CS/Math/Phil 360, Fall 2007
Topics in Logic/Advanced Symbolic Logic

9:00 MWF CNS E106

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Required Texts:	J.L. Bell, David DeVidi and Graham Solomon, *Logical Options*
	Ash, Crossley, Brickhill, Stillwell, and Williams, *What is Mathematical Logic?*
Recommended:	Robert S. Wolf, *A Tour Through Mathematical Logic*

Course Description

Logic is the formal analysis of valid patterns of argument and deductive inference. This has been one of the concerns of philosophy since Aristotle. Since mathematics requires careful deductive reasoning and provides a systematic way to study patterns and structures, logic and mathematics have had a symbiotic relationship, particularly in the last century. Since Boole (in the mid 1800's) mathematicians have formalized logic so that it can be studied as part of the subject matter of mathematics as well as providing a careful check on the kind of reasoning allowed in mathematics. Computers can be thought of as logic cast in silicon. Computer science uses logical notions in design of programming languages and the analysis of computing paradigms. Computers are also used in automated reasoning, searching for proofs in suitable formal systems. Logic sits firmly on the boundary between the three disciplines of mathematics, philosophy, and computer science. (Meetings of the Association for Symbolic Logic often have papers by philosophers, mathematicians, and computer scientists in the same sessions. They provide an interesting contrast in academic cultures.)

This course will study formal logic as used in the foundations of mathematics and the analysis of philosophical argument: classical propositional calculus and predicate calculus with a special focus on syntax, semantics, soundness, completeness, compactness, decideablity and incompleteness. We'll look at model theory and proof theory as ways to apply mathematical thinking to questions in logic. We will ask what kinds of questions in logic can be solved in a deterministic fashion and will provide an algorithmic approach to decide logical questions which can be decided. Bell et al use a tree based approach to logic though they also discuss the Hilbert-style axiomatic approach and natural deduction.

Along with our understanding of classical logic, we will look at how mathematical structures can shed light on non-classical logics: many-valued logics, intuitionistic logic (which may be thought of as dealing with states of knowledge rather than truth), fuzzy logic (which deals with vagueness), modal logic (addressing questions of necessity, possibility, and tense), and categorical logic (a framework which can include all of these in a natural way). These are topics close to my research interests and they provide several possible topics for student research projects. Some of these logics are closely tied to current developments in the logical foundations of theoretical computer science.

This course presupposes some prior exposure to formal logic: Philosophy students should have had Phil 102; math students should have Math 200 and 135; Computer Science students are assumed to have CS 256 (which has a prerequisite of Math 135).

Written work and grading:

There will be two small projects leading to short papers (50 points each), a larger final project/paper (100 points), and a midterm and a final (100 each).

I will use a straight scale for determining grade. To allow flexibility at boundaries, I reserve the right to change the boundaries, but will draw them no higher than:

A :	90% or over
A-:	[87,90)
B+:	[83,87)
B :	[78,83)
B-:	[75,78)
C+:	[70,75)
C :	[65,70)
C-:	[60,65)
D :	[50,60)
F :	below 50%

Note: The line for passing will not move, the others *may* move downward.

Attendance Policy

I expect you to read the relevant sections of the books before the class where we will be discussing them. Classes and office hours are what you pay tuition for, so take advantage of them.

There is no deduction of points for classes missed.

Policy on Academic Integrity

Work handed in for a grade is expected to be your own work. On exams and individual projects there should be no collaboration: this will be made explicit on the assignment sheet. On daily homework there is something to be gained by talking and working with your fellow students; the writeup, however, should be your own. If you use outside sources, cite them. If you get help from an individual, give credit. It is not wise for you to neglect learning how to do the work on your own, since exams will all require all work to be done individually. Any cheating on exams or collaboration on assignments where it has been explicitly prohibited will be treated as a violation of the policy on academic dishonesty in the student handbook and will be reported to the Associate Provost.