Logic and Reasoning (Introductory Level)

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Course Description

This course is an introduction to logic with both formal and informal components. Its goal is to get you to learn the basic formal concepts from logic and then to help you use them in your reasoning. I hope to get you to see, on the one hand, that logic, as a subject of mathematical investigation, is very beautiful, and that as a tool for analyzing claims and arguments that we encounter every day, it is also very powerful. When we engage with the claims made by, for instance, journalists, politicians, and academics, whether we should believe their claims depends largely on our ability to make distinctions, detect ambiguities, and ultimately test their arguments for validity. Formal systems are not necessary for this kind of critical evaluation, but they are immensely helpful. This class will try to emphasize the status of formal logic as a powerful tool, and so will move back and forth between the introduction of formal logical tools and their applications. Here is a partial list of the things you will know before the term is over:

1. the syntax and semantics of propositional logic and first-order logic;
2. how to do natural deduction in both languages;
3. how to translate a fragment of English into each of the languages, and which portions are not susceptible to such translations;
4. how to detect and capture scope and other kinds of ambiguities;
5. how to detect the traditional fallacies using truth-tables;
6. and how to detect many other common but faulty modes of reasoning.

These tools will help you evaluate the evidence and arguments presented to you by your friends, parents, teachers, and everyone else you know. They provide a scaffold, or a guide, for what you should come to believe, given your other beliefs or other claims that you accept.

Texts

Virginia Klenk: *Understanding Symbolic Logic*
Jamie White: *Crimes Against Logic*

Course Requirements

Problem Sets: (50%) You will be assigned six problem sets during the term, consisting of various exercises both from our texts and elsewhere. They are due on the dates listed on the schedule below. Grades for late problem sets decrease one portion of a grade for each day late. (e.g. A to A- for 1 day late, A to B+ for two days late, *etc.*).

Exams: (50%) There will be one midterm exam, worth 20% of your grade, and one final exam during finals period, worth 30% of your grade.

Schedule

Week	**Topics**	**Readings**
Week 1	Reasons, Premises, and Arguments Argument markers and notation Argument Construction Inductive vs. Deductive Arguments Solving LSAT Problems	*Crimes Against Logic*, Ch. 1 Klenk, pp. 1-18
Week 2	Formal vs. Natural Languages Form vs. Content Logical Words and Logical Symbols Syntax of Sentential Logic vs. English Diagrams of Sentences in SL and English Construct your own formal language	Klenk, pp. 22-31 *Crimes Against Logic*, Ch. 2 "Motives" PS1 due
Week 3	Truth-functions Truth-tables Computing truth-values of complex sentences Object Language and Metalanguage	Klenk, Ch. 3
Week 4	Symbolizing English sentences Introduction to Scope Non-truth-functional words	Klenk, Ch. 4 *Crimes Against Logic*, Ch. 3 "Authority" PS2 due
Week 5	Semantics for Sentential Logic Truth-tables Validity of Arguments Sentential Logic Fallacy Detection Can computers detect fallacies?	Klenk, Ch. 5
Week 6	Consistency and Inconsistency Tautologies, Contradictions, Contingencies Implication, Equivalence Intro to Rules of Inference Fallacies with Conditionals	Klenk, Ch. 6 *Crimes Against Logic*, Ch. 4 PS3 due
Week 7	Introduction to Proofs in SL Rules of Inference and their justifications Basic proof methods The notion of soundness	Klenk, Ch. 7 *Crimes Against Logic*, Inconsistency Midterm!!
Week 8	Replacement rules and their justification Ways proofs can go wrong: equivocation Proof Strategies	Klenk, Ch. 8 *Crimes Against Logic*: Equivocation PS4 due

Week 9	Conditional proof Proof by contradiction Deduction Theorem Suppositions in philosophical argument	Klenk, Ch. 9 *Crimes Against Logic*: Begging the Question
Week 10	A richer language: syntax for Predicate Logic Subject vs. Predicate The square of opposition	Klenk, Ch. 10 PS5 due
Week 11	Modern views of quantifiers Variables and Binding Scope revisited	Klenk Ch. 11 *Crimes Against Logic*: Weasel Words
Week 12	Interpretations for Predicate Logic Logical vs. non-logical symbols Sets and models as tools of abstraction	Klenk Ch. 12 PS6 due
Week 13	Relationship between formal and informal Practice reasoning in natural language Predicate Logic Proofs Statistical Fallacies	*Crimes Against Logic*: Shocking Statistics