

CSCI 240 Outline

Data Structures & Algorithms

Data Structures and Algorithms in C++

by Goodrich, Tamassia, and Mount, Second Edition, Wiley (required)

Approved:

Effective: Fall 2022

Topics	Sections	Time
C++ Primer and Object-Oriented Design: control flow, functions, classes, inheritance and polymorphism, templates, exceptions, arrays, linked lists, and recursion	1.1 – 1.7 2.1 - 2.4 3.1 – 3.5	4 hours
Analysis Tools: growth functions, analysis of algorithms, asymptotic notation and asymptotic analysis – upper bounds (big-Oh), lower bounds (big-Omega), and big-Theta, justification techniques	4.1 – 4.3	3 hours
Stacks, Queues, and Deques: stack ADT and its implementations, queue ADT and its implementations, deque ADT and its implementations; Lists and Iterator ADTs: vector ADT and its implementations, list ADT and its implementations	5.1 – 5.3 6.1 – 6.4	5 hours
Trees: general trees (definitions, properties, functions, and interface), tree traversal algorithms, the binary tree ADT (properties, interface, and traversals), data structures for representing trees (vector-based structure and linked structure), binary trees	7.1 – 7.3	4 hours
Heaps and Priority Queues: priority queue ADT (keys, priorities, comparators, functions, and implementation), heap data structure and its implementation	8.1 – 8.4	4 hours
Hash Tables, Maps, and Skip Lists: Map ADT and list-based implementation, hashing (bucket arrays, hash functions, hash codes, collision-handling schemes, load factors and rehashing), ordered maps, binary search, skip lists (search and update operations), dictionaries	9.1 – 9.5	6 hours
Search Trees: binary search trees (search, insert, and delete), AVL trees, splay trees, multi-way search trees and 2-4 trees, red-black trees (optional)	10.1 – 10.5	6 hours
Sorting, Sets, and Selection: $O(n^2)$ sorting algorithm (insertion), $O(n \log n)$ sorting algorithms (quick sort and merge sort), special sorting algorithms (bucket sort and radix sort), empirical comparison of sorting algorithms, lower bound for sorting, set ADT, selection (prune-and-search and quick-select)	11.1 – 11.5	6 hours
Text Processing and Dynamic Programming: string operations, pattern matching algorithms, tries, text compression (Huffman coding algorithm and greedy method), dynamic programming	12.1 – 12.5	5 hours

Graphs: terminology, applications, representations graph traversals, directed graphs and weighted graphs, shortest paths (Dijkstra's algorithm), minimum spanning trees	13.1 – 13.6	7 hours
Memory Management and B-Trees: memory management, external memory and caching, external searching and B-trees, external sorting with multi-way merging	14.1 – 14.4	3 hours

4-unit class: hours total 57.5 (15 x 3 hours 50 minutes) – hours for exams + 2.5 hour final

This outline allows for 4 hours of exams.

Submitted by: Atanasio, Tamayo, Vo