Brooklyn College
Department of Computer and Information Science

CISC 3230 [38] Theoretical Computer Science
3 hours; 3 credits

Overview of theoretical computer science. Formal language theory, computability theory. Finite automata, context-free and regular grammars, push-down automata, and Turing machines. Other models of computation, including recursive functions. Universal program and unsolvability.

Objectives

By course-end, students will be able to:

1. Understand and design deterministic and non-deterministic finite state automata as well as regular expressions.
2. Design simple context-free grammars and push-down automata.
3. Design simple Turing machines and understand its relationship with real-world computers.
4. Understand the limits of computation via the halting problem and other problems.
5. Understand the basic concepts reducibility of problems and the main ideas of computational complexity.

Textbook

Michael Sipser; *Introduction to the Theory of Computation.* (1997)

Syllabus

Week 1- Introduction. Relationship between languages and machines

Week 2 - Finite automata. Regular languages

Week 3 - Finite automata. Nondeterministic Finite automata. Converting NFA to DFA

Week 4 - Finite automata. Regular expressions. Non-regular languages.

Week 5 - Review and Test 1

Week 6 - Pushdown automata

Week 7 - Context-Free Grammars.

Week 8 - The relationship between Pushdown automata and Context-Free Grammars

Week 9 - Non-context free grammars.

Week 10 - Turing machines. Basic definitions. Variants of TMs

Week 11 - Review and Test 2

Week 12 - The halting problem.

Week 13 - Turing decidable languages. Turing Recognizable languages.

Week 14 - Time complexity.

Bibliography

- Martin Davis, Ron Sigal, Elaine J. Weyuker; *Computability, Complexity, and Languages: Fundamentals of Theoretical Computer Science.* Second Edition. (1994)

- John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman; *Introduction to Automata Theory, Languages, and Computation.* Second Edition. (2001)

- Harry R. Lewis, Christos H. Papadimitriou, *Elements of the Theory of Computation.* Second Edition. (1997)