

CSCI 435

Algorithms and Complexity

First Offering: Winter 2021

Prerequisite: CSCI 355 (Algorithm Design and Analysis)

This course provides an introduction to some fundamental areas of research in algorithms and computational complexity theory. Flow networks and randomized, approximation, parameterized, and online algorithms and complementary techniques in hardness of approximation and lower bounds are presented. This course is a broad exploration of these topics to provide a well-rounded introduction to modern theories in **algorithms** and **theoretical computer science**.



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How can we *solve* computationally intractable problems efficiently, if $P \neq NP$?

Efficient and practical algorithms for hard optimization problems with numerous applications.

How can we prove there does not exist a certain kind of algorithm, under reasonable assumptions?

Main Topics:

Flow Networks, *Minimum-Cost Flows*
Intro to *Randomized Algorithms*
Intro to *Approximation Algorithms*
Intro to *Parameterized Complexity*
Intro to *Online Algorithms*

Some Highlights:

Some of the "Hardest" Problems of P
Las Vegas and Monte Carlo Algorithms
Approximate Rounding Techniques
Approximation Schemes
Intro to Hardness of Approximation
Fixed-Parameter Tractable Algorithms
Kernelization
Treewidth
Exponential-Time Hypothesis
Intro to Competitive Analysis

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