Course summary: Data Structures and Algorithms (FS 2012)

Below you find the topics discussed in the Data Structures and Algorithms lecture held in spring 2012, along with suggested readings in English. Please note that not every topic is discussed at the same level as in the German book accompanying the lecture.

Literature


Topics


9.3.2012 Computing the median. Randomized computation of the median. Computing the median in linear time.
15.3.2012 *Data structures for dictionaries*. Binary search trees. AVL trees. [Cormen, Ch. 12.1 – 12.3 & Goodrich, Ch. 3.2]

16.3.2012 *AVL Trees and amortized analysis*. AVL-Trees: insertion, deletion. Amortized analysis of the insert operation. [Goodrich, Ch. 3.2]

22.3.2012 *Hashing I*. Hash tables, hash functions, universal hashing. Collision resolution by chaining. [Cormen, Ch. 11.1 – 11.3]

23.3.2012 *Hashing II*. Open hashing, probing. Cuckoo hashing. [Cormen, Ch. 11.4 – 11.5]


30.3.2012 *Optimal search trees*. Optimal search trees, construction with dynamic programming. Self-organizing search trees: move-to-root rule, splay trees. [Cormen, Ch. 15.5 & Goodrich, Ch. 3.4]

5.4.2012 *Dynamic programming I*. Longest common subsequence. Matrix chain multiplication. Matrix multiplication by Strassen. Subset sum problem. [Cormen, Ch. 4.2, 15.2 – 15.4, 35.5]

19.4.2012 *Dynamic programming II*. Knapsack problem, FPTAS. [Vazirani, Ch. 8.1 – 8.2]

20.4.2012 *Backtracking, Branch and bound*. Backtracking with examples: $n$ queens, SAT. Branch and bound with examples: MAXSAT, KNAPSACK, TSP. [Skiena, Ch. 7.1 & Wolsey, Ch. 7.1 – 7.2]

26.4.2012 *Graph algorithms I*. Data structures for graphs. Graph traversal: BFS and DFS. Reflexive and transitive closure. Topological sorting. [Cormen, Ch. 22.1 – 22.4]

27.4.2012 *Graph algorithms II*. Minimal spanning trees: introduction, greedy algorithms, Kruskal’s algorithm with union find structure. [Cormen, Ch. 23]

3.5.2012 *Graph algorithms III*. Minimal spanning trees with Prim/Dijkstra. Fibonacci Heaps. [Cormen, Ch. 19, 23]


11.5.2012 *Graph algorithms VI: Flows in networks II*. Shortest augmenting path algorithms, $O(m^2n)$ algorithm by Edmonds-Karp, $O(mn^2)$ algorithm by Dinic. Matchings in bipartite graphs. Hall’s theorem. [Ahuja, Ch. 7.5 & Cormen, Ch. 26.2 – 26.3, Problem 26.3-4]
18.5.2012 Geometric algorithms I. Convex hull of points in the plane: Jarvis, Graham, linear scan. Intersection of orthogonal line segments: Check for intersection, report all intersection points, count all intersection points.

[Cormen, Ch. 33.1 – 33.3 & deBerg, Ch. 1.1 – 1.2]

24.5.2012 Geometric algorithms II. Intersection of arbitrarily oriented line segments: checking and reporting. Intersection of axis-parallel rectangles, 2-dimensional range trees.

[deBerg, Ch. 5.3]

25.5.2012 Geometric algorithms III. Intersection of axis-parallel rectangles using segment trees, tile trees or interval trees. Pair of nearest neighbors in a point set: scan, geometric divide and conquer. [Cormen, Ch. 33.4 & deBerg, Ch. 10.1 – 10.3]


[Cormen, Ch. 18]