CS 385 Algorithms Syllabus

The syllabus below describes a recent offering of the course, but it may not be completely up to date. For current details about this course, please contact the course coordinator. Course coordinators are listed on the course listing for undergraduate courses and graduate courses.

Text Books

Required
Anany Levitin, *Introduction to The Design and Analysis of Algorithms*, 3rd ed., Pearson, 2012
Bjarne Stroustrup, *Programming: Principles and Practice Using C++*, 2nd ed., Addison Wesley, 2014

Week-by-Week Schedule

Week	Topics Covered	Reading	Assignments
1	Introduction, Important problem types, Review of fundamental data structures.	1.1-1.4 Levitin	Sieve of Eratosthenes -- numerical algorithm
2	Analysis framework; big-O, Theta, Omega; Analysis of non recursive algorithms.	2.1-2.3 Levitin	Unique Letters -- bitwise operations
3	Analysis of recursive algorithms, Master theorem.	2.4-2.5 and Appendix B Levitin	Stair Climber -- recursive algorithm
4	Brute force algorithms, Exhaustive search.	3.1-3.4 Levitin	
5	Divide and conquer algorithms; Review Mergesort, Quicksort, Binary search.	4.1-4.6 Levitin	Inversion Counter -- application of mergesort
6	Decrease and conquer algorithms; DFS, BFS, and topological sorting.	5.1-5.5 Levitin	BFS, DFS, topsort -- in-class coding exercise
7	Instance simplification: presorting, Gauss elimination, and balanced search trees. Representation change: Horner's rule and binary exponentiation.	6.1-6.5 Levitin	
8	Space-time tradeoffs: string matching, hashing, red-black trees, B-trees.	7.2-7.4 Levitin	Implement a red-black tree; Optional: use tree to find common words in body of text
9	Dynamic programming: Binomial Coefficients, Floyd and Warshall algorithms, Knapsack problem, memory functions.	8.1-8.4 Levitin	0-1 knapsack problem
10	Greedy technique. Prim's algorithm, Kruskal's algorithm, Dijkstra's algorithm, and Huffman trees.	9.1-9.4 Levitin	Dijkstra's algorithm -- in-class coding exercise
11	Iterative algorithms. Simplex Method, Maximum flow through Ford Fulkerson method.	10.1-10.2 Levitin	
12	Lower bound arguments; Decision Trees; P, NP, and NP complete problems.	11.1-11.3 Levitin	
13	Numerical algorithms. Backtracking, Branch-and-bound.	11.4-12.4 Levitin	Optional: use backtracking to solve a maze and/or find a Hamiltonian circuit
14	Approximation algorithms for NP-hard problems.	12.3 Levitin	