Computer Science & Engineering Syllabi

College of Engineering & Computer Science

Spring 2013

CS 3200/5200: Theoretical Foundations of Computing

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CS 3200/5200
Theoretical Foundations of Computing
Syllabus: Spring 2013

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Class Time: 11:15-12:10 MWF
Room: RC 153
Instructor: Professor Guozhu Dong
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CS 3200/5200 is an introduction to (a) formal language and automata theory and (b) computability. For (a), we will examine mechanisms for defining syntax of languages and devices for recognizing languages. Along with the fundamentals of these two topics, the course will investigate the relationships between language definition mechanisms and language recognition devices. For (b), we will study decision problems, the Church-Turing thesis, the undecidability of the Halting Problem, and problem reduction and undecidability. The text will be the third edition of *Languages and Machines: An Introduction to the Theory of Computer Science*, by Thomas Sudkamp.

The prerequisites for this course are CS 3100 (direct prerequisite) and Math 2570 (indirect prerequisite). In particular, it is assumed that you have seen and mastered the material in Chapter 1 of the text that is listed below.

Topics: The topics to be covered include
- Review: naive set theory, recursive definitions, and proof by induction. Sections 1.1, 1.2, 1.6-1.7.
- String operations, regular sets and languages. Chapter 2.
- Context-free grammars, derivations, derivation trees, regular and context-free languages, and ambiguous grammars and languages. Chapter 3.
- Normal forms for context-free grammars. Chapter 4.
- Deterministic finite automata (DFA), nondeterministic finite automata, and DFA minimization. Chapter 5.
- Relationships between regular grammars and finite automata, and pumping lemma and closure properties for regular languages. Chapter 6.
- Pushdown automata, equivalence with context-free grammars, and pumping lemma for context-free languages. Chapter 7.
- Turing machines. Chapters 8 & 9.
- The Church-Turing Thesis. Chapter 11.
- Undecidability, the Halting Problem, and problem reduction. Chapter 12.

Office Hours: 4:30—5:30 MW. I will be pleased to make appointments with you at other times if you need to see me but cannot make my office hours.

Email and the phone may be used to obtain the answers to simple questions, such as "what did we cover in class?" or "what was today's homework assignment?" Email and the phone, however, are not appropriate for obtaining help on the topics of the course. Technical assistance needs to be given in a face-to-face manner so I can see where you are having difficulties and then help you to overcome them.

Exams: There will be four exams given during the semester. The final exam will be 75 minutes long and all other exams will be 55 minutes long.

There will be no make-up exams except for documented emergencies. Examples of acceptable documentation are a letter from a doctor (on his/her letterhead) indicating that you were unable to take the exam due to illness or a letter from an employer indicating that you will be out of town on company business at the scheduled exam time.

The exams will be closed books and closed notes, except that you can use one sheet of hand written notes for each of the first three exams and two sheets for the final.

The exams for graduate students will contain more problems than the undergraduate exams. These additional problems will be more theoretic in nature, reflecting the added sophistication expected of graduates students. They may also cover material in the readings that is not represented in any of the assigned homework.

The exam dates (subject to change) are:
Wednesday, Jan 30 (Week 4)
Wednesday, March 6 (Week 9) [note: Week 8 is Spring break]
Wednesday, April 3 (Week 13)

Friday, April 26 (Finals week) (75 minutes).
You will be notified of any change of exam dates in class and/or via announcement on pilot.

Grading: Two methods will be used to calculate grades; your grade will be the higher one obtained through either of the two methods.
Method 1: The lowest score among the **first three exams** will be dropped. The grade for the course will be determined by the scores of the three exams (the final and the best two out of the first three). Each of the three exams used to determine the grade will make up 1/3 of the total score. Grades will be assigned using the following scale:
   A - 90% or above
   B - 80% - 89%
   C - 70% - 79%
   D - 60% - 69%
   F - below 60%
Method 2: All four exams are used to determine the grade, and each will make up 25% of the total score. Grades will be assigned using the following scale:
   A – 87.5% or above
   B - 75% - 87.5%
   C – 62.5% - 75%
   D - 50% - 62.5%
   F - below 50%
The instructor may curve the final grades in such a way that they deviate from these standards at his discretion.

A missed exam counts as a 0. Method 1 allows you to miss or do poorly on one of the first three exams and not have it affect your grade.

The grade A indicates excellence: To receive an A, you must demonstrate a *thorough* knowledge of the material throughout the course. There will be no grades of incomplete given except when documented emergencies have prevented the student from finishing the course.

Study Guides: There are old exams online on pilot. There is also a solutions manual that contains worked out solutions for about one third of the exercise in the text, which is also available online.

Slides: Slides will be available at pilot.

The instructor wishes to thank Professor T.K. Prasad for sharing his slides for a dozen of the modules with the instructor; the instructor also acknowledges that he obtained slides for several modules from several other universities as indicated in those modules. The instructor has made modifications, sometimes substantially, to slides for all modules.

Homework: Homework problems will be assigned. You should try to work on the homework problems soon after the corresponding materials have been covered in class. The problems are assigned to prepare you for the exams. If you are able to master the homework, you will also do well on the exams. Time will be spent in class reviewing the homework. Initial answers to the homework problems will be provided by the students. Student participation in presenting the answers will be rewarded for up to 4 bonus (percentage) points towards the final grades. Students are expected to read the parts of the text book corresponding to the materials covered in class. The Topics section above describes the correspondence.

I urge you to work together on the homework problems. This makes the entire process more enjoyable and fruitful. Most of the homework problems have more than one solution. Sharing your ideas and listening to those of others will increase your understanding and facilitate the solution of the problem. The absolute (as opposed to relative) grading scale is designed to encourage students to work together. The results of the other students in the class will not affect your grade: thus help others and get help from others yourself.

Attendance: Attendance at classes is strongly recommended. If you miss a class, it is your responsibility to obtain class notes and assignments from other students and to be prepared for subsequent topics. A student who chooses to miss multiple classes is assumed to be able to master the materials by herself or himself. As stated above, there will be no make-up exams except for documented emergencies. No grades of incomplete will be given except in the case of documented emergency that precludes a student from completing the course. The determination of the sufficiency of the emergency and the documentation will be made by the instructor.