Problem Solving with Data Structures and Algorithms
ITA5002

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September 15, 2021

- **Course Objectives:**
  - Familiarize with basic techniques of algorithm analysis and master the implementation of linked data structures
  - Familiarize with several sub-quadratic sorting algorithms.
  - Familiarize with graph algorithms
- **Expected Course Outcomes:**
  - Able to Compute time and space complexities of various algorithms
  - Choose appropriate data structure as applied to specified problem definition
  - Handle operations like searching, insertion, deletion and traversing mechanism on various data structures
  - Use linear and non-linear data structures
  - Solve problems using data structures
  - Apply concepts learned in various domains

- The Problem-solving Aspect
- Analysis framework
- Asymptotic notations
- Growth rate of functions
- Complexity analysis
- Mathematical analysis of recursive algorithms
- Mathematical analysis of non-recursive algorithms

Fundamental Data Structures: List, Stacks and Queues

- List ADT
- Singly linked lists
- Doubly Linked lists
- Circular Linked Lists
- Stack ADT
- Implementation of Stacks
- Stacks Applications
- Queue ADT
- Implementation of Queue and Applications

Tree

- Tree ADT
- Binary tree
- Search Tree ADT
- Tree Traversals
- AVL tree
- Splay tree

- Insertion Sort
- Selection Sort
- Heap Sort
- Merge sort
- Linear time sorting: Bucket Rocket
- Linear time sorting: Radix Rocket
- Linear search
- Binary search

Graph algorithms

- Graph ADT
- Graph Representations: List and Matrix
- Graph traversals: DFS
- Graph traversals: BFS
- Implementation of DFS and BFS
- Shortest path Algorithms
- Dijkstra's algorithm
- Minimum spanning tree
- Prim's and Kruskal's algorithm

Algorithm Design Techniques

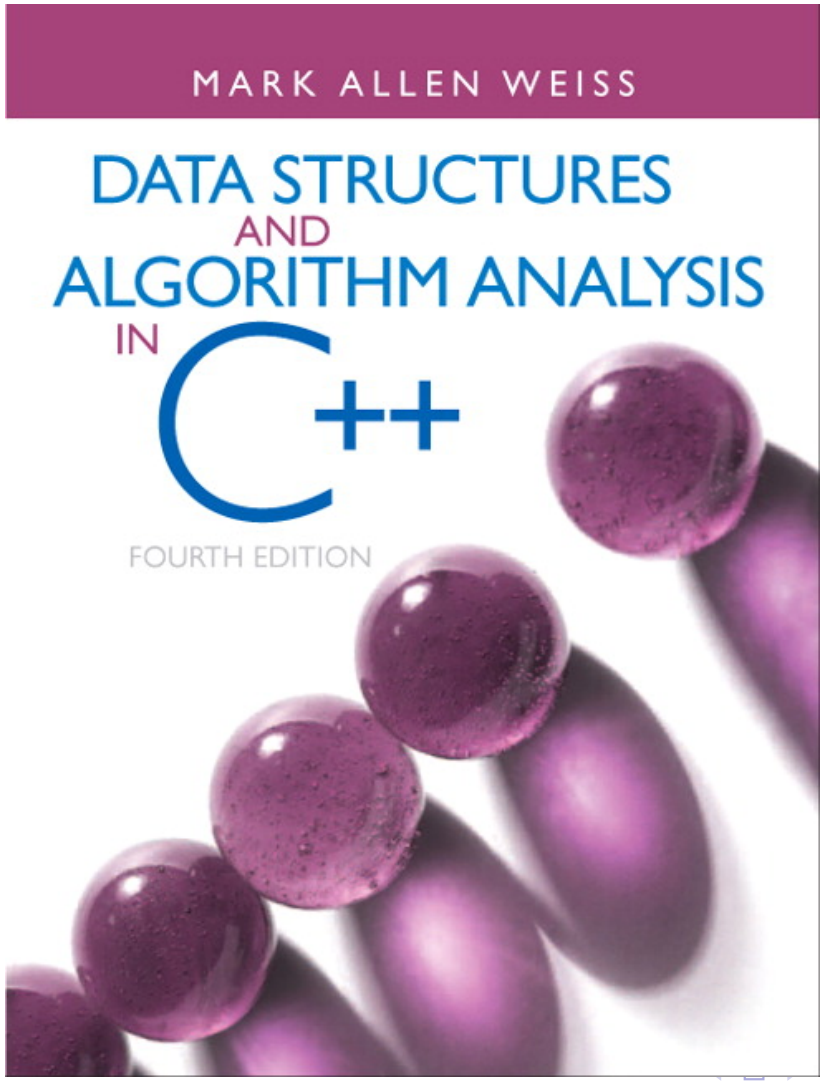
- Introduction to Greedy algorithms
- Simple scheduling algorithms
- Huffman code
- Introduction to Divide and Conquer: Running time of divide and conquer technique
- Implementation of DFS and BFS
- Closest point problem
- Selection problem
- Introduction Backtracking technique

- Introduction to Dynamic Programming: Using a table Instead of recursion
- Ordering matrix multiplication
- Optimal binary search tree
- All Pairs Shortest path

- Guest Lecture

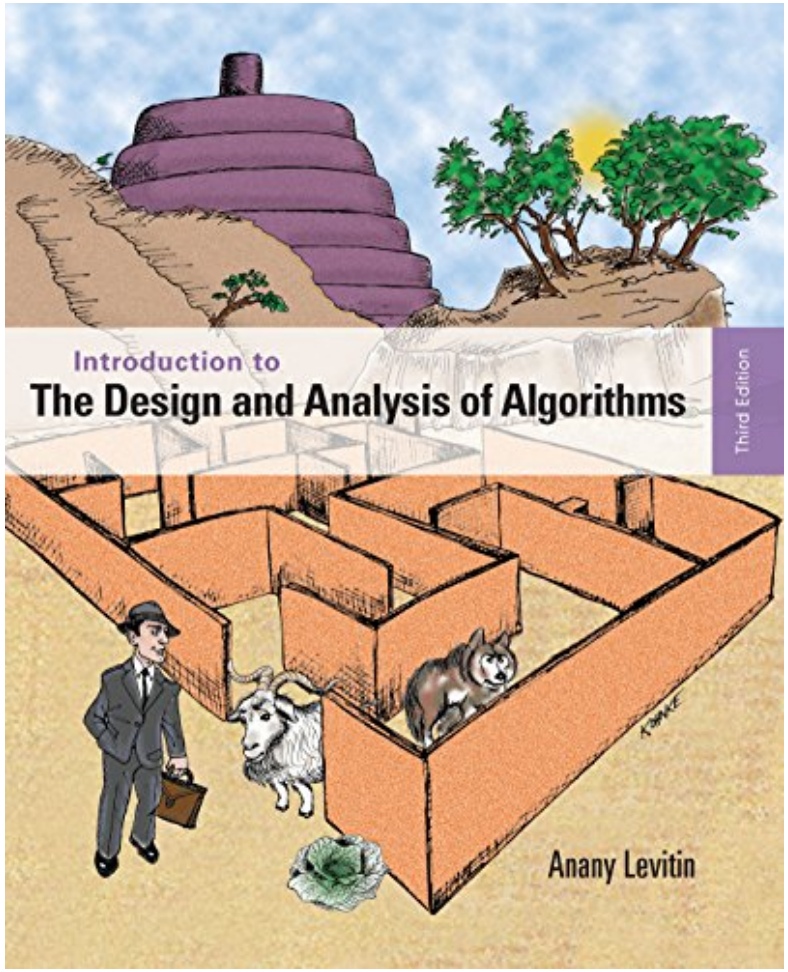
Text Books

- Mark Allen Weiss, Data Structure and Algorithm Analysis in C++, 2014, Fourth Edition, Pearson Education Limited.



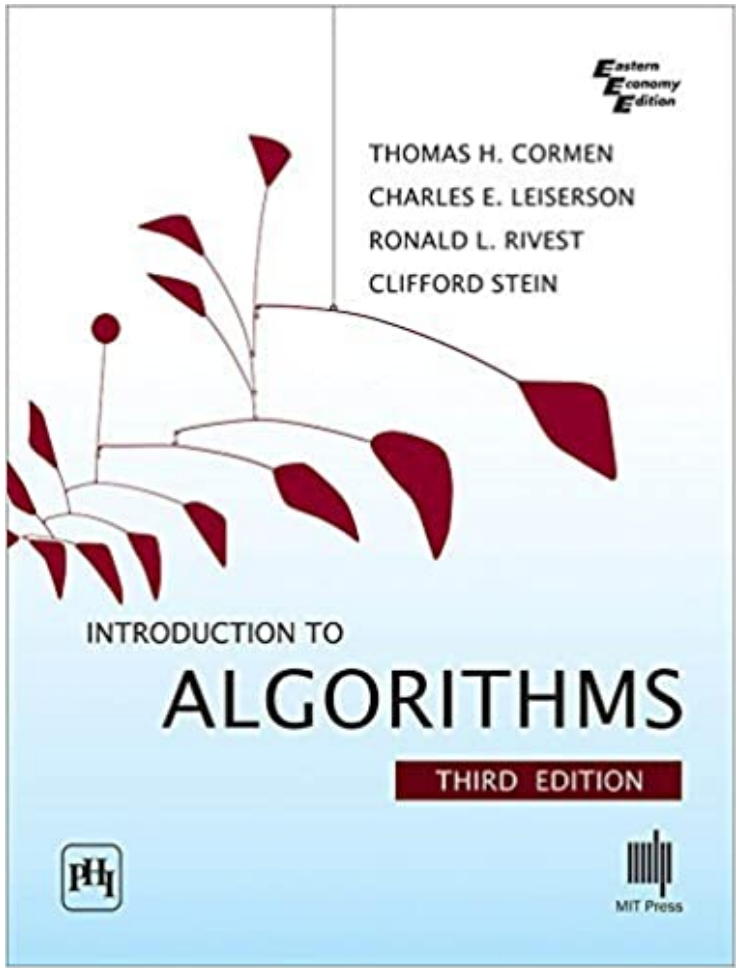
Reference Books

- AnanyLevitin, Introduction to design and analysis of algorithm, 2012, Third Edition, Addison Wesley.



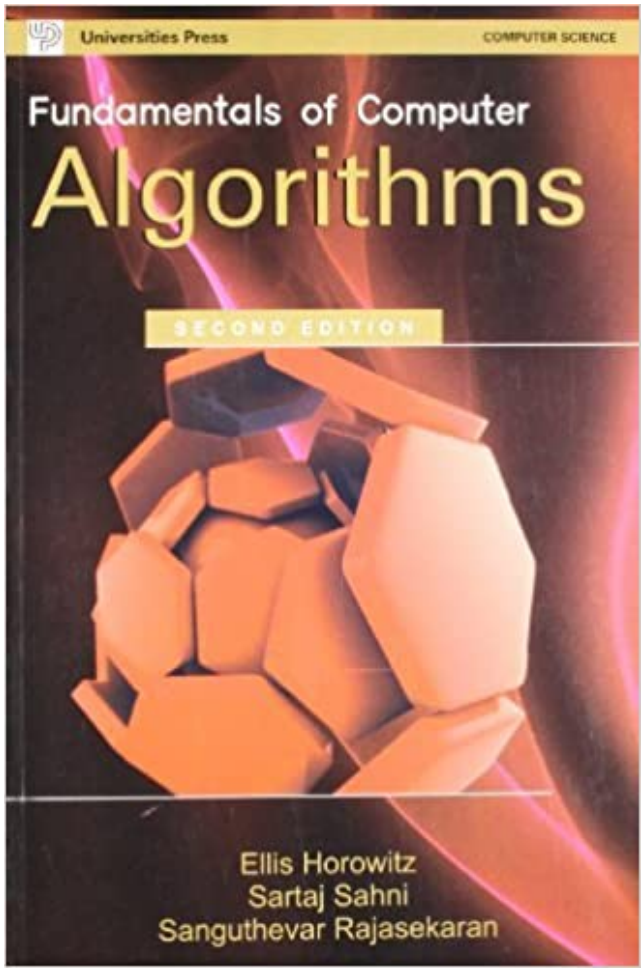
Reference Books

- Thomas H. Cormen, C.E. Leiserson, R L.Rivest and C. Stein, Introduction to Algorithms, 2010, Third Edition, MIT Press



Reference Books

- Fundamentals Of Computer Algorithms by Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajsekaran



Reference Books

- Data Structures Using C and C++ by Langsam Yedidyah, Moshe J. Augenstein , Aaron M. Tenenbaum