

CSCI 240 Outline

Data Structures & Algorithms

Data Structures and Algorithms in C++

by Goodrich, Tamassia, Mount, and Goldwasser, zyBooks 2026 (required)

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Topics	Sections	Revised Time
C++ Primer and Object-Oriented Design: control flow, functions, arrays, classes, inheritance and polymorphism, templates, exceptions, standard template library (STL)	1.1 – 1.7 2.1 - 2.6	2 hours
Algorithm Analysis: growth functions, analysis of algorithms, asymptotic notation and asymptotic analysis – upper bounds (big-Oh), lower bounds (big-Omega), and big-Theta, justification techniques	3.1 – 3.4	2 hours
Recursion, Arrays, and Linked Lists: recursive algorithms, one-dimensional and two-dimensional arrays, vector ADT and its implementations, singly linked lists and doubly linked lists, list ADT and its implementations, iterators	4.1 – 4.5 5.1 – 5.6 6.1 – 6.4	4 hours
Stacks, Queues, and Deques: stack ADT and its implementations, queue ADT and its implementations, deque ADT and its implementations	7.1 – 7.3	2 hours
Trees: general trees and binary trees (definitions, properties, and interface), data structures for representing trees (vector-based structure and linked structure), tree traversal algorithms	8.1 – 8.6	3 hours
Priority Queues and Heaps: priority queue ADT (keys, priorities, comparators, and implementation), heap data structure and its implementation, adaptable priority queue (optional)	9.1 – 9.6	3 hours
Maps, Hash Tables, 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), sets	10.1 – 10.7	4.5 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)	11.1 – 11.5	4.5 hours
Sorting and Selection: $O(n \log n)$ sorting algorithms (quick sort and merge sort), special sorting algorithms (bucket sort and radix sort), empirical comparison of sorting algorithms, lower bound for sorting, selection (prune-and-search and quick-select)	12.1– 12.5	3.5 hours

Text Processing and Dynamic Programming: string operations, pattern matching algorithms, tries, text compression (Huffman coding algorithm and greedy method), dynamic programming	13.1 – 13.5	4 hours
Graphs: terminology, applications, representations, graph traversals, directed graphs and weighted graphs, shortest paths (Dijkstra's algorithm), minimum spanning trees, disjoint partitions and union-find structures (optional)	14.1 – 14.9	6 hours
Memory Management and B-Trees: memory management, external memory and caching, external searching and B-trees, external sorting with multi-way merging	15.1 – 15.4	2.5 hours

3-unit class: hours total 45 (15 x 2 hours 50 minutes) – hours for exams + 2.5 hour final
This outline allows for 4 hours of exams.

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