3: Undecidable problems about TMs	
9.5: Other undecidable problems (if time)	
Chapter 10: Intractable Problems	2
We don't have time to do this topic justice. We'll cover some subset of Sections 10.1, 10.2, 10.3, and 10.4.	
TOTAL	26

NOTE: We have 28 classes this semester, 2 of which will be used for exams.