CO1001 Logic and Problem Solving

Credits: *20* **Convenor:** *Dr A. Kurz* **Semester:** *2nd*

Prerequisites:	*Essential: basic discrete mathematics*				
Assessment:	*Coursework: 100%*				
Lectures:	*30*	*hours*	**Problem Classes:**	*6*	*hours*
Surgeries:	*6*	*hours*	**Private Study:**	*100*	*hours*
Laboratories:	*8*	*hours*			

Subject Knowledge

Aims This module teaches the very basic principles of logic in computer science and gives the student an understanding of the principles of logic programming and how these are applied to standard problems in Artificial Intelligence (AI).

Learning Outcomes Students should be able to demonstrate understanding of

- propositional and predicate logics, and how they can help to solve problems and to write correct programs;
- the principles and techniques of logic programming, and how these can be applied in practice, for example in AI;
- how Prolog relates to the predicate calculus;
- the execution mechanism of Prolog in terms of unification, resolution and SLD-trees.

Methods Lectures, surgeries, problem classes, laboratories, class tests, web-support.

Assessment Marked problem-based worksheets, class tests.

Skills

Aims To teach students the use of logic for computing in general and that of Prolog in particular.

Learning Outcomes Students will be able

- to formalise problems in a formal logical language;
- to apply the tableau-method to check satisfiability and validity of propositional formulae;
- to use predicate logic to query a database;
- to use the concepts of invariant and pre/post-condition;
- to solve standard problems in AI;
- to write programs in Prolog using a mixture of recursion, arithmetic, lists/trees.

Methods Class sessions together with worksheets.

Assessment Marked problem-based worksheets, class tests.

Course Description Logic provides foundations, methods, and skills to Computer Science. To give only a few examples:

- foundations: the very hardware of computers is based on Propositional Logic;
- methods: logic helps in understanding (and specifying and verifying) programs;
- skills: understanding crucial programming concepts such as the scope of an identifier or analysing a given problem in logical terms.

The first part of the course introduces the two most important logics, Propositional Logic and Predicate Logic. Various examples of their importance to computing will be discussed. The second part of the course will show that a fragment of Predicate Logic can actually be used as a programming language (PROLOG). It will be used to exemplify the use of logic to solve problems.

Detailed Syllabus Propositional Logic, Predicate Logic, Logic and Programming (Invariants, Pre/Post Conditions), Logic Programming (predicate logic as a programming language, programming with lists/trees and recursion, execution mechanism (unification, SLD-trees).

Reading List

[B] I. Bratko, *Prolog, Programming for Artificial Intelligence, 3rd edition; ISBN: 0201403757,* Addison-Wesley, 2001.

[C] L. Sterling and E. Shapiro, *The Art of Prolog, 2nd edition.; ISBN: 0262691639,* MIT Press, 1994.

Resources Course notes, web page, study guide, worksheets, hand-outs, lecture rooms.

Module Evaluation Course questionnaires, course review.