COURSE PRESENTATION FORM – ACADEMIC YEAR 2010/2011

COURSE NAME	**Logic**
COURSE CODE	70014
LECTURER	Rosella Gennari
TEACHING ASSISTANTS	Rosella Gennari
TEACHING LANGUAGE	English
CREDIT POINTS	4
LECTURE HOURS	24
EXERCISE HOURS	12
TIME SPAN	27.09.2010 - 21.01.2011
TIME TABLE	See Timetable Page
OFFICE HOURS LECTURER	During the lecture time span; after previous arrangement by email.
OFFICE HOURS TEACHING ASSISTANT	
PREREQUISITES	Basics of algebra and computability theory
OBJECTIVES	Students completing this course unit are expected to - have acquired a working knowledge and understanding of propositional and first-order logic, - grasp the expressiveness and limitations of such logics, given a problem (like an instance of the TSP), be able to (1) formalise it in the more adequate formal language, (2) decide if the resulting formal problem is consistent or not, (3) decide if the resulting formal problem is valid or not
SYLLABUS	Lectures will closely follow the course textbooks, except otherwise stated. **Introduction** 1. Why logic: examples from - program verification examples; - self-reference puzzles; - standard benchmark propositional and first-order problems.

2. What is a logic in a nutshell:
   - it separates: (1) syntax, that is, the language; (2) semantics, that is, the meaning; (3) proof theory, that is, the axioms and inference rules;
   - such a separation will be motivated by some of the above examples and historical notes, e.g., (1) Hilbert's view on the entities of geometry, (3) the hyperbolic non-Euclidean geometry and its axioms, (2) its Poincaré models.

Propositional logic
1. Syntax: alphabet: expressions; well formed formulae.
2. Semantics: truth-tables; relevant semantic properties (e.g., compactness).
3. Proof theory: a natural deduction calculus.
4. Soundness and completeness.
5. Computability and complexity.

First-order logic
1. Syntax: alphabet; expressions, with/without identity; well formed formulae.
2. Semantics: algebraic structures (e.g., partial orders); relevant semantic properties (e.g., compactness).
3. Proof theory: a natural deduction calculus.
4. Soundness and completeness.
5. Computability and complexity of fragments of first-order logic.

Conclusions
1. Highlights on:
   a. other proof calculi, e.g., tableau-based, see the Computational Logic course;
   b. other logics, e.g., second-order logic, see the Nonclassical Logic and Knowledge Representation and Reasoning courses;
   c. other applications than those in the Introduction, see also the following courses: Semantic Web, Knowledge Representation and Reasoning with Ontologies, Computational Linguistics, Formal Methods, Foundations of Databases.

   Historical notes.

TEACHING FORMAT Frontal lectures.

ASSESSMENT Final exam only

READING LIST

Main textbooks

[1] Enderton, H.B. A Mathematical Introduction to Logic. Academic Press, 2004.
[2] van Dalen, D. Logic and Structures. Springer, 1983

Suggested readings

[3] Barwise, J., and Etchemendy, J. The Language of First-Order Logic. Center for the Study of Language and Information, Stanford, 1992.
[4] Benchmark Problems for Classical Propositional and First-order Logics at http://www.cs.uni-potsdam.de/ti/iltp/formulae.html.
[5] Boolos, G., and Jeffrey, R. Computability and Logic. Cambridge University Press, Cambridge, 1989.
[6] Doets, K., 1996, Basic Model Theory, Stanford: CSLI Publications.
[7] Doxiadis A., Papadimitriou, C.H., Papadatos A., and Di Donna, A. Logicomix: An Epic Search for Truth. 2009. See http://www.logicomix.com/ en/. For a review, see http://homepages.cwi.nl/~apt/ps/logicomix09. pdf.
[8] Gries, D. The Science of Programming. Springer, 1981.
Troelstra, A.S., and Schwichtenberg, H. Basic Proof Theory. Cambdrige University Press.

SOFTWARE USED

LEARNING OUTCOME

After completing this course, students should

- be capable of formalising computational problems (e.g., properties of programs),
- have refined their reasoning skills, e.g., by analysing, formalising and deciding on the logical dependencies between statements of an argument,
- have improved their communication skills by developing the habit of reading and expounding an argument in an organised and a precise manner — think of your thesis.

COURSE PAGE

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