

**SOICT**  
Hanoi University of Science and Technology  
School of Information and Communications Technology

## Data structures and Algorithms

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**3iud4uw**

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## Data structures and Algorithms

When you tell your friends or your family that you are student of Global ICT program, and you are taking “Data structure and algorithm” course, can you explain what it is about?

The content of this class

- Introduce and examine the basic properties of data structures and algorithms.
- Learn how to use data structures as a tool to support algorithm development.
- Present algorithms for sorting, searching, algorithms on graphs.

The goal of this class

- Know how to choose the appropriate data structure to implement algorithms to solve problems in real applications.
- Know the approach to developing algorithms to solve real-world problem.

## Course content

**Chapter 1. Fundamentals**

**Chapter 2. Algorithmic diagrams**

**Chapter 3. Some basic data structures**

**Chapter 4. Tree**

**Chapter 5. Sorting**

**Chapter 6. Searching**

**Chapter 7. Graph**

## Course content

### Chapter 1. Fundamentals

- 1.1. Introductory Example
- 1.2. Algorithm and Complexity
- 1.3. Pseudocode
- 1.4. Asymptotic notation
- 1.5. Running time calculation

## Course content

### Chapter 2. Algorithmic paradigms

- 2.1. Brute force
- 2.2. Recursion
- 2.3. Backtracking
- 2.4. Divide and conquer
- 2.5. Dynamic programming

## Course content

### Chapter 3. Basic Data Structures

- 3.1. Basic concepts
- 3.2. Linked Lists
- 3.3. Stack
- 3.4. Queue

### Chapter 4. Tree

- 4.1. General Tree
- 4.2. Binary Tree
- 4.3. Applications

## Course content

### Chapter 5. Sorting

- 5.1. Insertion sort
- 5.2. Selection sort
- 5.3. Bubble sort
- 5.4. Merge Sort
- 5.5. Quick Sort
- 5.6. Heap Sort

## Course content

### Chapter 6. Searching

- 6.1. Linear Search and Binary Search
- 6.2. Binary Search Tree
- 6.3. Red black tree
- 6.4. Hashing

## Course content

### Chapter 7. Graph

- 7.1. DFS and BFS
- 7.2. Disjoint set and Priority queue

## Text books

1. T.H. Cormen, C.E. Leiserson, R.L. Rivest, C. Stein. *Introduction to Algorithms*. Second Edition, MIT Press, 2001. 1202 pages. (Có bản dịch tiếng Việt)
2. Robert Sedgwick. *Algorithms in C++, Parts 1-4: Fundamentals, Data Structures, Sorting, Searching*. 3th Edition, Addison-Wesley, 1999.
3. Robert Sedgwick. *Algorithms in C++ Part 5: Graph Algorithms* (3rd Edition). 3th Edition, Addison-Wesley, 2002.
4. Michael T. Goodrich, Roberto Tamassia, David M. Mount, *Data Structures and Algorithms in C++*. 704 pages. Wiley, 2003.
5. Nguyễn Đức Nghĩa. *Cấu trúc dữ liệu và thuật toán*. NXB Đại học Bách khoa Hà nội, 2013. 368 trang.
6. Đỗ Xuân Lôi. *Cấu trúc dữ liệu và giải thuật*. NXB ĐH Quốc gia, Hà nội, 2005.



T.H. Cormen, C.E. Leiserson, R.L. Rivest., C. Stein  
*Introduction to Algorithms*.  
Second Edition, MIT Press, 2001.



**Thomas H. Cormen**  
Professor  
Chair of the Dartmouth  
College Writing Program



**Charles E. Leiserson**  
Professor  
Department of Electrical  
Engineering and  
Computer Science (EECS),  
MIT



**Ronald Rivest**  
Professor  
Department of Electrical  
Engineering and  
Computer Science  
(EECS), MIT



**Clifford Stein**  
Professor  
IEOR,  
Columbia University.

## Text books

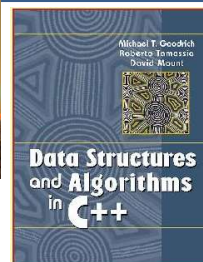
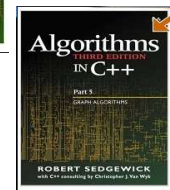
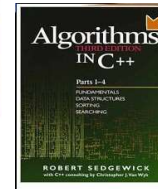
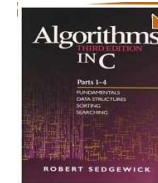
- Nguyễn Đức Nghĩa. *Cấu trúc dữ liệu và thuật toán*. NXB Đại học Bách khoa Hà nội, 2013. 368 trang.



## Text books



**Robert Sedgewick**  
William O. Baker Professor  
Department of Computer Science  
Princeton University



- **Michael T. Goodrich**  
Chancellor's Professor at the Department of Computer Science, University of California,
- **Roberto Tamassia**  
Professor, Department of Computer Science, Brown University
- **David Mount**  
Professor in the [Department of Computer Science](#) and [UMIACS](#).