

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. *Prerequisites: CSCI 361.* Satisfies the proof-based requirement in major contracts.

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 student 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](#)