Philosophy 0540
Deductive Logic

Course Site: http://frege.org/phil0540/

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What Is Deductive Logic?

Logic is the study of what makes an inference, in a certain limited sense, 'good', 'valid', or 'correct'. Logic, as the great logician (and founder of modern logic) Gottlob Frege convincingly argued, is not a branch of psychology: It does not concern itself with how people do in fact reason, with what sorts of arguments they find compelling, nor even with whether a given argument in fact shows its conclusion to be true. Logic is, instead, a normative discipline: It is about one important constraint on what it is to reason or argue correctly. Logic is concerned with how people ought to reason, that is, with what rules they ought to follow when they do reason; it concerns itself with whether, if one accepts the assumptions someone is making, one must also (on pain of irrationality) either accept the conclusion for which she is arguing or else give up one of one's assumptions.

One should not, however, expect this to be a course in reasoning or argument. Logic studies the principles of valid argument abstractly: While the course should teach you something about distinguishing valid from invalid arguments—and, like any good course, should teach you something beyond its specific subject-matter, something which will help you with other courses (and in your life after all the courses are over)—this course is not designed to help you write or reason better. What the course will do is introduce you to the fundamental concepts of modern mathemaatical logic.

We shall seek to characterize valid arguments of two different types. In order to do so, however, we shall have to introduce a great deal of special symbolism: We wish to consider, not specific arguments, but kinds of arguments; and we want to see, for example, what is common to the good, or 'valid', arguments "John is at home; so either he is at home or at the zoo" and "Tom is a professor; so he is either a professor or a fireman".

As part of our study of logic, we will develop a 'formal system' in which to prove that various arguments are, indeed, valid. Much of this middle part of the course will be something like a high school geometry class, as we shall be learning to do proofs in this system, just as one learns, in high school, to do proofs in axiomatic geometry.

Finally, we shall turn our attention upon the formal system itself and study it. We shall ask such questions as: Is it possible to prove, in this system, that any given valid argument really is valid? Or are there some valid arguments whose validity can not be demonstrated in this system? Is there some kind of way to decide or to calculate whether an argument is valid?

Course Structure and Requirements

The course will meet Monday, Wednesday, and Friday at 10am, in Wilson 102. Class meetings will consist primarily of lectures. The course website will always contain the most up-to-date information about it. It can be found at http://frege.org/phil0540/.

The text for the course is *Deductive Logic*, by Warren Goldfarb. Copies are available at the Brown bookstore. Students should plan to read the relevant material from the book before each lecture. Lectures will not cover all material for which students will be responsible. There will be a mid-term examination on 9 October and a final examination during the final examination period. There will also be seven problem sets.

Final grades will be determined by a variety of factors.

- The first and most important factor is that *all of the problem sets must be completed and submitted for marking*. We'll let you off once, if you do miss one. But failure to submit all (but one) of the problem sets will *automatically* lead to a grade of NC. It is, quite simply, impossible to learn this material without doing a lot of problems, and students should actually plan to do a lot more problems than are actually assigned. Please note that the requirement is that the problem sets should be "completed", and by that I mean that one has given them a proper effort. Simply turning in a piece of paper with a few random jottings does not count as completing a problem set.

- If you turn in all the problem sets, then it is impossible to do worse in this class than you do on the final exam. That is: If you get an A on the final (and have turned in all the problem sets), you will get an A for the course; if you get a B on the final, you cannot get worse than a B for the course, though you might get an A.

- Effort matters a lot. It is *impossible* to fail this class if you have given it what we regard as proper effort. That would mean such things as coming for help, if you need it, not to mention turning in all the problem sets.

- A presumptive grade will be determined by performance on the two exams, with about twice as much weight being given to the final. Borderline cases will be decided by performance on the problem sets. Exceptionally good or bad performance on the problem sets may move a grade up or down.

Problem sets are due in class on the day specified below. *We will not accept late problem sets*, as late sets make the graders' task much more difficult. On the other hand, you will find that we are quite prepared to grant extensions, so long as they are requested in advance, that is, *at least one day prior to the due-date*. Extensions will not be granted after that time except in very unusual and unfortunate circumstancess.

Because we are so reasonable, exploitation of our reasonableness will be taken badly. Do not make a habit of asking for extensions.

Let me emphasize again something said above. As with any mathematical subject-matter, it is impossible to learn this material without doing a lot of exercises. The book contains many more than are assigned, and students are encourage to do additional exercises to improve their understanding of the material. Students are also encouraged to work on the problems together—though, of course, submitted material should be a student's own work.

I should also emphasize, and will emphasize repeatedly throughout the semester, that, while the course is fairly easy at the beginning, it starts to get more difficult after the mid-term, and it then quickly becomes *very* difficult. The course is cumulative, too, so, if you get behind, it can be very difficult to catch up. It is *absolutely impossible* to learn this material in the two weeks before the final exam, and, if you try to learn it that way, I can pretty much guarantee that you will fail the course. People do fail the course each time it is offered for this very reason. Don't be one of them.

Prerequisites

There are no formal prerequisites for this course. In particular, the course presupposes no college-level mathematical knowledge. However, much of the course is mathematical in content: Some familiarity, experience, and comfort with proofs, such as those in a high-school geometry course, is extremely useful. Anyone uncertain of their background in this area is encouraged to speak with the instructor.

Syllabus

4 September	Introductory Meeting
6 September	Sections 2–5, 7
9 September	Sections 6, 8

End of material covered by Problem Set #1: Due 16 September

11 September	Section 9
13 September	Sections 10–11, 13
16 September	Section 14
18 September	Sections 14–15
20 September	Section 16
23 September	Review Session

End of material covered by Problem Set #2: Due 30 September

25 September	Introduction to Quantification Theory
27 September	Sections 18–19
30 September	Sections 20–22

End of material covered by Mid-term Examination

2 October	Section 23
4 October	Section 24
7 October	Section 27

End of material covered by Problem Set #3: Due 11 October

9 October	Review Session
11 October	Mid-Term Examination

14 October	No Class: Columbus Day Holiday
16 October	Introduction to Polyadic Quantification Theory
18 October	No Class: Instructor Out of Town
21 October	Sections 28–9
23 October	Section 29
25 October	Review Session

End of material covered by Problem Set #4: Due 1 November

28 October	Section 30
30 October	Sections 30–31

1 November	Sections 31–32
4 November	Section 32
6 November	Review Session

End of material covered by Problem Set #5: Due 13 November

8 November	Section 33
11 November	Section 33
13 November	Section 33
15 November	Sections 33–34
18 November	Review Session

End of material covered by Problem Set #6: Due 25 November

20 November	Section 41
22 November	Section 41
25 November	Identity and Number
27 November	Review Session
29 November	No Class: Thanksgiving Holiday
2 December	Section 35
4 December	Section 35
6 December	Review Session

End of material covered on Problem Set #7: Due 13 December

TBA	Review Session for Final Exam
13 December	Final Exam, 2pm

Problem Sets

Problem Set 1	Section IA (pp. 253-5): 1b,e; 2, 3; 4b,d,g,k
Problem Set 2	Section IB (pp. 255-60): 1a; 2a,c; 3a,c; 4a,d; 6; 7b; Section IC (pp. 260-4):2; 3a,c; 5; 7; 11b,d; Extra Problems 1–2
Problem Set 3	Section IIA (pp. 265-7): 1b; 2b; 3b; 4a,f; Section IIB (pp. 267-71): 1a,c; 3a,b,e,f; 5a,c
Problem Set 4	Section IIIA (pp. 273-6): 1a,c,e; 2a,c; 3a,b,c; 5a,b; Extra Problem 3
Problem Set 5	Section IIIB (pp. 276-81): 1b,d; 2a,c,e; Extra Problem 4
Problem Set 6	Section IIIB (pp. 276-81): 4a,b,c; 7; 11; 14; Extra Problem 5
Problem Set 7	Section IV (pp. 284-8): 1b; 2a; 3a; 4b,d Section IIIC (pp. 281-3): 1; 2 For problem (1), you need only do deductions for two versions of the CQ rule; you can choose which to do.