Algorithm II

# 0. Course info

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# Course info

| Computer Science - UG3/G | |
|---|---|
| **Course** | Algorithm |
| **Term** | 2021H |
| **Final** | Tba |
| **Credits** | 2 |
| **Staff** | WU Xiaokun 吴晓堃 |
| **Lecture** | 32 hours |

# Short Intro

The objective of this course is to provide a complete introduction to *algorithm design* and *complexity analysis* techniques.

# Topics overview

- Basic concepts recap: tractability, asymptotic order, graphs.
- Major algorithm design techniques: greedy algorithms, divide and conquer, dynamic programming, network flow.
- Computational intractability: $\mathcal{NP}$, NP-Complete, PSPACE.
- Dealing with intractable problems: identification of structured special cases, approximation algorithms, local search heuristics.
- Randomized algorithms.

# Prerequisites

**Required**:

- Sufficient programming experience.
- Comfortable with mathematical proofs.

**Recommended**:

- Knowledge in computer science fundamentals: data structure, operating system, computer architecture, etc.
- As much knowledge of mathematics as possible.
- Insights in your own specific area of study.

Short survey: background statistics.

# Evaluation

# Evaluation guideline

- Attendance & participation: 20%
- Understanding of the topic: 40%
- Final project: 40%
- Honorable bonus: 10%

# Presentation

Read the textbook on your own, then present the topic during our meetings.

- Greedy Algorithms
- Divide and conquer
- Dynamic Programming
- Network Flow

By the end of this course: read through the whole textbook.

- Guided *independent study*.

Topics beyond the textbook are also welcomed.

# Why you are asked to present?

- It's a proved best way of learning,
  - if you are motivated and disciplined.
  - Difficult problems can be discussed during the seminar.
- It's required by the Graduate Training Program.
  - You have to demonstrate the skill of independent study.

# Evaluation criterion

- Attendance & participation: 20%
- Understanding of the topic: 40%
  - Presenting skill: 20%
    - Questions to the audience.
    - Questions to the presenter.
  - Assignments: 20%
- Final project: 40%
  - Write an two-page essay of any topic related to your research.
- Honorable bonus (*mutual exclusive options, only admissive if you got at least 90% already*): 10%
  - Creative solution including analysis to your own research topic.

# Assignments

Solve problems on LeetCode (leetcode.com)

- 4 basic design approaches
- Design, implementation, analysis

# Final Project

A short essay about your own research topic.

- Design, implementation, analysis

# Resources

- It's possible to find PDF files from the web for all textbooks listed above.
- [Lecture Slides for *Algorithm Design*][1]
- [Lecture Slides for *Algorithm*][2]
- [LeetCode][3]
- [Course site][4]

# Questions?

1. https://www.cs.princeton.edu/~wayne/kleinberg-tardos/↩
2. https://algs4.cs.princeton.edu/home/↩
3. https://leetcode.com/↩
4. https://xkunwu.github.io/teach/Algorithm/2022H.html↩