

# A Reading List in Combinatorial Optimization

Brian Borchers

February 9, 1999

I've compiled this list of books on combinatorial optimization and integer programming as a source of additional reading and project ideas for students in my graduate course in combinatorial optimization.

## References

- [AK89] Emile H.L. Aarts and Jan Korst. *Simulated Annealing and Boltzmann Machines: A Stochastic Approach to Combinatorial Optimization and Neural Computing*. Wiley, Chichester, 1989.

A textbook on simulated annealing, one of the most popular meta heuristic methods.

- [AL87] Emile H. L. Aarts and Peter J. M. Van Laarhoven. *Simulated Annealing: Theory and Applications*. Kluwer Academic Publishers, 1987.

Another textbook on simulated annealing

- [AMO93] Ravindra K. Ahuja, Thomas L. Magnanti, and James B. Orlin. *Network Flows : Theory, Algorithms, and Applications*. Prentice Hall, Englewood Cliffs, NJ, 1993.

An encyclopedic text/reference on network flow problems, algorithms, and computational complexity issues.

- [AS92] Noga Alon and Joel H. Spencer. *The Probabilistic Method*. John Wiley and Sons, New York, 1992.

The probabilistic method is a very powerful technique in combinatorics for proving the existence of combinatorial objects. There are strong connections between this mathematics and randomized algorithms.

- [Ber91] Dimitri P. Bertsekas. *Linear Network Optimization: Algorithms and Codes*. MIT Press, Cambridge, MA, 1991.

A textbook on network flow problems. Particularly good for its discussion of auction algorithms.

- [Bla93] Jacek Blazewicz. *Scheduling in computer and manufacturing systems*. Springer-Verlag, New York, 1993.

A textbook on scheduling problems.

- [CCPS98] William J. Cook, William H. Cunningham, William R. Pulleyblank, and Alexander Schrijver. *Combinatorial Optimization*. John Wiley and Sons, New York, 1998.

A textbook that concentrates mostly on integer programming/cutting plane methods for combinatorial optimization problems.

- [CLR90] Thomas H. Cormen, Charles E. Leiserson, and Ronald L. Rivest. *Introduction to Algorithms*. MIT Press, Cambridge, MA, 1990.

The standard textbook on algorithms.

- [Dav87] Lawrence Davis. *Genetic Algorithms and Simulated Annealing*. Morgan Kaufmann, Los Altos, CA, 1987.

A textbook on two popular meta heuristics, genetic algorithms and simulated annealing.

- [Dav91] Lawrence Davis. *Handbook of Genetic Algorithms*. Van Nostrand Reinhold, New York, 1991.

Just what it says- A handbook on genetic algorithms.

- [DMM97] Mauro Dell'Amico, Francesco Maffioli, and Silvano Martello, editors. *Annotated bibliographies in combinatorial optimization*. John Wiley and Sons, New York, 1997.

An up-to-date and very useful collection of bibliographies on various topics in combinatorial optimization.

- [Eve79] Shimon Even. *Graph Algorithms*. Computer Science Press, Potomac, Maryland, 1979.

A textbook on graph algorithms and complexity, including depth first search, planarity testing, and max flow problems.

- [Gib85] Alan Gibbons. *Algorithmic Graph Theory*. Cambridge University Press, Cambridge, 1985.

A textbook on graph theory with lots of algorithms.

- [GJ79] Michael R. Garey and David S. Johnson. *Computers and Intractability: A Guide to the Theory of NP-Completeness*. W. H. Freeman and Company, New York, 1979.

This book covers that theory of computational complexity. It also includes a large list of known NP-complete and NP-hard problems.

- [GKP92] Fred Glover, Darwin Klingman, and Nancy Phillips. *Network Models in Optimization and Their Applications in Practice*. Wiley, New York, 1992.

A textbook on network flow problems. Particularly good at demonstrating the range of applications of network flow models.

- [GLS88] Martin Grötschel, László Lovász, and Alexander Schrijver. *Geometric Algorithms and Combinatorial Optimization*. Springer-Verlag, New York, 1988.

Very theoretical, but the source of many important ideas in combinatorial optimization

- [Gol89] David E. Goldberg. *Genetic Algorithms in Search, Optimization, and Machine Learning*. Addison-Wesley, Reading, MA, 1989.

This textbook is an easy to read introduction to Genetic algorithms, which can be used as heuristics for combinatorial optimization problems.

- [Hoc97] Dorit Hochbaum, editor. *Approximation algorithms for NP-hard problems*. PWS Publishing, Boston, 1997.

A collection of survey papers on approximation algorithms and recent theory on the limited possibility of approximation algorithms for various NP-Complete problems.

- [Law76] Eugene Lawler. *Combinatorial Optimization: Networks and Matroids*. Saunders College Publishing, Fort Worth, 1976.

This is a very well written treatment of network flows and matroids. Unfortunately, it predates the theory of computational complexity. This book is now out of print.

- [Law85] Eugene Lawler. *The Traveling Salesman Problem: A Guided Tour of Combinatorial Optimization*. Wiley, New York, 1985.

This book discusses the traveling salesman problem from a number of points of view. Along the way, it discusses branch and bound, cutting plane, and heuristic approaches, along with computational complexity.

- [Mot95] Rajeev Motwani. *Randomized algorithms*. Cambridge University Press, Cambridge, 1995.

A textbook on randomized algorithms. These can be very useful for obtaining approximate solutions to NP-Complete problems.

- [MT90] Silvano Martello and Paolo Toth. *Knapsack Problems: Algorithms and Computer Implementations*. Wiley, New York, 1990.

Covers branch and bound and dynamic programming approaches to knapsack problems. Includes Fortran codes.

- [NW88] George L. Nemhauser and Laurence A. Wolsey. *Integer and Combinatorial Optimization*. John Wiley and Sons, New York, 1988.

This is an advanced graduate level text/reference book. It covers a wide range of topics, including linear programming, network flow problems, polyhedral theory, cutting plane methods, branch and bound methods, duality in integer programming, and computational complexity. The book may be a bit too advanced for the beginning student, but it is a very good book for the more advanced reader. The only weaknesses are in their areas of heuristics and approximation algorithms.

- [OLK85] M. O'hEigeartaigh, J. K. Lenstra, and A. H. G. Rinnooy Kan. *Combinatorial Optimization: Annotated Bibliographies*. Wiley, New York, 1985.

Although now somewhat out of date, this book is a very useful bibliography of older books and papers on combinatorial optimization.

- [Pap94] Christos H. Papadimitriou. *Computational Complexity*. Addison-Wesley, Reading, MA, 1994.

A textbook on computational complexity that goes far beyond the basics of NP-Completeness.

- [Par95] R. Gary Parker. *Deterministic Scheduling Theory*. Chapman and Hall, London, 1995.

A textbook on deterministic scheduling theory, including single and parallel processor problems, time tabling, and the TSP.

- [Pin95] Michael Pinedo. *Scheduling: Theory, Algorithms and Systems*. Prentice Hall, Englewood Cliffs, New Jersey, 1995.

A textbook on scheduling theory and algorithms. Looks at both deterministic and stochastic models. Contains a very useful appendix classifying many deterministic problems by computational complexity.

- [PR88] R. Gary Parker and Ronald L. Rardin. *Discrete Optimization*. Academic Press, Boston, 1988.

This textbook covers computational complexity, matroids, cutting plane techniques, branch and bound, duality in integer programming, and approximation schemes. The coverage of heuristics is limited.

- [PS82] Christos H. Papadimitriou and Kenneth Steiglitz. *Combinatorial Optimization: Algorithms and Complexity*. Prentice-Hall, Englewood Cliffs, NJ, 1982. Now available in an inexpensive paperback edition from Dover.

This textbook covers computational complexity, linear programming and the simplex method, network flows, matching problems, matroids, integer programming, cutting plane algorithms, branch and bound algorithms, dynamic programming, heuristics, and approximation algorithms. The material on cutting planes, approximation algorithms and heuristics is somewhat out of date, but overall, this is a very useful textbook.

- [Ree93] Colin R. Reeves. *Modern Heuristic Techniques for Combinatorial Problems*. Halsted Press, New York, 1993.

A collection of papers on heuristic techniques, including simulated annealing and tabu search.

- [Sch87] Alexander Schrijver. *Theory of Linear and Integer Programming*. John Wiley and Sons, New York, 1987.

This textbook covers the theory of integer programming, especially polyhedral theory, computational complexity, and the theory of lattices.

- [Sto92] Mechthild Stoer. *Design of Survivable Networks*, volume 1531 of *Lecture Notes in Mathematics*. Springer Verlag, Heidelberg, 1992.

This monograph describes a modern cutting plane approach to designing telecommunications networks that can survive the loss of links and nodes. A good example of modern cutting plane methods at work.

- [Wil91] H. P. Williams. *Model Building in Mathematical Programming*. John Wiley and Sons, New York, third edition, 1991.

A textbook on formulating linear and integer linear programming models.

- [Wol98] Laurence A. Wolsey. *Integer Programming*. John Wiley and Sons, New York, 1998.

A textbook on integer programming, including branch and bound, cutting plane methods, and Lagrangian duality. More accessible than Nemhauser and Wolsey.