DECLARATIVE PROGRAMMING
(DEC)
Logic Programming

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Course Introduction

A Course Structure

There will be the following contact time: three lectures per week, and three hour-long practicals per week, each student attending only one of these.

Students will need to put in at least six additional hours per week to complete the necessary reading and to make adequate progress on the exercises.

A handful of lectures will cover the details of 'pure Prolog'. (This is a reasonably neat subset of Prolog.) Students will commence practicals using 'pure Prolog'.

While the 'pure Prolog' practicals continue, the lectures will cover the theory behind logic programming.

With this complete, the remainder of the course will cover Prolog programming techniques (including some 'impure Prolog'), and will illustrate these topics with examples drawn from Artificial Intelligence.

B Books

For the logic parts of the course, try one of the following alternatives:

- Ben-Ari,M.: *Mathematic Logic for Computer Science*, Prentice-Hall, 1993 (Chapters 1 to 4)
- Chang,C.-L. and Lee,R.C.-T.: *Symbolic Logic and Mechanical Theorem Proving*, Academic Press, 1973 (Chapters 1 to 5)
- Foxley, E. and Burke, E.: *Logic and its applications*, Prentice-Hall, 1996
- Genesereth,M.R. and Nilsson,N.J.: *Logical Foundations of Artificial Intelligence*, Morgan Kaufmann, 1988 (Chapters 1 to 5)
- Nilsson,N.J.: *Principles of Artificial Intelligence*, Springer-Verlag, 1982 (Chapters 4 and 5)
- Rich,E. and Knight,K.: *Artificial Intelligence (2nd edn)*, McGraw-Hill, 1991 (Chapters 4 to 6)

For the Prolog parts of the course, try one of the following alternatives:

- Bratko,I.: *Prolog Programming for Artificial Intelligence (2nd edn)*, 1990
- Clocksin,W.F. and Mellish,C.S.: *Programming in Prolog*, Springer-Verlag, 1981

- Flach, P.: *Simply Logical*, Wiley, 1994
- Nilsson,U. and Maluszynski,J.: *Logic, Programming and Prolog* (2nd edn.), Wiley, 1995 (First edition is also still useful.)
- Sterling,L. and Shapiro,E.: *The Art of Prolog* (2nd edn.), MIT Press, 1994 (First edition is also still useful.)

There are many more books on Prolog, some with a simpler tutorial style than those listed above. Be warned though: Prolog has many dialects. You need a book that says that it uses C-Prolog, Edinburgh Prolog or DEC-10 Prolog (which are all the same thing). Some other dialects are very close (e.g. Wisdom Prolog, Quintus Prolog, Sicstus Prolog); others are a bit further off (e.g. IBM-Prolog); others are way off (e.g. MicroProlog).

C Symbols Used

$\cup, \cap$	union and intersection of sets
$\subseteq, \subset, \in$	subset, proper subset and element
$\{\}$	empty set
$A_1 \times A_2$	cartesian product of A_1 and A_2
$\neg, \wedge, \vee$	negation, conjunction and disjunction
$\rightarrow, \leftrightarrow$	implication and bi-implication
$\forall, \exists$	universal and existential quantification
$\equiv$	logical equivalence (metalanguage)
$\models$	logical consequence (metalanguage)
$\vdash$	deduction (metalanguage)

D Notational Conventions

normal font lowercase letters and words (a, b, c, elephant, clyde)	predicate, function and constant symbols of first-order logic
normal font uppercase letters and words (X, Y, Z, Elephant)	variables of first-order logic
typewriter font lowercase letters and words (`a, b, c, elephant, clyde`)	predicate, function and constant symbols of Prolog
typewriter font uppercase letters and words (`X, Y, Z, Elephant`)	variables in Prolog
italic lowercase letters (p, f, c)	variables ranging over predicate, function and constant symbols (metalanguage)
italic uppercase letters (P, Q)	variables ranging over propositions and atoms (metalanguage)
lowercase letters from the beginning of the Greek alphabet ($\alpha, \beta, \gamma, \delta$)	variables ranging over wffs (metalanguage)
lowercase letters from the middle of the Greek alphabet ($\theta, \lambda, \sigma, \mu$)	variables ranging over substitutions (metalanguage)
uppercase letters from the Greek alphabet (Φ, Δ, Θ)	variables ranging over sets of wffs (metalanguage)