

Chapter 0

Course Outline

Data Structures and Algorithms

Dept. Computer Science
Faculty of Computer Science and Engineering
Ho Chi Minh University of Technology, VNU-HCM

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Learning outcome

By completing this course, students are able to:

- **USE** fundamental data structures like list, stack, queue, tree, graph, and hash table for programming and particular problems
- **UNDERSTAND** ways to implement an efficient algorithm
- **EXPRESS** algorithms using pseudocode as well as using C++
- **ANALYZE** the computational complexity of algorithms associated with these data structures.



Course learning outcomes

- L.O.1 Determine the complexity of simple algorithms (polynomial time - nested loop - no recursive)
 - L.O.1.1 Give definition of Big-O notation
 - L.O.1.2 Determine complexity of simple polynomial algorithms

- L.O.2 Manipulate basic data structures such as list, tree and graph
 - L.O.2.1 Describe and present basic data structures such as: array, linked list, stack, queue, tree, and graph
 - L.O.2.2 Implement basic methods for each of basic data structures: array, linked list, stack, queue, tree, and graph

- L.O.3 Implement basic sorting and searching algorithms
 - L.O.3.1 Illustrate how searching algorithms work on data structures: array, linked list, stack, queue, tree, and graph
 - L.O.3.2 Illustrate how sorting algorithms work on an array
 - L.O.3.3 Implement necessary methods and proposed algorithms on a given data structure for problem solving



- **Course credit: 4**
- Lectures: 30 period units (12 weeks)
- Lab: 30 period units (10 weeks)
- Teaching from 01/2022 to 04/2022
- Final exam: in ?



- Lectures: course contents in class, QAs and quiz
- Readings: course contents (books and references) and course videos at home
- Lab: coding practice
- Assignments: small projects



Contents and Schedule

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No	Topics	Quiz	Assignment
1	Course outline, C/C++ Re-view		
2	Recursion, complexity	Q0	
3	List (Part 1)	Q1	
4	List (Part 2)	Q2	
5	Sorting	Q3	
6	Tree concept	Q4	
7	Advanced tree + Heap	Q5	
	<i>Midterm test</i>		
8	Searching + Hash	Q6	
9	Graph	Q7	
10	Algorithmic toolbox	Q8	
11, 12	Advanced topics in DSA	Q9	

Labs Schedule

Week	Topics
1, 2, 3	C/C++ Review (Online)
4	ArrayList, Singly Linked List
5	Doubly Linked List, Stack, Queue
6	Sorting
7	-
8	Tree concept
9	Balanced tree + Heap
10	Balanced tree + Heap
11	Searching + Hash
12	Graph
13	Algorithmic toolbox
14	Final test for lab

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- Midterm: 10% (80 mins, 30 MC + 1 Writing)
- Lab: 10%
- Assignment: 30% (A1:15%, A2:15%)

$$X_i = \frac{2 \times A_i \times B_i}{A_i + B_i}$$

A_i : scored by testcases grading

B_i : scored by some questions in midterm or final test.

- Final Exam: 50% (Open book, 1 A4 paper, 120 mins, 15 - 20 MC + 4 Writing)



References

- ① **"Data Structures and Algorithm Analysis"** - Clifford A. Shaffer (Edition 3.2).
- ② **"Data Structures: a Pseudocode Approach with C++"**, R.F.Gilberg and B.A. Forouzan, Thomson Learning Inc., 2001.
- ③ **"Data Structures and Algorithms in C++"**, A. Drozdek, Thomson Learning Inc., 2005.
- ④ **"C/C++: How to Program"**, 7th Ed. – Paul Deitel and Harvey Deitel, Prentice Hall, 2012.
- ⑤ Internet.

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- BK E-learning
 - `http://e-learning.hcmut.edu.vn/login/index.php`
- Any question:
 - Using BKeL forum, DO NOT send email.



Preparation for the course

- Materials:
 - Slides of this course
 - E-book: **Data Structures and Algorithm Analysis** - Clifford A. Shaffer (Edition 3.2).
<http://people.cs.vt.edu/~shaffer/Book/>

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- Outside of lecture room
 - Read slides, books
 - Do exercises, labs, assignments
 - Check BK-Elearning
- During lectures:
 - Listen & Discuss

