CS199: Data Structures
Fall 2012

Handout #00
September 26, 2012

CS199 Syllabus

This syllabus is purely tentative. I'm more than happy to change it if there's demand for other topics, or if what's listed doesn't look interesting.

Date	Topics	Reading Assignments
Part One: Trees		
Th 1	AVL Trees How do you prove worst-case bounds?	
Tu 2	**Presentation #1a:** 2-3-4 Trees and (Left-Leaning) Red/Black Trees Learning about one data structure by looking at a totally different one.	http://www.cs.princeton.edu/~rs/talks/LLRB/RedBlack.pdf
Th 2	**Presentation #1b:** B-Trees, *k*-d Trees, Interval Trees, AA-Trees, …	
Part Two: Amortization		
Tu 3	Dynamic Arrays, Two-Stack Queues, Cartesian Trees Why is the vector so fast?	CLRS Ch. 17
Th 3	**Presentation #2a:** Skew Heaps A remarkably fast priority queue (in the long run).	Sleator and Tarjan, "Self-Adjusting Heaps"
Tu 4	**Presentation #2b:** Splay Trees Can you make a balanced search tree with no balance info?	Sleator and Tarjan, "Self-Adjusting Binary Search Trees"
Th 4	**Presentation #2c:** Scapegoat trees, tango trees, Fibonacci heaps, link/cut trees, disjoint-set forests, ...	
Part Three: Randomization		
Tu 5	Treaps How bad is a totally random binary search tree?	http://www.cs.uiuc.edu/class/sp09/cs473/notes/08-treaps.pdf
Th 5	**Presentation #3a:** Dynamic perfect hash tables. Can you have worst-case O(1) lookups in a hash table?	CLRS Ch 11.5
Tu 6	**Presentation #3b:** Bloom Filters Can you store data without actually storing it?	
Th 6	**Presentation #3c:** Cardinality Estimation Can you count objects without actually storing them?	

Date	Topics	Reading Assignments
Part Four: String Data Structures		
Tu 7	Tries, Ternary Search Trees, and Radix Tries The trie is a great idea. Can we reduce the space usage?	
Th 7	DAWGs and Levenshtein Automata How much mileage can we get out of automata?	http://blog.notdot.net/2010/07/Damn-Cool-Algorithms-Levenshtein-Automata
Tu 8	**Presentation #4a:** Suffix Trees and Suffix Arrays A powerful and versatile structure for string operations.	http://www.engr.uconn.edu/~ywu/Courses/XJTU11/IntroSuffixTreeGusfield.pdf
Th 8	**Presentation #4b:** Compressed suffix arrays, ropes, Burrows-Wheeler transform, LZW algorithm, Knuth-Morris-Pratt / Aho-Corasick string matching, efficient suffix tree construction, …	
Part Five: Bitwise Data Structures		
Tu 9	Binary Tries, Fenwick Trees How can we speed up algorithms that we know will run on integer data?	Fenwick, Peter. "A New Data Structure for Cumulative Frequency Tables."
Th 9	van Emde Boas Trees Exponentially speeding up binary search trees for integers.	CLRS Third Edition, Ch. 20
Tu 10	**Presentation #5a:** Succinct Binary Tries How many bits do you need to store a data structure?	http://stevehanov.ca/blog/index.php?id=120
Th 10	**Presentation #5b:** Fusion trees, y-Fast tries, …	