Discrete Applied Mathematics 39 (1992) 95–97
North-Holland



# Book Announcements

## Richard A. O'Keefe, The Craft of Prolog (MIT Press, Cambridge, MA, 1990) 387 pages

*Chapter* 1: *Basic Topics in Prolog.* Introduction. Cases and structural induction. Inputs and outputs. Context arguments. (Accumulator passing. Last call optimisation. Partial data structures). Difference lists. Counters. Backwards correctness. *Chapter* 2: *Searching.* Introduction. Simple depth-first search. Depth-first search with explicit open set. Breadth-first search. A digression on queues. Back to breadth-first search. Digression: unpacking the 'queue' records. Keeping track of visited nodes. Local heuristic ordering. Global heuristic ordering. An example. Iterative deepening (Avoiding duplicate solutions. Pruning earlier. Stopping). Returning the path to a solution. Explain the method in your comments. The algebra of binary relations. *Chapter* 3: *Where Does The Space Go*?. The clause store. Variables. Box diagrams. Measuring space used. A hack. The trail. Choice points and the cut. Uses of the cut. Cutting away clauses. Pruning alternative solutions. RED cuts. GRUE cuts. How far do cuts reach?. Disjunction and if-then-else (Introduction. Disjunction. Pushing a choice point. Member/union). 'repeat' loops. If-then-else. Tips. *Chapter* 4: *Methods of Programming.* The problem of the Dutch national flag. The problem of merging two ordered lists. Computing the size of a tree. The search for the small superset. Rem's algorithm for the recording of equivalence classes. Efficient data structures. Keep it clean!. *Chapter* 5: *Data Structure Design.* Introduction. Writing a set-union predicate. The importance of data structures. The problem of transitive closure (Beware of the general case). General principles (Round lists). *Chapter* 6: *Sequences.* Introduction and notation. Representing sequences. Conversion (List to generator. List to enumerator. List to relation. Generator to list. Generator to enumerator. Enumerator to list. Enumerator to generator). Computing functions of lists (The "tower" method. The "linear" method. When $f$ has no left identity. The "Logarithmic" method. Odds and evens. Summary). Naming and calculating parts of sequences (Head. Tail. Element. Prefix. Suffix. Segment. Summary). Tree traversal. Selecting a subsequence. Prefixes (Prefixes of lists. Generators. Enumerators. Prefixes determined by length). Concatenation (Concatenating generators. Concatenating enumerators). Mapping. Cross-products. Recurrences. Meta-programs and object-oriented programming (Meta-programming. Object-oriented programming). Quantification (Lists and generators. Enumerators). The importance of algebra. Summary. *Chapter* 7: *Writing Interpreters.* Introduction. But first, an easy case. Compiling the interpreter away (Summary). Multiple interpretations. Writing simple Prolog interpreters. Conditional cuts (In broken Prologs). Augmenting Prolog. Summary. *Chapter* 8: *Some Notes on Grammar Rules.* Introduction. A brief description of grammar rules. Phrase/[2,3]. Examples (Append. Flattening a tree. Replacing one sublist by another. Finding a pattern in a string. library (morelists)). A notational convention. Perspective on a problem. *Chapter* 9: *Prolog Macros.* A digression about print/1. How expand_term/2 works. Conditional reading. Macros. Problems. *Chapter* 10: *Writing Tokenisers in Prolog.* Reading a sentence. What tools already exist?. A simplified problem. Programming definition 1. Programming definition 2. Character output. Tokenising Prolog. *Chapter* 11: *All Solutions.* Introduction. Some examples. Standard predicates. Clocksin & Mellish. Doing it right. findall/3 reconsidered. bagof/3 and setof/3. How do bagof/3 and setof/3 work?. Doing it differently. In NU Prolog.

## Diderik Lund and Bernt Øksendal, eds., Stochastic Models and Option Values: Applications to Resources, Environment and Investment Problems (North-Holland, Amsterdam, 1991) 301 pages

PART I: INTRODUCTION. *Stochastic Models and Option Values: An Introduction* (Diderik Lund). *Stochastic Control Theory: A Brief Summary* (Bernt Øksendal). PART II: FINANCIAL OPTION THEORY APPLIED TO REAL INVESTMENT. *The Price of Convenience and the Valuation of Commodity Contingent Claims* (Michael J. Brennan). *Valuation of Long Term Oil-Linked Assets* (Rajna Gibson and Eduardo Schwartz). *The Cost of a Promise to Develop an Oil Field within a Fixed Future Date* (Petter Bjerksund). *Irreversibility and the Explanation of Investment Behavior* (Robert S. Pindyck). *Financial and Non-financial Option Valuation* (Diderik Lund). PART III: STOCHASTIC CONTROL AND DYNAMIC PROGRAMMING. *Partial Investment Under Uncertainty* (T.Ø. Kobila). *The High Contact Principle as a Sufficiency Condition for Optimal Stopping* (Kjell Arne Brekke and Bernt Øksendal). *Invariant Controls in Stochastic Allocation Problems* (Trond E. Olsen and Gunnar Stensland). *Shadow Prices in Stochastic Programming: Their Existence and Significance* (Sjur D. Flam). PART IV: STATISTICAL MODELS OF NATURAL RESOURCE EXPLOITATION. *Estimating Structural Resource Models When Stock is Uncertain: Theory and Its Application to Pacific Halibut* (Peter Berck and Grace Johns). *Optimal Decisions With Reduction of Uncertainty over Time: An Application to Oil Production* (Gunnar Stensland and Dag B. Tjøstheim).

## E.G. Coffman Jr and G.S. Lueker, Probabilistic Analysis of Packing and Partitioning Algorithms (Wiley, New York, 1991) 192 pages

*Chapter* 1: *Introduction*. Overview. Illustrative applications. Notation. Classical algorithms (Makespan scheduling. Bin packing). *Chapter* 2: *Analysis Techniques*. Sums of i.i.d. random variables (Small deviations and the central limit theorem. Bounds on the tails of the distributions. Estimates of moments). Markov chains. Bounds. Dominating algorithms. Bounds that usually hold. Monotonicity. More specialized techniques (Applications of the Poisson process. Kolmogorov–Smirnov statistics. The second moment method. An application of renewal theory). *Chapter* 3: *Matching Problems*. Proofs for Euclidean and rightward matching (The lower bound. The upper bound. A rightward matching problem). Proof of the up-right matching estimate (The lower bound. The upper bound). *Chapter* 4: *Scheduling and Partitioning*. Analysis of classical greedy heuristics. Differencing methods. On the optimum solution. *Chapter* 5: *Bin Packing: The Optimum Solution*. Basic algorithms and bounds. Perfect packings. Functional analysis of the packing constant. *Chapter* 6: *Bin Packing: Heuristics*. Off-line packing: FFD and BFD (The expected behavior. Deviation from the expected behavior). On-line bin packing: Best Fit. On-line linear-time bin packing (Next Fit: The expected behavior. Deviation from the expected behavior. The HARMONIC algorithm. On-line matching. On-line packing with limited active bins). *Chapter* 7: *Packings in Two Dimensions*. Off-line algorithms (Packing squares into a strip. Packing rectangles into a strip. Two-dimensional bin packing). On-line algorithms.

## E.A. Bender and S.G. Williamson, Foundations of Applied Combinatorics (Addison-Wesley, Redwood City, CA, 1991) 425 pages

PART 1: COUNTING AND LISTING. *Chapter* 1: *Basic Counting*. Lists with repetitions allowed (Using the rules of sum and product). Lists with repetitions forbidden. Sets. Recursions. Multisets. *Chapter* 2:

*Functions.* Some basic terminology (Terminology for sets. What are functions?). Permutations. Other combinatorial aspects of functions (Image and coimage. Monotonic functions and unordered lists). Boolean functions. *Chapter* 3: *Decision Trees.* Basic concepts of decision trees. Ranking and unranking (Calculating RANK. Calculating UNRANK. Gray codes). Backtracking. *Chapter* 4: *Sieving Methods.* Introduction (Structures with symmetries. Structures lacking things). Listing structures with symmetries. Counting structures with symmetries. The principle of inclusion and exclusion (Bonferonni's inequalities. Partially ordered sets). PART II: GRAPHS. *Chapter* 5: *Basic Concepts in Graph Theory.* What is a graph?. Equivalence relations and unlabeled graphs. Paths and subgraphs. Directed graphs (digraphs). Rooted plane trees. Computer representations of graphs. *Chapter* 6: *A Sampler of Graph Topics.* Spanning trees. Coloring graphs. Analysis of algorithms (NP-complete problems. VLSI design). Finite state machines (Turing machines. Finite state machines and digraphs). *Chapter* 7: *Two More Graph Topics.* Planar graphs (Euler's relation. The five color theorem. Algorithmic questions). Flows in networks (The concepts. An algorithm for constructing a maximum flow. Cut partitions and cut sets). PART III: RECURSION. *Chapter* 8: *Induction and Recursion.* Inductive proofs and recursive equations. Thinking recursively. Recursive algorithms (Some examples. Computer implementation). *Chapter* 9: *Rooted Plane Trees.* Unlabeled binary RP-trees. Traversing trees (Depth first traversals). Grammars and RP-trees. *Chapter* 10: *Sorting Theory.* Limits on speed (Proof of the theorem). Software sorts (Binary insertion sort. Bucket sort. Merge sorts. Quicksort. Heapsort). Sorting networks (Speed and cost. (Parallelism. How fast can a network be?. How cheap can a network be?). Proving that a network sorts (The batcher sort)). Divide and conquer. PART IV: GENERATING FUNCTIONS. *Chapter* 11: *Ordinary Generating Functions.* What are generating functions?. Solving a single recursion. Manipulating generating functions (Obtaining recursions. Derivatives). The rules of sum and product. *Chapter* 12: *Generating Function Topics.* Introduction. Systems of recursions (Exercises). Exponential generating functions (The exponential formula. Exercises). Symmetries and Pólya's theorem (Exercises). Asymptotic estimates (Linear recursions. Sums of positive terms. Generating functions).

## Dimitri P. Bertsekas, Linear Network Optimization: Algorithms and Codes (MIT Press, Cambridge, MA, 1991) 359 pages

*Chapter* 1: *Introduction.* Problem formulation (Graphs and flows. The minimum cost flow problem. Transformations and equivalences). Three basic algorithmic ideas (Primal cost improvement. Application to the max-flow problem - the max-flow/min-cut theorem. Duality and dual cost improvement. Auction. Good, bad, and polynomial algorithms). The shortest path problem (A general single origin/many destinations shortest path method. Label setting (Dijkstra) methods. Label correcting methods. Single origin/single destination methods. Multiple origin/multiple destination methods). *Chapter* 2: *Simplex Methods.* Main ideas in simplex methods (Using prices to obtain the in-arc. Obtaining the out-arc. Dealing with degeneracy). The basic simplex algorithm (Justification of the simplex method. Choosing the initial strongly feasible tree - the big-$M$ method). Extension to the problem with upper and lower bounds. Implementation issues. *Chapter* 3: *Dual Ascent methods.* Dual ascent. Primal-dual (sequential shortest path) methods. The relaxation method. Implementation issues. *Chapter* 4: *Auction Algorithms.* The auction algorithm for the assignment problem (The main auction algorithm. The approximate coordinate descent interpretation. Computational aspects - $\varepsilon$-scaling). Reverse auction and inequality constrained assignment problems (Auction algorithms for asymmetric assignment problems. Auction algorithms for multiassignment problems). An auction algorithm for shortest paths (Algorithm description and analysis. Efficient implementation - forward/reverse algorithm. Relation to naive auction and dual coordinate ascent). A generic auction algorithm for the minimum cost flow problem. The $\varepsilon$-relaxation method. Implementation issues. *Chapter* 5: *Performance and Comparisons.* Shortest path problems. Max-flow problems. Assignment problems. Minimum cost flow problems. Sensitivity analysis.