CSCI 220 Topical Outline

Data Structures I

*Data Structures and Algorithm Analysis*

by Clifford Shaffer, Third Edition, Dover 2011

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| **Topics** | **Sections** | **Time** |
| Data Structures and Algorithm: the need for data structures, costs and benefits, abstract data types, problems vs. algorithms vs. programs, OOP and class templates | * 1. - 1.3
 | 2 Hour |
| Mathematical preliminaries: sets and relations, miscellaneous notation, recursion, summations and recurrences, mathematical proof techniques, proof by contradiction and proof by math induction, estimating | 2.1 - 2.7 | 5 hours |
| Algorithm Analysis: best, worst, and average cases, asymptotic analysis , upper bounds (big-Oh), lower bounds (big-Omega), and big-Theta, calculating running time, analyzing problems, time vs. space tradeoffs | 3.1 - 3.10 | 5 hours |
| Lists, Stacks, and Queues: lists -- array-based list implementation, linked lists, header node, comparison of list implementations, doubly linked lists, circular linked lists; the dictionary ADT; stacks -- array-based stacks, linked stacks, comparison of array-based and linked stacks, implementing recursion; queues, array-based queues, linked queues, comparison of array-based and linked queues | 4.1 - 4.4 | 8 hours  |
| Binary Trees: definitions and properties, the binary tree node ADT, binary tree traversals (pre-order, in-order, post-order, and level-order), pointer-based node implementations, array implementation for complete binary trees, binary search trees (search, insert, and delete), heaps and priority queues, Huffman coding trees and data compression | 5.1 - 5.6 | 10 hours |
| Non-Binary Trees: general tree definitions and terminology, an ADT for general tree nodes, general tree traversals, the parent pointer implementation, general tree implementations (list of children, the left-child/right-sibling, dynamic node, and dynamic,left-child/right-sibling implementations), K-ary trees, sequential tree implementations | 6.1 - 6.5 | 8 hours |
| Advanced Tree Structures: tries, balance trees (AVL trees and splay trees), spatial data structures -- the K-D tree and the PR quad-tree  | 13.1- 13.3 | 3 hours |

Notes:

* 1 week: 3 lecture hours
* The above outline allows 1 week for review and exams, not counting holidays. Keep in mind that most holidays affect MW or MWF classes, so this timeline NOT the topical outline may need adjustment

Submitted: H Pop