CS 280: Introduction to Formal Languages and Theory of Computation

Date of Handout: 6 Oct 99.

Instructor: Divakar Viswanath, Ryerson 162C, divakar@cs.uchicago.edu.

Office hours: Wednesdays 2:00-3:00 p.m., Fridays 1:00-2:00 p.m. and by appointment. Feel free to catch the instuctor in the hallway to talk about the class.

Course Overview: The central aim of this class is to answer some basic questions about commonly used programming languages, or models of computation, like C, C++, and Scheme. Given a C program, can one write a Scheme program that does exactly the same task? Can one write a C program which takes in any C program as input and says if the input program uses only a finite amount of memory for any finite input?

Answering these and other questions requires a precise understanding of the power and limitations of computing. CS 280 will talk first about finite automata, and then about the far more expressive models of computation given by pushdown automata and context free grammars, and finally about Turing machines. The class will emphasize how natural questions about computation can be answered using finite automata, context free grammars, and Turing machines.

Course Outline:

(i) Sept 27 - Oct 1 and Oct 4: Mathematical induction, sets, relations. Taught by Prof. Ridgway Scott.

(ii) Oct 6-8, Oct 11-15 and Oct 18: Finite automata, nondeterminism, pumping lemma, regular languages, closure properties.

(iii) Oct 20-22, Oct 25-29 and Nov 1-5: Context free grammars, pushdown automata, normal forms, pumping lemmas, closure properties.

(iv) Nov 8-12, Nov 15-19, Nov 22-24, Nov 29 and Dec 1: Turing machines and undecidability.

Textbook: J.E. Hopcroft and J.D. Ullman, *Introduction to automata theory, languages, and computation.* The book is on reserve at the Eckhart library.

Homework: There will be nine homework assignments totally, including the two already collected. Starting from Oct 13, an assignment will be handed out in class every wednesday and collected in class the following monday. This will be changed to suit your convenience during the midterm and thanksgiving weeks.

Every homework will have one or two problems marked *optional* which must be attempted by grad students. These problems are optional for undergraduates, but will earn extra credit if solved correctly.

Late Homework Policy: You are not allowed any late submissions generally. But in extreme cases you may obtain permission for late submission from the instructor.

Exams: The midterm will be scheduled in the first week of November. The final will be in December.

Final Grade: Of the nine assignments, only the best eight will count towards your grade. Your final grade is based on either 40% for homework, 30% for the midterm and 30% for the final, or 100% for the final, whatever is to your advantage. Expect the final to be comprehensive.

Academic Integrity: You are encouraged to discuss the class material and the homework problems with each other. But the final submissions must be your own work, not an approximate copy of someone else's. Input received form others must be acknowledged.

Missing Information: You will soon be supplied with a web address for the class, the phone number of the instructor, and the name of the yet-to-be-assigned grader.