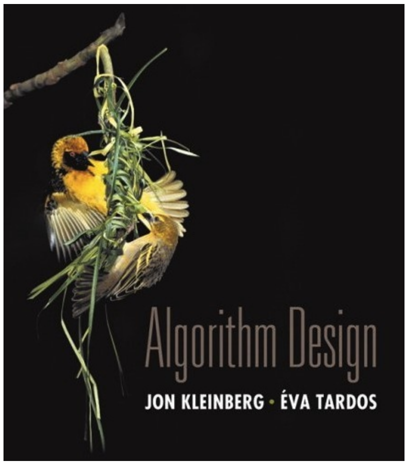

Algorithm Design
JON KLEINBERG · ÉVA TARDOS

Lecture Slides for Algorithm Design

These are a revised version of the lecture slides that accompany the textbook *Algorithm Design* by Jon Kleinberg and Éva Tardos. Here are the original and official version of the slides, distributed by Pearson.

TOPIC	SLIDES	READINGS	DEMOS
Stable Matching (*Gale–Shapley*)	1up · 4up	Chapter 1	Gale–Shapley
Algorithm Analysis (*big O notation*)	1up · 4up	Chapter 2	binary search
Graphs (*graph search*)	1up · 4up	Chapter 3	–
Greedy Algorithms I (*basic techniques*)	1up · 4up	Chapter 4	interval scheduling interval partitioning
Greedy Algorithms II (*shortest paths and MSTs*)	1up · 4up	Chapter 4	Dijkstra Prim, Kruskal, Borůvka Edmonds
Divide and Conquer I (*sorting and selection*)	1up · 4up	Chapter 5	merging quickselect
Divide and Conquer II (*integer and polynomial multiplication*)	1up · 4up	Chapter 5	–
Dynamic Programming I	1up · 4up	Chapter 6	–

(*basic techniques*)			
Dynamic Programming II (*sequence alignment, Bellman–Ford*)	1up · 4up	Chapter 6	–
Network Flow I (*maximum flow theory*)	1up · 4up	Chapter 7	Ford–Fulkerson
Network Flow II (*maximum flow applications*)	1up · 4up	Chapter 7	–
Network Flow III (*assignment problem*)	1up · 4up	Chapter 7	–
Intractability I (*polynomial-time reductions*)	1up · 4up	Chapter 8	–
Intractability II (*P, NP, and NP-complete*)	1up · 4up	Chapter 8	–
Intractability III (*coping with intractability*)	1up · 4up	Section 10.2, 11.8	independent set vertex cover
PSPACE (*PSPACE complexity class*)	1up · 4up	Chapter 9	–
Limits of Tractability (*extending limits of tractability*)	1up · 4up	Chapter 10	–
Approximation Algorithms (*approximation algorithms*)	1up · 4up	Chapter 11	list scheduling
Local Search (*Metropolis, Hopfield nets*)	1up · 4up	Chapter 12	–
Randomized Algorithms (*randomized algorithms*)	1up · 4up	Chapter 13	–
Data Structures I (*amortized analysis*)	1up · 4up	Chapter 17 (*CLRS*)	dynamic table
Data Structures II (*binary and binomial heaps*)	1up · 4up	Chapter 6 (*CLRS, 2nd edition*)	binary heap heapify
Data Structures III (*Fibonacci heaps*)	1up · 4up	Chapter 19 (*CLRS*)	–
Data Structures IV (*union–find*)	1up · 4up	Section 5.1.4 (*Dasgupta et al.*)	–
Linear Programming I (*simplex algorithm*)	1up · 4up	(*Chvátal*)	–
Linear Programming II (*linear programming duality*)	1up · 4up	(*Chvátal*)	–
Linear Programming III (*ellipsoid algorithm*)	1up · 4up	Lecture notes (*Michel Goemans*)	–

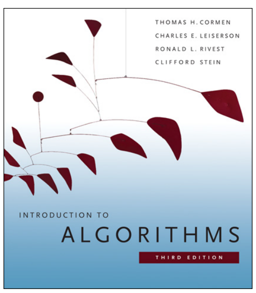
References.

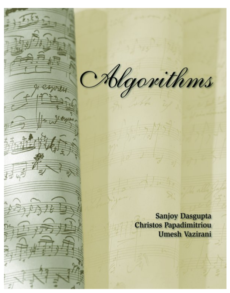
The lectures slides are based primarily on the textbook:

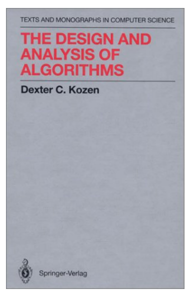
- *Algorithm Design* by Jon Kleinberg and Éva Tardos. Addison-Wesley, 2005.

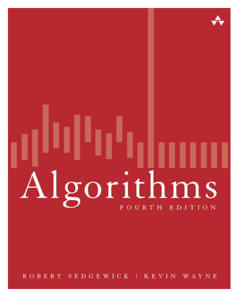
Some of the lecture slides are based on material from the following books:

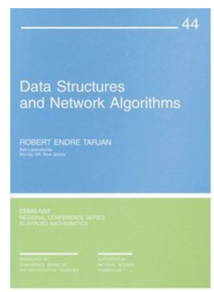
- *Introduction to Algorithms, Third Edition* by Thomas Cormen, Charles Leiserson, Ronald Rivest, and Clifford Stein. MIT Press, 2009.
- *Algorithms* by Sanjoy Dasgupta, Christos Papadimitriou, and Umesh Vazirani. McGraw Hill, 2006.
- *The Design and Analysis of Algorithms* by Dexter Kozen. Springer, 1992.
- *Algorithms 4/e* by Robert Sedgewick and Kevin Wayne. Addison-Wesley Professional, 2011.
- *Data Structures and Network Algorithms* by Robert Tarjan. Society for Industrial and Applied Mathematics, 1987.
- *Linear Programming* by Vašek Chvátal. W. H. Freeman, 1983.

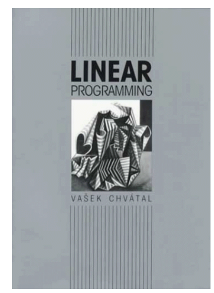












Instructors.

If you are an instructor using the textbook and would like the latest version of the keynote source files, please email Kevin Wayne.

Errata.

Here are the known errata in these lecture slides.

Credits.

Special thanks to Pierre Flener, for finding and reporting dozens of errors and suggesting numerous improvements in the presentation.