

Background Reading for AI2 Module 1, Task 1

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This document lists some sources of background reading on the material covered in the lectures of Module 1, Task 1. Unfortunately there is no single textbook that covers all this material. The examinable content of Module 1, Task 1, consists of the material covered in the lectures, tutorials and assigned work. In general, many of the sources listed below go into more detail than is needed to follow the examinable material, but they may provide useful clarification and alternative descriptions in some cases.

Russell and Norvig (RN) contains a good amount of the material.

Luger and Stubblefield (LS) also contain a lot of useful material. I have referenced the 2nd edition here but the 3rd is currently on sale.

1 Using Constraints to (Partially) Solve a Problem

The Mutilated Chessboard problem is described in Raphael p31 onwards.

2 Exploting Subproblems

The Towers of Hanoi problem is described in Raphael p79 onwards as a search problem (using a heuristic search algorithm which is a simplification of A*). The recursive algorithm is described in Harel p32 onwards. The usefulness of “islands” for planning is described in Stefik p223 onwards. Means-ends analysis is described in Stefik p210 onwards and, in connection with an early problem-solving system called GPS, in Winston p150 onwards. Memoisation is discussed in connection with the Perl programming language in Dominus and for Prolog in Sterling and Shapiro p181 onwards.

3 Dynamic Programming

The task of finding a subset of a list with a given sum is described in Dominus. Russell and Norvig very briefly mention dynamic programming for selecting the most useful ac-

tion, finding shortest paths and matching edges in stereo vision. Harel describes dynamic programming for finding shortest paths on p87 onwards.

4 Stereo and the Viterbi Algorithm

zeus.rutgers.edu/~feher/rds_e/rds.html

www.people.virginia.edu/~ls8j/perception/class11.htm

homepages.inf.ed.ac.uk/cgi/rbf/CVONLINE/entries.pl?TAG68

homepages.inf.ed.ac.uk/cgi/rbf/CVONLINE/entries.pl?TAG72

The first 12 pages of: I. Cox, S. Hingorani and S. Rao, "A Maximum Likelihood Stereo Algorithm", Computer Vision and Image Understanding, Vol. 63, No. 3, May 1996. at homepages.inf.ed.ac.uk/rbf/AI2P1AUDIO/CVGIP.PS.gz. The Viterbi algorithm is covered on p765 (VN1) onwards.

5 Constraint Satisfaction

CSPs are defined briefly and solution approaches are summarised in Russell and Norvig CH 5. Stefik describes simple and backtracking constraint satisfaction on p187 onwards. Winston describes propagation of deterministic numerical constraints on p72 onwards. LS: p204

6 Pruning Values in CSPs

Kumar provides a useful survey of constraint satisfaction techniques.

7 Edge Labelling

Steedman gives a very readable discussion of the edge labelling problem and also describes the AC3 algorithm and its properties. The edge labelling problem (but not the pruning algorithm) is described in the context of early machine vision research in Raphael p233 onwards. The problem is described as constraint satisfaction in Winston p43 onwards. Russell and Norvig Chapter 24, gives an introduction to machine vision, including covering line labelling.

8 Exploiting Constraints in Prolog

The cut is described in Clocksin and Mellish, Chapter 4. `assert` and `retract` are covered in Chapter 6. Memoisation in Prolog is shown in Sterling and Shapiro p181 onwards.

9 Constraint Logic Programming

Marriott and Stuckey describe some of the techniques behind CLP in detail, and they also have quite a good introductory section. The Sicstus Prolog User's Manual has details of the CLP libraries in Sicstus Prolog.

THE REFERENCES

- Clocksin, W. F. and Mellish, C., *Programming in Prolog*, Springer Verlag.
- Dominus, Mark-Jason, “Bricolage: Memoization”, *The Perl Journal* Vol 4, No 2, 1999. Also available at www.plover.com/~mjd/perl/MiniMemoize/memoize.html.
- Harel, D., *Algorithmics: The Spirit of Computing*, Addison-Wesley, 1987.
- Kumar, V., “Algorithms for Constraint-Satisfaction Problems: A Survey”, *AI Magazine* Vol 13, No 1, pp32-44, 1992.
- Luger, G. F. and Stubblefield, W. A. *Artificial Intelligence: Structures and Strategies for complex problem solving*, Addison-Wesley Pub Co; ISBN: 0805311963, 3rd edition, 1997.
- Marriott, L. and Stuckey, P., *Programming with Constraints: An Introduction*, MIT Press, 1998.
- Raphael, B., *The Thinking Computer: Mind inside Matter*, W. H. Freeman, 1976.
- *Sicstus Prolog User's Manual*, available at: www.sics.se/sicstus/docs/latest/html/sicstus.html/
- Steedman, M., “Cognitive Algorithms”, in S. Sternberg and D. Scarborough, (eds.), *Invitation to Cognitive Science, vol 4: Conceptual Foundations*, MIT Press, 171-210.
- Stefik, M., *Introduction to Knowledge Systems*, Morgan Kaufmann, 1995.
- Sterling, L. and Shapiro, E., *The Art of Prolog*, MIT Press, 1986.
- Winston, P. H., *Artificial Intelligence*, Addison-Wesley, second edition, 1984.