Data Structures -- DAST

Detailed course syllabus for exam

Last updated: May 2, 2004.

Lecture 2: Elements of complexity analysis
1. Asymptotic analysis.
2. Insertion sort analysis: Chapter 2, section 2.2: pp 21—27.
3. Asymptotic functions: Chapter 3: pp 41—56.
Tirgul 2 slides.
Understand asymptotic analysis and the differences between, big-oh, theta, and omega functions.

Lecture 3: Recurrence equations
1. Formulating recurrence equations
2. Solving recurrence equations
   - Substitution method: Chapter 4. section 4.1: pp 63—66.
   - Recursion tree: Chapter 4. section 4.2: pp 67—72.
   - Master method: Chapter 4. section 4.3: pp 72—76. Understand the simplified proof.

Recommended material: Appendix A (pp 1058—1069).
Practice formulating and solving recurrence equations. Understand the cases of the Master method.

Lecture 4: Comparison-based sorting
1. Quicksort: Chapter 7: pp 145—155.
2. Lower bound of comparison-based sorting: Chapter 8, section 8.1: pp 165—167.
Understand quicksort and randomized quicksort in depth.
Understand the lower bound proof and its meaning.

Lecture 5: Linear-time sorting
1. counting sort: Chapter 8, section 8.2: pp 168—170.
2. Radix sort: Chapter 8, section 8.3: pp 170—173.
3. Bucket sort: Chapter 8, section 8.4: pp 174 (excluding the proof).
Understand each algorithm and the assumptions that they make.
Understand why relaxing the assumptions does not work.

Lecture 6: Dynamic data structures
1. Stacks and queues: Chapter 10, section 10.1: pp 200—203.
2. Lists: Chapter 10, section 10.2: pp 204—208.
3. Implementation: Chapter 10, section 10.3: pp 209—212.
Tirgul 3 slides.

Lecture 7: Heapsort and priority queue
1. Heaps and heapsort: Chapter 6, section 6.1--6.4 pp 127—138.
2. Priority queue: Chapter 6, section 6.5 pp 138—142.
3. Order statistics: Chapter 9, sections 9.1-9.2 pp 183—189 (no proofs).
Tirgul 4 slides.

Lecture 8: Binary search tree
Chapter 12, sections 12.1--12.3 pp 251—264. Does not include randomly built trees 12.4.

Lecture 9: Balanced trees
1. Red-Black trees: Chapter 13, sections 13.1--13.4 pp 273—289.
2. AVL trees: 13-3, pp 296, Tirgul 5 slides.
3. B-trees: Chapter 18, pp 435--452, no proofs. Tirgul 6 slides.
Understand how the cases are handled and how to insert and delete.

Lecture 10: Huffman coding
Chapter 16, section 3 pp 385—391.

Lecture 11: Hashing
1. Chaining and open chaining: Chapter 11, sections 11.1--11.4 pp 221—244.
2. Perfect hashing: Chapter 11, section 11.5 pp 245--247 (does not include proof of theorem).
Tirgul 7 and 8 slides.

Lecture 12: Graphs and basic search algorithms
1. Graphs, DFS, BFS: Chapter 22, sections 22.1--22.3 pp 527—549.
Includes understanding of the proofs.
2. Topological sort: Chapter 22, section 22.4 pp 549—551.
Tirgul 9 slides

Lecture 13: Minimum spanning trees
Chapter 23, all, pp 561—573.
Tirgul 10 slides.

Lecture 14: Strongly connected components
Chapter 22, section 22.5 pp 552--557
Tirgul 10 slides.

Lecture 15: Shortest path algorithms
1. Properties: Chapter 24, intro pp 580--588 and section 24.5 pp 607—613.
2. Bellman-Ford algorithm: Chapter 24, section 24.1 pp 588—591.
3. Dijkstra's algorithm: Chapter 24, section 24.3 pp 595—599.
4. All shortest paths: Chapter 25, sections 25.1 and 25.2 pp 622—634.
Tirgul 11 slides.