

Intermediate Logic

CONTACT INFORMATION

cfranks@nd.edu; Malloy 411; M&W 1:30–3pm and by appointment

THIS COURSE

“Intermediate Logic” is the Department of Philosophy’s central course in logic. It is an appropriate course for students with no formal training in logic because it starts from the very beginning. It is also an appropriate course for students who are interested in studying advanced topics in mathematical logic or philosophical logic because it aims to leave one with a solid enough understanding of modern logic to build on immediately in several ways. The nature of logic is that it is possible to be both of these things in a single semester. Undergraduates and graduate students are welcome regardless of their major, department, or background, though the course is specifically designed as a cornerstone of the Philosophy Department’s PhD. program.

APPROACH

Our aim is to become acquainted with modern logic as a philosophically significant cultural phenomenon. We do this by showcasing its central theorems and situating these in their philosophical and historical contexts. This approach is contrary to the trend to think of logic as a tool chest to bring to bear on philosophical problems. If you are interested in that sort of thing, this course will not leave you wanting in technical sophistication and applicability. But our focus is more on an understanding and appreciation of logic itself.

In the first half of the course we study the concept of a formal axiomatic system and the notions of logical completeness it engenders (the criterion of maximality and the correspondence of form and content). We aim to understand the completeness (Bernays, Post, Gödel, Henkin), compactness (Gödel), and cardinality (Cantor, Löwenheim, Skolem) theorems as well as the relationship between completeness and decidability.

In the second half of the course we reformulate logical theory in the sequent-calculus and observe an alternative notion of logical completeness (the coordination of analytic and synthetic reasoning). We aim to understand the cut-elimination (Gentzen), interpolation (Craig), and definability (Beth) theorems.

We consider mostly classical propositional logic and quantification theory, but we will also study intuitionistic logic. By considering what it would mean for intuitionistic logic to be complete in the various senses that classical logic can be seen to be complete, we aim to deepen our understanding of the completeness phenomenon. We will also see how the sequent calculus makes evident that the peculiarities of intuitionistic logic are related to its *substructurality*, and we will begin to understand what this has to do with the separation of the concepts of admissibility and derivability and other remarkable features of intuitionistic logic.

REQUIREMENTS

There is no required text. There are a few books with illustrative exercises that you might want to look at in a library. Two good, elementary ones are Warren Goldfarb's *Deductive Logic* and W. V. O. Quine's *Methods of Logic*, though the latter is notationally obscure. A more advanced book is Richard Grandy's *Advanced Logic for Applications*, and another one is the first chapter of Sam Buss's *Handbook of Proof Theory*. I do not expect you to acquire any of these. Our lectures and discussions, and the periodic handouts of the central results and exercises, should suffice. I expect that we will look at some classical papers by Gödel, Gentzen, and Henkin.

There will be problems and questions circulated approximately weekly. Their main purpose will be to help you understand the main aspects of modern logic that we are exploring—what the theorems really say, how their proofs work, how the different phenomena hook up with one another, etc. Their other purpose will be to allow me to monitor your progress. You may discuss these problems with one another and with me as you work on them. At the end of the semester, there will be a final exam, similar in format to the problems and questions we have considered all term, but geared even more towards explanations of the central phenomena we have studied and less towards problem solving. This will be a “take home exam” that you will have several days to complete, although you won't be allowed to collaborate with one another while you write it.

NOTE

Please be aware of the University's policies regarding academic honesty, anti-discrimination, and access to education for students with disabilities.

Here is the web-page of the office for students with disabilities:

<http://www.nd.edu/~osd/NEWHOME PAGE.htm>

Here is the Philosophy Department's web-page devoted to academic honesty, with links to information about plagiarism and the University's honor code:

<http://philosophy.nd.edu/undergraduate-program/honesty/>

In addition I am someone you can approach if you have concerns about discrimination or proper scholarly behavior, whether or not the concern is related to this course.

IMPORTANT DATES

October 15 no class Hoshana Rabbah