

Introduction to Theory of Computation

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Purpose and Motivation

We try to answer the following three questions

1. What are the mathematical properties of computer hardware and software?
2. What is a **computation** and what is an **algorithm**? Can we give rigorous mathematical definitions of these notions?
3. What are the **limitations** of computers? Can 'everything' be computed?

Purpose of the Theory of Computation

Develop formal mathematical methods of computation that reflect real-world computers.

Central Question in

Automata Theory

Do these models have the same power, or can one model solve more problems than the other?

Computability Theory

Classify problems as being solvable or unsolvable.

Complexity Theory

Classify problems according to their degree of difficulty. Give a rigorous proof that problems that seem to be *hard* are really *hard*.

This course

1. This course is about the fundamental capabilities and limitations of computers. These topics form the core of computer science.
2. It is about mathematical properties of computer hardware and software.
3. This theory is very much relevant to practice, for example, in the design of new programming languages, compilers, string searching, pattern matching, computer security, artificial intelligence, etc., etc.
4. This course helps you to learn problem solving skills. Theory teaches you how to think, prove, argue, solve problems, express, and abstract.

References

[http://cglab.ca/~michiels/TheoryOfComputation/
TheoryOfComputation.pdf](http://cglab.ca/~michiels/TheoryOfComputation/TheoryOfComputation.pdf)