

A594 Data Structures

Qualifying Test Study Guide

1. Linked Lists, Object Oriented Approach
 - i. List operations: insert nodes, delete nodes, traversal
 - ii. List container, list iterators
 - iii. Standard Template Library lists
2. The Stack and Queue Abstract Data Types (ADT)
 - i. Definition as an ADT
 - ii. Linked list and array implementations
 - iii. Applications
3. The C++ Standard Template Library (STL)
 - i. Lists, vectors, stacks, queues, dictionaries (maps), union-find
4. Measuring Algorithm Performance
 - i. Definitions of Big-Oh, Big-Theta, Big-Omega
 - ii. Basic operation, complexity function
 - iii. Counting loop iterations and recursive calls
5. The Table ADT, Hash Tables
 - i. Table ADT definition, applications
 - ii. Definition of a hash table
 - iii. Examples of Hash functions for integers and strings
 - iv. Collision resolution schemes, implementation
6. Binary Trees
 - i. Definition,
 - ii. Node struct implementation
 - iii. Tree operations, inserting and deleting nodes
 - iv. Tree traversal, pre-order, post-order, in-order
7. Recursion, Tail Recursion

8. Binary Search Trees, AVL Trees, Red-Black Trees
 - i. Definition of a BST
 - ii. Search, insert, and remove from a BST
 - iii. AVL: Height-Balanced trees definition
 - iv. Insert and remove from an AVL tree, rotations
 - v. Definition of a Red-Black tree, insert and remove functions
9. B-Trees, Splay Trees, General Trees
 - i. Node struct for a general purpose tree
10. The Priority Queue ADT
 - i. Min-queues and Max-queues
 - ii. Heap definition and array representation
 - iii. Insert and percolate up
 - iv. Delete and percolate down
11. Sorting Algorithms
 - i. $O(n^2)$ sorts: Selection Sort, Insertion Sort, Bubble Sort
 - ii. $O(n \log(n))$ sorts: Quicksort, Merge Sort, Heapsort
 - iii. Other sort: Bucket sort, Radix sort
12. Finite Graphs
 - i. Definition, applications
 - ii. Directed-undirected, weighted, path, cycle, connectivity
 - iii. Breadth-first search, depth-first search
 - iv. Dijkstra's Shortest Path Algorithm,
 - v. The Collection of Disjoint Sets (Union-Find) ADT
 - vi. Minimum Spanning Tree, Kruskal's and Prim's algorithms