Janet Folina
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Office: OM 106
Hours: M, F 2:10-3:10
(& by appointment)

PHILOSOPHY/MATH 313: ADVANCED SYMBOLIC LOGIC

I. Course Description: Logic is the science of correct reasoning or argument. Introduction to Logic, and/or Discrete Math, presents systems of tools for determining whether and why arguments of a certain sort (first order deductive arguments) are valid. Some questions quite naturally arise as a result of studying systems of symbolic logic. For example, you might wonder about alternatives to the standard system of introductory logic, or whether it is adequate to our needs. This course will address some of these further questions about standard logic, focusing on those that can be answered with logic/mathematics. Thus, a large part of this course is considered to be "metalogic", for it involves the formal study of logic.

II. Books:

Metalogic, An Introduction to the Metatheory of Standard First Order Logic, Geoffrey Hunter, UC Press

What is Mathematical Logic?, J.N. Crossley et. al., Dover

(Also useful: Beginning Logic, E.J. Lemmon, Axiomatic Set Theory, Suppes, Naïve Set Theory, Halmos. These are not ordered. They will be on reserve.)

III. Evaluation: Final grades will be roughly based on the following. Homework and attendance: 30%; Exams (tentative dates: Oct 2 and Dec 2): 30%; Final paper and presentation: 40%. **Please note:** Final papers due **May 3**.

IV. Topics: The following is just a list of topics. We will go through them in order up to section 8 of the course. How far we get into section 8 depends on how fast we go; and how fast we go depends on you - your background, how hard this seems, your interests. Some results we will discuss though not prove (for example, the incompleteness of arithmetic). So this is a rough list of topics (in order), without a definite timetable.

1. Intro and Review of Propositional and Predicate Logic. (Lemmon; Crossley 1)

2. Beyond First Order Logic: theory of relations and second order logic.

3. Tools: Informal set theory. (Lemmon appendix B; Crossley 6; texts on reserve)

4. Formal Languages; introduction to syntax and semantics (Hunter 1, s15-s19)

5. Decision Procedures (truth tables, semantic trees); first metatheoretic result.

6. Standard main Results about First Order Logic: Soundness, Consistency and Completeness. (Crossley 2 for overview; Hunter - much of the book. The bulk of the course content is here. In a series of sub-proofs, over a few weeks, we prove soundness and completeness of propositional logic; then soundness and completeness of full first order (predicate) logic. Many related results are proved along the way.)

7. Arithmetic and its Incompleteness. (Crossley 5)

8. Other Possible Topics: Turing Machines, Computability and Church's Thesis (Crossley 4), Modal Logic and its semantics, Intuitionistic Logic, Relevance Logic, Predicative mathematics, the philosophy of logic, history of set theory, etc. (some to be explored by student projects).

9. Final Presentations

V. Policies

1. I am committed to ensuring that all students have access to course content. Reasonable accommodations are available for students with documented disabilities. Please contact the Office of Student Affairs, 651-696-6220 to schedule an appointment to discuss your individual circumstances. It is important to do this as soon as possible and to discuss any accommodations with me, so that they can be implemented early in the semester.

2. NO EXTENSIONS unless circumstances are VERY extenuating and documented.

3. Cell phones must be **turned off** and **stowed** during class; the same goes for all other electronic equipment, unless needed for a documented disability. **UNPLUG!!!**