

# Data Structures and Algorithms

## Lecture notes: Course outline

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# Outline of Topics

1. Teams code: 322ofwm
2. Introduction, definitions, terminology (Introduction2023.pdf)
3. Asymptotic notations (Asymptotic-Notations.pdf)
4. Basic data structures (Basic Data Structures.ppt)
  - 4.1 Basic concepts
  - 4.2 Array
  - 4.3 Lists
  - 4.4 Stack
  - 4.5 Queue
5. Tree (Tree.pdf)
  - 5.1 General Tree
  - 5.2 Binary Tree
  - 5.3 Binary tree traversal
6. Analyzing iterative algorithms (loops)  
(Analysis-of-IterativeAlgorithms.pdf)
7. Analyzing recursive algorithms (recurrences)  
(Analysis-of-RecursiveAlgorithms.pdf)

# Outline of Topics (cont)

## 7. Graphs (GraphAlgorithms.pdf)

- 7.1 Definition and notations
- 7.2 Data structures for graphs
- 7.3 Breadth-First Search
- 7.4 Depth-First Search
- 7.5 Topological sort

## 8. Sorting (SortingAlgo.pdf)

- 8.1 Introduction to sorting
- 8.2 Selection Sort
- 8.3 Insertion Sort
- 8.4 Bubble Sort
- 8.5 Merge Sort
- 8.6 Quick Sort
- 8.7 Heap Sort

# Outline of Topics (cont)

## 9. Searching

9.1 Linear Search and Binary Search

9.2 Binary Search Tree (BinarySearchTrees.pdf)

9.3 Balanced Binary Search Trees (RedBlackTrees.pdf)

9.4 Hashing (HashTable.pdf)

## 10. Algorithm paradigms

10.1 Greedy algorithms (GreedyAlgorithms.pdf)

10.2 Divide and Conquer

10.3 Dynamic Programming (DynamicProgrammingPart1.pdf,  
DynamicProgrammingPart2.pdf)

## Textbooks

Cormen, Leiserson, Rivest and Stein, Introduction to Algorithms, 3rd edition, ISBN 978-0-262-53305-8, Publisher: MIT Press

<https://mitpress.mit.edu/books/introduction-algorithms-third-edition>

Brassard and Bratley, Fundamentals of Algorithmics, 1<sup>st</sup> Edition, ISBN-13: 978-0133350685 ISBN-10: 0133350681, Publisher: Pearson

<https://www.goodreads.com/book/show/19717329-fundamentals-of-algorithmics>

Robert Sedgewick. Algorithms in C++, Parts 1-4: Fundamentals, Data Structures, Sorting, Searching. 3th Edition, Addison-Wesley

<https://www.amazon.com/Algorithms-Parts-1-4-Fundamentals-Structure/dp/0201350882>

## Textbooks (cont)

Robert Sedgewick. Algorithms in C++ Part 5: Graph Algorithms (3rd Edition). 3th Edition, Addison-Wesley

Michael T. Goodrich, Roberto Tamassia, David M. Mount, Data Structures and Algorithms in C++. 704 pages. Wiley

Nguyen Duc Nghia, Cau truc du lieu va thuat toan. NXB Dai Bach khoa Ha noi 2013.

Do Xuan Loi. Cau truc du lieu va giai thuat. NXB DH Quoc gia, Ha noi, 2005

## Other study materials

Class notes will be made available prior to each lecture on Teams

Most class notes end with a series of exercises, solutions are provided later on.

# Evaluation procedure

One midterm around the semester brake

One final



# Fonctioning of the lectures

It is a 3 hours lecture, we will have one brake per lecture

We will try to use the last hour of the lecture to do exercises

You are welcome to ask question any time during a lecture

However, I would ask not talking with your colleagues when I am lecturing