

Indian Institute Of Technology Mandi
CS202: Data Structures and Algorithms
Syllabus

1. **Complexity Analysis:** Time and Space complexity of algorithms, asymptotic analysis, average and worst case analysis, asymptotic notation, importance of efficient algorithms, program performance measurement, data structures and algorithms. (2 hours)
2. **Stacks and Queues:** Abstract data types, sequential and linked implementations, representative applications such as towers of Hanoi, parenthesis matching, finding path in a maze. (4 hours)
3. **Lists:** Abstract data type, sequential and linked representations, comparison of insertion, deletion and search operations for sequential and linked lists, list and chain classes, doubly linked lists, circular lists, skip lists, applications of lists in bin sort, radix sort, sparse tables. (6 hours)
4. **Dictionary:** Abstract data type, array and tree based implementations. (1 hour)
5. **Hashing:** Search efficiency in lists and skip lists, hashing as a search structure, hash table, collision resolution, universal hashing, linear open addressing, chains, hash tables in data-compression, LZW algorithm. (4 hours)
6. **Trees:** Abstract data type, sequential and linked implementations, tree traversal methods and algorithms, Binary trees and their properties, threaded binary trees - differentiation, leftist trees, tournament trees, use of winner trees in mergesort as an external sorting algorithm, bin packing. (8 hours)
7. **Search Trees:** Binary search trees, search efficiency, insertion and deletion operations, importance of balancing, AVL trees, searching, insertion and deletions in AVL trees, Tries, 2-3 tree, B-tree. (4 hours)
8. **Heaps:** Heaps as priority queues, heap implementation, insertion and deletion operations, binary heaps, binomial and Fibonacci heaps, heapsort, heaps in Huffman coding. (3 hours)
9. **Graphs:** Definition, terminology, directed and undirected graphs, properties, implementation – adjacency matrix and linked adjacency chains, connectivity in graphs, graph traversal – breadth first and depth first, spanning trees. (4 hours)
10. **Basic algorithmic techniques:** Greedy algorithms, divide & conquer, dynamic programming. Search techniques - backtracking, Sorting algorithms with analysis, integer sorting, selection sort. Graph algorithms: DFS and BFS with applications, MST and shortest paths. (6 hours)

Reference Books:

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, Introduction to Algorithms, MIT Press, 3/e, 2009.
2. S. Sahni, Data Structures, Algorithms, and Applications in C++, Silicon Press, 2/e, 2005.
3. A. M. Tenenbaum, Y. Langsam, and M. J. Augenstein, Data Structures Using C and C++, Prentice Hall, 2/e, 1995.

Evaluation Pattern:

Quiz 1: 15 %
Quiz 2: 15 %
Programming assignments: 30 %
End sem exam: 40 %

Attendance Requirement: 75 %

Other Requirements: 1. Switch off your mobile phone inside the class
2. Be punctual to the class. Late arrival is not entertained.