

AE2ADS: Algorithms Data Structures and Efficiency

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Teaching Staff

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- [Qiao Lin](#)
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Basic Information

- ***Total Credits:*** 10 (100 study hours)
- ***Level:*** 2
- ***Target Students:*** Part I undergraduate students in the School of Computer Science only.
- This module is part of the ***Foundations of Computer Science*** theme in the School of Computer Science.

Education Aims

- To develop mathematical and formal *reasoning* skills to reason about software systems, in particular their efficiency
- To gain understanding of the issues involved in designing a program for a specific task
- To gain a good working knowledge of some *common algorithms* and *data structures*

Learning Outcomes

Knowledge and Understanding

- The theory and practice of designing algorithms
- The mathematical properties of algorithms
- The relevant basic mathematical concepts, definitions and notations

Learning Outcomes

Intellectual Skills

- To be able to *apply* mathematical techniques to algorithms and data structures
- To be able to *understand* the specification of data structures and algorithms, and analyse their efficiency

Learning Outcomes

Professional Skills

To understand data structures and algorithms and their efficiency, evaluate available tools, applications, algorithms and data structures, and *select* those that are *fit for purpose* within a given domain/scenario

Learning Outcomes

Transferable Skills

- To be able to *solve problems* using a variety of data structures and algorithms
- To use mathematical techniques when necessary to achieve the above
- The ability to use mathematics to *solve problems*

Textbook

- M. T. Goodrich, R. Tamassia and M. H. Goldwasser, *Data Structures and Algorithms in Java*, 6th Edition, 2014.
- T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, *Introduction to Algorithms*, 4th Edition, 2022.

Algorithms and Data Structures

- ***Algorithm:***

An algorithm is a sequence of steps which provides a solution to a given problem.

- ***Data Structure:***

A data structure is a way to store and organize data in order to facilitate access and modifications.

Abstraction

- Algorithms are *independent* of a particular programming language.
- They get *implemented* in a particular program.
- The course is about analysing and solving problems on an *abstract* level before starting to program.

Topics Covered by AE2ADS

Mathematical Tools for Algorithm Analysis

1. Algorithm Efficiency Analysis

- Big-Oh
- Big-Omega, Big-Theta and Little-Oh

2. Recurrence and Master Theorem

Topics Covered by AE2ADS

Algorithms and Data Structures

1. Stacks and Queues
2. List Abstractions
3. Tree Structures
4. Sorting Algorithms
5. Priority Queues and Heaps
6. Maps and Hash Tables
7. Sorted Maps and Binary Search Trees
8. Graphs and Graph Algorithms

Teaching

- Lecture:
 - two hours a week
 - 4-6 pm on Mondays, IAMET-326
- Tutorial:
 - one hour a week
 - group 1: 2-3 pm on Tuesdays, PMB-432
 - group 2: 3-4 pm on Tuesdays, PMB-432
- Computing:
 - one hour a week
 - group 1: 4-5 pm on Tuesdays, PMB-306
 - group 2: 5-6 pm on Tuesdays, PMB-306

Assessment

- Coursework 25%
- Final exam 75%

Questions?
Suggestions?