Introduction to Deductive Logic

Instructor: Erin Gerber
TR 9:40a-10:55a in Kennedy Hall 105
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Texts:

For this course, you will need to have a copy of Logic: Techniques of Formal Reasoning written by Donald Kalish, Richard Montague, and Gary Mar and published by Oxford University Press. There are several editions of this text and any of them will work for this course. Unless otherwise noted, all other reading materials will be made available at the course Canvas page. Please do not distribute these materials without first contacting me.

Course Description:

"If Sally Ride hadn't been the first women in space, then Judith Resnick would have been. But Judith Resnick was not the first women in space— therefore Sally Ride must have been." Is this conclusion true? And, if so, what makes it that way? We often look to the truth or falsity of factual claims in order to determine whether we should take an argument seriously. In this course, however, we will be looking at the relationship *between* the claims in an argument in order to determine if that argument is any good. In order to do this, we will translate ordinary English sentences into symbolic expressions to reveal the logical structures at work in them. And once we have identified these logical structures, we can examine and manipulate them in order to identify arguments which can't be right, and to produce ones which must be.

Course Objectives:

The primary objectives of the Fall 2021 introductory course in deductive logic are:

1. To learn how to symbolize ordinary language arguments using variables, logical connectives, and quantifiers
2. To determine the truth values of complex statements and inference rules using truth tables
3. To put those inference rules into practice in derivations from symbolic premises

Course Requirements:

1. Register for the class on the Cornell Canvas website and check it regularly. All readings should be completed before they are discussed in section.
2. Enable your Cornell email account and check it regularly. Important announcements and updates to the class will be sent to your Cornell email account. Please send any correspondence to my Gmail or Cornell address from your Cornell email account.
3. You are required to attend section regularly. I expect you to participate actively in

class; less extroverted students are welcome to participate in office hours. Attendance and participation will account for 10% of the course grade. Feel free to stop by my office hours even if you do not have a specific question– I will be happy to start talking!

4. Practice problem sets. There will be twelve graded practice problem sets due (roughly) each week of the course. These sets will cover material from the week's reading and lecture, and will be graded for correctness and completion. These assignments will account for 25% of the course grade. The bottom two problem set grades will be dropped from calculation of the final grade.
5. Weekly short quizzes. There will be twelve graded short quizzes given (roughly) each week of the course. These quizzes give students the opportunity to check their own understanding of the material and evaluate their standing in the class prior to the midterm and final. These quizzes will be graded for correctness and account for 25% of the course grade. The bottom two quiz scores will be dropped from calculation of the final grade.
6. Midterm. The students will take an in-class midterm in the tenth week of this course, covering all of the material up to that point. The midterm score will account for 20% of the course grade.
7. Final. The students will take a cumulative final exam during the time period scheduled in the last week of the semester. The final score will account for 20% of the course grade.
8. Class participation can influence the outcome of borderline grades. Please note: late work will be penalized one third of a letter grade for each day (or portion thereof) that they are late. Extensions should be requested at least 24 hours prior to the due date/time, and will be granted highly selectively.

Grading System:

1. Attendance and participation: 10% of course grade.
2. Practice Problem Sets: 25% of course grade.
3. Weekly quizzes: 25% of course grade.
4. Midterm 20% of course grade.
5. Final paper: 20% of course grade.

The grading schema will be as follows:
the grade of "A" is approximately 90% or above;
"B" is approximately 80-89%;
"C" is approximately 70-79%;
"D" is approximately 60-69%;
"F" is below 60%.

Academic Honesty:

"Absolute integrity is expected of every Cornell student in all academic undertakings. Integrity entails a firm adherence to a set of values, and the values most essential to an academic community are grounded on the concept of honesty with respect to the

intellectual efforts of oneself and others. Academic integrity is expected not only in formal coursework situations, but in all University relationships and interactions connected to the educational process, including the use of University resources…

A Cornell student's submission of work for academic credit indicates that the work is the student's own. All outside assistance should be acknowledged, and the student's academic position truthfully reported at all times. In addition, Cornell students have a right to expect academic integrity from each of their peers." For further information, see the complete Code of Academic Integrity (https://theuniversityfaculty.cornell.edu/dean/academic-integrity/code-of-academic-integrity/).

Accommodation of Disabilities:

"Cornell values diversity and inclusion within its campus community and seeks to provide an affirming environment for all its students. Student Disability Services (SDS) provides the opportunity for you to disclose your disability status, as well as to request any needed accommodations or services. You are an important part of Cornell and we are here to support you in your success."

If you have a disability-related need for reasonable academic adjustments in this course, provide the instructor with an accommodation notification letter from Student Disability Services. Cornell SDS can be reached at https://sds.cornell.edu/.

Class Schedule: Introduction to Logic

The following is the planned schedule for the introductory course in Logic. All reading is to be completed prior to the class meeting for which it is assigned. Problem sets will be due on Fridays by 7:00 PM, unless otherwise noted. In-class quizzes will be held on Tuesday mornings at the beginning of class.

Please note that this schedule is provisional and subject to revision as the course progresses.

1. First-Order Logic

Week 1	**Introduction** and the question **What is Logic For?**	
	W.V. Quine (1959). "Introduction". In: *Methods of Logic.* rev. ed. New York: Holt, pp. 1–5	
Week 2	**Formalization**	
	§§1.1 and 1.2: Symbols and sentences and From symbols to English and back in Donald Kalish, Richard Montague, and Gary Mar (1964). *Logic: Techniques of Formal Reasoning.* Oxford: Oxford University Press	Problem Set #1
Week 3	**Logical Connectives**	
	§§2.1 & 2.2: Symbols and sentences and Translation and symbolization in *Logic: Techniques of Formal Reasoning*	Problem Set #2

Week 4	**Truth-Functionality**	Problem Set #3
Week 5	**Truth Tables**	
	§§2.8 & 2.9: Truth-value analysis of sentences and Truth-value analysis of arguments in *Logic: Techniques of Formal Reasoning*	Problem Set #4
Week 6	**First-Order Derivations: Structure and Basic Theorems**	
	§2.3: Inference rules and derivability in *Logic: Techniques of Formal Reasoning*	Problem Set #5
Week 7	**First-Order Derivations: Advanced Theorems**	Problem Set #6
Week 8	**Review for Midterm** & **Midterm**	

2. Second-Order Logic

Week 9	**Quantifiers: Symbolization and Use**	
	§§3.1 & 4.1: Variables, quantifiers, formulas and Terms and formulas in *Logic: Techniques of Formal Reasoning*	Problem Set #7
Week 10	**Nested Quantifiers**	
	§§3.2 & 3.4: Bondage and freedom and Translation and symbolization in *Logic: Techniques of Formal Reasoning*	Problem Set #8
Week 11	**Derivation with Quantifiers**	
	§§3.5 & 3.6: Inference rules and Derivations in *Logic: Techniques of Formal Reasoning*	Problem Set #9
Week 12	**Equivalence & Counting**	
	§§5.1, 5.2, and 5.3: Terms and formulas, Translations and symbolization, and Inference Rules in *Logic: Techniques of Formal Reasoning*	Problem Set #10
Week 13	**Definite Descriptions and Their History**	
	§6.1: Descriptive phrases, terms, formulas in *Logic: Techniques of Formal Reasoning*	
	Peter Hylton (1989). "The Significance of "On Denoting"". In: *Reading Russell*. Ed. by C. Wade Savage and C. Anthony Anderson. Minneapolis: University of Minnesota Press	Problem Set #11
Week 14	**Set Theory: Introductory concepts and terms**	

	§11: Set Theory in Howard DeLong (1970). *A Profile of Mathematical Logic*. Addison-Wesley Publishing Company	Problem Set #12
Week 15	**Russell's Paradox and others**	
	Susan Haack (1976). "The Justification of Deduction". In: *Mind* 85, pp. 112–119	