CARLETON UNIVERSITY
SCHOOL OF COMPUTER SCIENCE

COMP 5307: Knowledge Representation
Fall Term 2015

Instructor: Dr. Leopoldo Bertossi. **Email:** bertossi@scs.carleton.ca

Course web page: http://www.scs.carleton.ca/~bertossi/KR

Office hour: Room 5125A. W 14:00 – 15:30 or by appointment

Lectures: WF 11:30-13:00. Room: Leeds House 118

Prerequisite: A first course on discrete mathematics, e.g. equivalent to COMP 1805. Desirable a first course on databases.

Objectives and Contents: Knowledge representation (KR), traditionally a main area of artificial intelligence, deals the problem of representing knowledge in computers and using it in computer systems. Symbolic logic provides formal languages with a clear syntax and semantics for representing knowledge, and deductive systems that can be used to automate reasoning and decision making.

Knowledge representation has regained the interest and attention from the computer science and computer engineering communities due to the emergence of new and important areas that are based on or applying KR tools and concepts. Some of them are: semantic web, ontologies, logic-based agents technology, databases and information systems, and logic programming.

This course presents the fundamentals and applications of logic-based knowledge representation and reasoning. It will not only benefit the students who wish to learn KR, but also those who need to learn the fundamentals of computational logic, a fundamental discipline for many areas of computer science. Automated reasoning tools will be used throughout the course. Specific topics will be taken from the following list:

1. Introduction: Different forms and applications of KR.
2. Review of propositional logic. Introduction to First-Order Logics (FOL).
3. Automated reasoning in FOL: Resolution, automated reasoning systems and techniques.
4. Commonsense reasoning and non-monotonic reasoning
5. Non-Monotonic logics

6. Non-monotonic reasoning: Extensions of logic programming, answer set programming for KR
7. Reasoning about action and change. Specification of system dynamics, situation calculus, cognitive robotics. Automated planning.
8. Reasoning with incomplete and inconsistent information.
9. Diagnostic Reasoning, automated diagnosis.
10. Description Logics and formal ontologies
11. Introduction to logico-probabilistic reasoning.

Assessment:

- 2 midterm tests, in class (no final examination): %55

  Lecture notes (slides) prepared by the instructor will be posted right after every lecture on the course web page. Reading them carefully (i.e. understanding everything, filling in details, and solving the proposed exercises) is crucial to get good marks in the tests. Posted slides should read right after every lecture and before attending the next lecture.

  Also active class attendance and participation is strongly recommended. What is said or discussed in class (and possibly not directly reflected in the lecture slides) may be asked in a test.

- Individual written assignments (conceptual and applications of automated reasoning systems): % 45

Literature:

1. Instructor's lecture slides.

   Books:

2. "Knowledge Representation and Reasoning" by Ronald Brachman and Hector Levesque, Morgan Kauffmann Publishers, 2004.
3. F. van Harmelen et al. "Handbook of Knowledge Representation". Elsevier, 2008.
4. M. Gelfond and Y. Kahl. "Knowledge Representation, Reasoning, and the Design of Intelligent Agents". Cambridge Univ. Press, 2014.
5. C. Baral. "Knowledge Representation, Reasoning and Declarative Problem Solving". Cambridge University Press, 2003.