

# CS 3510: Design and Analysis of Algorithms

## Description

In order to be useful in practice, any computer or information system must be *efficient*, that is, consumes a small amount of resources, such as time and space. The efficiency of such a system relies crucially on the efficiency of the underlying algorithm(s). This course provides an introduction to the central subject of the design and analysis of efficient algorithms. In the course, we will cover

- major paradigms for algorithm design such as divide and conquer, the greedy method, dynamic programming, and randomization;
- efficient algorithms for computational problems involving graphs, strings, integers, polynomials, and geometric objects; and
- computational problems that are inherently hard to compute, and coping with such intractability if time permits.

## Tentative List of Topics

- Algorithm Design Paradigms:
  - Divide and Conquer
  - The Greedy Method
  - Dynamic Programming
  - Randomization
- Algorithms for Sorting, Searching, and Order Statistics
- Algorithms for Graph Problems:
  - Breadth-First Search and Depth-First Search and Connectivity
  - Minimum Spanning Trees
  - Shortest Paths
  - Maximum Flow
- NP-Completeness
- Elementary Number-Theoretic Algorithms
- Polynomial Arithmetics
- More on Randomized Algorithms (if time permits)
- Introduction to Approximation Algorithms (if time permits)

## Textbook

Required textbook (**tentative**): "[Introduction to Algorithms](#)", 2nd Edition, by T.H. Cormen, C.E. Leiserson, R.L. Rivest, and C. Stein, MIT Press, 2001.

## Prerequisites

None