Non-Classical Logics

Research Master in Cognitive Science and Humanities:
Language, Communication and Organization

Number of credits: 4
Optional

Instructors: Marga Vázquez and Xabier Arrazola

Skills/Competence Acquired by Students

1. Knowledge of First Order Logic (FOL), its semantics. Syntactical and semantical treatment of the alternative Logics to FOL.
2. Syntactical and Semantical treatment of alternative logics of FOL.
3. Use different Non-Classical Logics in application to Natural Language, communication and social action.
4. Use formal skills to analyze theoretical studies about meaning and to formalize arguments from different research contexts.

Evaluation

It will be expected of all students participation in classroom discussions, presentations, and do the proposed exercises and comments on selected readings. Every student will do the proposed exercises (from a little book of exercises) and a short paper on one of the logics of the program.

Contents

1. Introduction. Logic and Logics. First Order Logic. Second Order Logic. Classical Logic and Non-Classical Logics. What is Logic?
2. Propositional Logic. Syntax and Semantics. Decision procedures.

3. First Order Logics. Language types. Decision: sublanguages.

4. Many-valued Logics and probability. Manyvaluedness. 3-valued logics and the matrix method: Lukasiewicz, Kleene and Bochvar. Post: many-valued logic.

5. Modal Logic. Syntax and Semantics. Possible worlds semantics: frames and general frames. Canonical structures and canonical models. First Order Modal Logic. Applications to Semantics of Natural Language.

6. Epistemic and Doxastic Logic. Knowledge and Belief. Syntax and Possible Worlds Semantics. Syntactic treatment of belief. Systems of limited inference. Multi-agency. Knowledge Representation and Belief bases.

7. Deontic Logic. Syntax and Semantics. Obligation, permission and forbidden. Applications in communication protocols.

8. Temporal Logic. Time and Representation: points and intervals. Systems of Temporal Logic: temporal operators. Lineal Time. Branching Time. Time and Modality. Applications.

References

[Abramsky; Gabbay and Maibaum (eds.)(1992)] Abramsky, S.; D.M. Gabbay and T.S.E. Maibaum (eds.), (1992) *Handbook of Logic in Computer Science. Vols. 1 and 2.* Oxford: Clarendon Press,

[Chagrov and Zakharyaschev (1997)] J.P. Burgess (1981), *Modal Logic.* Oxford: Clarendon Press, 1997. Esp. Cap. 2.

[Chellas (1980)] Chellas, B. (1980). *Modal Logic: an introduction* Cambridge University Press, Cambridge.

[Cleave (1991)] Cleave, J.P (1991) *A Study of Logics.* Oxford: Clarendon Press.

[Dunn and Epstein (eds.)(1977)] Dunn, J.M. and G. Epstein (eds.) (1977) *Many Uses of Multiple-Valued Logic.* Dordrecht: Reidel.

[Gabbay and Guenthner (eds.)(1983-1989)] Gabbay, D. and Guenthner, F., (eds.) (1983-1989) *The Handbook of Philosophical Logic (vol.I-IV)*, Reidel, Dordrecht.

[Gamut (1991a)] Gamut, L.T.F., (1991) *Logic, Languaje and Meaning. Vol. I Introduction to Logic*. Chicago: The University of Chicago Press.

[Gamut (1991b)] Gamut, L.T.F., (1991) *Logic, Languaje and Meaning. Vol. II Intensional Logic and Logical Grammar* Chicago: The University of Chicago Press.

[Hughes and Cresswell (1996)] Hughes, G.E. and M.J. Cresswell (1996), *A new introduction to Modal Logic*. London: Routledge.

[Prior 1957] Prior, A. (1957). *Time and Modality*. Clarendon, Oxford.

[van Benthem (1983)] van Benthem, J. 1983, *The Logic of Time.* Amsterdam: Kluwer, 2nd ed. 1991.

[van Benthem (1991)] van Benthem, J. (1991), *Language in action* Amsterdam:North Holland 1991.

Others resources

- Journal of Symbolic Logic (ASL).
- Journal of Applied Logic
- Journal of FoLLI
- Stanford Encyclopedia of Phylosophy
- world.logic.at