

CS166 Syllabus

Below is a (tentative) syllabus for this quarter's offering of CS166. It might change a bit if we move through some of the topics faster or more slowly than anticipated or if people have suggestions for other topics to cover.

Date	Topics	Assignments
<i>Part One: Preprocessing / Runtime Tradeoffs</i>		
T April 2	<i>Why study data structures?</i> Range Minimum Queries, Part I	Problem Set 0 Out
Th April 4	<i>There aren't many very tiny problems. Can we solve them all?</i> Range Minimum Queries, Part II The Method of Four Russians	
<i>Part Two: String Data Structures</i>		
T April 9	<i>Trees that expose hidden string substructures.</i> Tries Suffix Trees	Problem Set 0 Due Problem Set 1 Out
Th April 11	<i>A deceptively simple solution to string processing problems.</i> Suffix Arrays LCP Arrays	
T April 16	<i>The mother of all divide-and-conquer algorithms.</i> Constructing Suffix Arrays The SA-IS Algorithm	Problem Set 1 Due Problem Set 2 Out
<i>Part Three: Data Structure Isometries</i>		
Th April 18	<i>Modeling one data structure on one another.</i> 2-3-4 Trees Red/Black Trees	
T April 23	<i>Making the static dynamic.</i> Augmented Binary Search Trees Tree Splits and Joins	
<i>Part Four: Amortized Analysis</i>		
Th April 25	<i>A little accounting trickery never hurt anyone, right?</i> Amortized Analysis Two-Stack Queues	Problem Set 2 Due Problem Set 3 Out
T April 30	<i>From arithmetic to data structures.</i> Binomial Heaps Lazy Binomial Heaps	
Th May 2	<i>Propagating information slowly.</i> Fibonacci Heaps Asymptotically Optimal Dijkstra's and Prim's Algorithms	Project Proposal Due
T May 7	<i>Is there a single best binary search tree data structure?</i> Splay Trees Static and Dynamic Optimality	Problem Set 3 Due Project Topics Assigned

Part Five: Randomized Data Structures		
Th May 9	<i>Counting without counting.</i> Count and Count-Min Sketches Universal and Pairwise-Independent Hashing	Problem Set 4 Out
T May 14	<i>A simple data structure with a legendary analysis.</i> Linear Probing Concentration Inequalities	
Th May 16	<i>Brood parasites, English nobility, and dynamic perfect hashing.</i> Worst-Case Efficient Hash Tables Cuckoo Hashing	Project Checkpoint Due
T May 21	<i>Hashing in sublinear space.</i> Approximate Membership Queries From Hashing to Filters	Problem Set 4 Due Problem Set 5 Out
Part Six: Integer Data Structures		
Th May 23	<i>Tries + Cuckoo Hashing + Split/Join + Amortization</i> <i>x</i> -Fast and <i>y</i> -Fast Tries Exponentially Faster Ordered Dictionaries	
T May 28	<i>Parallel processing with machine words!</i> Sardine Trees Computing MSB in $O(1)$ Time	Problem Set 5 Due Take-Home Midterm Out
Th May 30	<i>Suffix Trees + Word Parallelism + Amortization</i> Fusion Trees Integer Sorting	Take-Home Midterm Due
Part Seven: The Big Picture		
T June 4	<i>Where to go from here</i> What's next in data structures? What else do you want to know?	