COMPUTER SCIENCE 370

THEORY OF COMPUTATION

I. Introduction

A. Catalog Description

An introduction to formal models of computers and computation. Topics include formal languages and automata theory, computability, decidability, and Church's Thesis. Satisfies the proof-based requirement in major contracts. *Prerequisites: CSCI 361 and either MATH 210 or 290.* Offered every other Fall; offered Fall 2007.

B. Learning Objective

After completing this course, the student should have a working knowledge of formal models of computation, with emphasis on the correspondence between formal languages and the formal machines required to recognize those languages, and on the theoretical limits to the computational paradigm. At the end of this course a student should be well-prepared to take the typical graduate course in theoretical computing (required of all computer science graduate students) if at some time in the future that students decides to do graduate work.

C. Prerequisites

CSci 361. A grade of C- or better is required in prerequisite courses.

II. Required Topics

A. Theory of regular languages.

1. Deterministic and nondeterministic finite automata.
2. Regular expressions.
3. Closure properties of regular languages.
4. Pumping lemma.

B. Context-free languages.

1. Context-free grammars.
2. Push-down automata.
3. Closure properties of context-free languages.
4. Ogden's lemma.

C. Recursive and recursively enumerable languages.

1. Turing machines.
2. Church's Thesis.
3. Computability and decidability.
4. The halting problem.
5. P and NP algorithms. NP-complete problems.

III. Bibliography

Hopcroft, & Ullman, Introduction to Automata Theory, Languages and Computation

Harrison, Introduction to Formal Language Theory

Donald Knuth, The Art of Computer Programming, Vol I, II, III

Lewis & Papadimitriou, Elements of the Theory of Computation

Garey & Johnson, Abstract Machines and Grammars