

# Logic and Artificial Intelligence

Carnegie Mellon University  
Spring 2013

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Instructor: Dr. Gregory Wheeler  
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Office: Baker Hall 155C  
Office Hours: Tuesday 11:00 - 12:00 & by appointment  
Classroom: Potter Hall A19  
Meeting Times: Tuesday & Thursday, 12:00 - 1:20

## Course Description

An introduction to several formalisms used in knowledge representation and reasoning (KRR). The first half of the course covers the theoretical foundations of KRR: first-order logic, the principles for creating knowledge bases, propositional and first-order resolution, horn logics, description logics for reasoning about individuals and categories, inheritance, 'non-monotonic' reasoning and defaults, principles of belief revision, representing and reasoning about actions, and planning. After this review, we will then look at a formalism for multiple epistemic agents and actions in some depth, and consider the trade-off between expressiveness and tractability. Finally, we shall introduce probabilistic methods for knowledge representation and reasoning under conditions of uncertainty.

## Readings

Required Texts: Ronald J. Brachman and Hector J. Levesque (2004), *Knowledge Representation and Reasoning*, San Francisco, CA: Morgan Kaufmann Press.  
Additional Reading: Online at CMU Blackboard

## Grading

Attendance: 5%  
6 analytical problem sets: 95%

You are allowed to discuss the problem sets with your classmates in attempting to solve the exercises, but each student must write up independent answers. If you collaborate with another student in solving a particular exercise, you must identify who that student is and note which problems you collaborated on. Failure to note collaboration or copying answers verbatim constitutes academic dishonesty.

## Course Schedule

WEEK	DATE	TOPIC	READINGS	ASSIGNMENTS
1	1/15 1/17	Introduction First-order Logic	KRR, ch 1 KRR, ch 2	Set 1
2	1/22 2/24	Expressing Knowledge Resolution I	KRR, ch 3 KRR, ch 4	Set 1 due
3	1/29 1/31	Resolution II Horn Logic	KRR, ch 4 KRR, ch 5	
4	2/5 2/7	Description Logic I Description Logic II	KRR, ch 9 KRR, ch 9	Set 2
5	2/12 2/14	Inheritance Defaults I	KRR, ch 10 KRR, ch 11	Set 2 due
6	2/19 2/21	Defaults II Belief Revision	KRR, ch 11 online	
7	2/26 2/28	Actions Situation Calculus	KRR, ch 14 KRR, ch 14	Set 3
8	3/5 3/7	Planning in Situation Calculus STRIPS & Alternatives	KRR, ch 15 KRR, ch 15	Set 3 due
9	3/12 3/14	<i>spring break</i> <i>spring break</i>		
10	3/19 3/21	Expressiveness & Tractability Tradeoff Vivid Knowledge & Beyond	KRR, ch 16 KRR, ch 16	Set 4
11	3/26 3/28	Modal Logic I Modal Logic II	online online	Set 4 due
12	4/2 4/4	Multi-Agent Epistemic Logic Dynamic Epistemic Logic	online online	
13	4/9 4/11	Epistemic Actions Representing Uncertainty	online KRR, ch12	Set 5
14	4/16 4/18	Reasoning about Uncertainty <i>spring carnival</i>	KRR, ch 12	Set 5 due
15	4/23 4/25	Bayesian Networks Advanced Uncertainty Frameworks	KRR, ch 12 online	Set 6
16	4/30 5/2	Advanced Frameworks (spillover) Advanced Frameworks (spillover)	online online	Set 6 Due (5 pm)