

# Competitive Programming Course

Leonardo Gabriel Martínez Uribarren, MS. in Computer Science and Engineer  
lg.mu@hotmail.com

Competitive Programming is an activity in which participants code specific logic and mathematical problems mainly focusing on getting the correct result. To solve such problems, is imperative to know the basics of Algorithm theory. For this reason, in the first section we will discuss what is *Competitive Programming* and its relation with the Computer Theory field. Following by a brief explanation of the Computational Complexity concept, an introduction to static and dynamic data structures and how to implement more complex structures such as Stacks, Queues, and Graphs using them. Finalizing with an introduction to an important programming strategy.

At the end of this course, students will learn what is Competitive Programming and how to get into, the importance of understanding Algorithm theory over memorizing, and the basic data structures and strategies widely used to solve computer problems.

## Outline

1. Competitive Programming
  - 1.1 What is Competitive Programming
  - 1.2 Competitions
  - 1.3 How to start
2. Computational Complexity
  - 2.1 What is Computational Complexity
  - 2.2 Qualitative approach
  - 2.3 Quantitative approach
  - 2.4 Big  $O$  notation
3. Arrays and Lists
  - 3.1 Static data structures
  - 3.2 Dynamic data Structures
4. Stacks and Queues
  - 4.1 Stack data structure
  - 4.2 Queue data structure
  - 4.3 Program a Stack and Queue using Array
  - 4.4 Program a Stack and Queue using List
5. Graph Theory
  - 5.1 What is a Graph
  - 5.2 Adjacency matrix
  - 5.3 Program a Graph with a List
6. Programming Strategies
  - 6.1 What are Programming Strategies
  - 6.2 Dynamic Programming

Schedule		
August 1, 2024	Course Overview	10 min
	Competitive Programming	20 min
	Computational Complexity	30 min
August 8, 2024	Arrays and Lists	30 min
	Programming Exercises	30 min
August 15, 2024	Stacks and Queues	30 min
	Programming Exercises	30 min
August 22, 2024	Graph Theory	30 min
	Programming Exercises	30 min
August 29, 2024	Programming Strategies	30 min
	Programming Exercises	30 min

## References

- [1] Antti Laaksonen. *Competitive Programmer's Handbook*. URL: <https://cses.fi/book/book.pdf>.
- [2] Ronald L. Rivest & Clifford Stein Thomas H. Cormen Charles E. Leiserson. *Introduction to Algorithms, Fourth Edition*. MIT Press, 2022.
- [3] Jon Kleinberg & Eva Tardos. *Algorithm Design*. Addison Wesley, 2014.
- [4] Adam Drozdek. *Data Structures and Algorithms in C++, Fourth Edition*. Cengage Learning, 2013.