FIL2405/4405 – Philosophical logic and the philosophy of mathematics, Autumn 2016

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Summary

The aim of this course is to give a philosophical introduction to axiomatic set theory. This includes a rigorous introduction to the most common axiomatic set theory, Zermelo-Fraenkel set theory with the axiom of choice (ZFC), based on the textbook *Elements of Set Theory* by Herbert Enderton, from which students will be required to submit weekly exercises. We will also read several articles on philosophical aspects of set theory, such as the conceptual motivations for the axioms of ZFC. Students will write a final essay on a philosophical topic from these and additional readings, and present their essay topic during one of the last two seminars.

Schedule

(See *Syllabus* section below for readings.)

1	26.08.	Enderton, 1–16
2	06.09.*	Enderton, 17–34, 263–267; Maddy 1, 481–487
3	09.09.	Enderton, 35–54; Horsten
4	16.09.	Enderton, 55–65, 167–172; Boolos 1, 13–26
5	20.09.*	Enderton, 66–73, 77–78; Maddy 1, 486; Benacerraf
6	30.09.	Enderton, 74–76, 83–89, 123–127; Maddy 2
7	07.10.	Enderton, 128–144; Boolos 2
8	14.10.	Enderton, 145–155; Maddy 1, 487–489; Potter 250–260
9	21.10.	Enderton, 156–166; Maddy 1, 490–501; Potter 138–140
10	28.10.	Enderton, 172–181; Maddy 1, 489–490; Boolos 1, 26–29
11	04.11.	Enderton, 182–199
12	11.11.	Enderton, 200–208; Maddy 1, 484; Barwise & Moss
13	25.11.	presentations
14	02.12.	presentations

All regular seminars are scheduled on Fridays at 12:15–14:00, and take place in GM Seminarrom 219. The two irregular seminars (marked with *) on 06.09. and 20.09 are scheduled on Tuesdays at 16:15–18:00, and take place in GM Lite seminarrom 141.

Syllabus

We will use the following textbook on set theory:

Enderton: Herbert B. Enderton. *Elements of Set Theory*. San Diego: Academic Press, 1977.

It will be worth investing in a paper copy.

We will also read and discuss the following shorter philosophical texts, which are available in pdf on fronter.

Maddy 1: Penelope Maddy. Believing the Axioms. I. *The Journal of Symbolic Logic* 53, 481–511, 1988.

Horsten: Leon Horsten. Philosophy of Mathematics. *Stanford Encyclopedia of Philosophy*. Stanford, 2012.

Boolos 1: George Boolos. The Iterative Conception of Set. *The Journal of Philosophy* 68, 215–231, 1971.

Benacerraf: Paul Benacerraf. What Numbers Could not Be. *The Philosophical Review* 74, 47–73, 1965.

Maddy 2: Penelope Maddy. Sets and Numbers. *Noûs* 15, 495–511, 1981.

Boolos 2: George Boolos. Gottlob Frege and the Foundations of Arithmetic. In his *Logic, Logic, and Logic*, Cambridge MA: Harvard University Press, 143–154, 1998.

Potter: Michael Potter. *Set Theory and its Philosophy*. Oxford: Oxford University Press, 2004.

Barwise & Moss: Jon Barwise and Larry Moss. Hypersets. *The Mathematical Intelligencer* 13:31–41, 1991.

Weekly Seminars

Before each seminar (except the first and the last two), read the assigned readings, always a section from Enderton and usually some further philosophical texts.

Philosophy courses usually assign 800-1000 pages of material. We will only read 345 pages, since mathematical writing is very dense, and you will have to do exercises to understand the material. So read slowly, and re-read the assigned texts (several times if necessary).

If you are not used to reading mathematics, here is a useful guide:

`https://www.math.uh.edu/~tomforde/MathReadingTips.pdf`

If you are not used to reading philosophy, here is a useful guide:

`http://www.jimpryor.net/teaching/guidelines/reading.html`

Even if you are used to reading mathematics/philosophy, it's worth looking at these guides for ideas about how to get more out of the time you spend with the readings.

In class, we will discuss the most important points from the readings. We will not have time to go through all definitions and proofs from Enderton. One of the most important parts of this course is the time you spend studying this book by yourself. The goal of the seminars is for me to explain those parts of the book that you found difficult to understand when reading on your own, and for us to discuss the philosophical readings together. So I will ask you each time what we should focus on: this is your chance get me to explain what you struggled with on your own. Take it!

You are not formally required to attend the seminars, but I will assume that you will attend most of them. If you don't find them useful, let me know so we can change them to make them useful.

Exercises

At each seminar except the last three, I will assign exercises from the book. You will have to submit at least 9 of these 11 exercises in time to be able to submit the final essay. Exercises are due at 15:00 on the day before the next seminar.

You may work on exercises together. In fact, I encourage you to do so – it's a good way to learn. However, everyone has to write down the answers to exercises *in their own words*.

Completed exercises should be submitted via email as pdfs, written in LaTeX. An introduction can be found here:

`https://en.wikibooks.org/wiki/LaTeX`

You can find a template for exercise solutions on fronter. Once you have installed the necessary programs on your computer (see the section on "Installation" of the wikibook), you can just start modifying the template to write your solutions, and learn LaTeX as you go.

Here is a useful tool for finding commands for symbols:

`http://detexify.kirelabs.org/`

At the start of each seminar, we will discuss some of the exercises. I will usually ask a student to present their solution. This is not a test. Presenting a solution helps you learn the material, and it makes the seminars less dull if it's not just me speaking all the time.

Final Essay and Presentation

At the end of the semester, you will write a final essay. You are free to write on any philosophical topic relating to the course contents. It is a good idea to start thinking early on about what topic you might want to write on; make a note of anything you encounter that might be useful for the essay.

The essay may relate to one of the philosophical texts we will be discussing in class, but it does not have to. There is a folder with further readings on fronter where you can find a number of additional articles that you might find useful. You can also find further materials on your own; see the corresponding section below for some starting points.

Make sure you leave enough time to write your essay, and plan the essay and your writing well in advance. If you have not read it before, read the following guidelines on essay writing:

`http://www.jimpryor.net/teaching/guidelines/writing.html`

(Note that some of the advice is specific to the author's university and courses; e.g., he refers to "Bobst", the NYU library.)

In the last two seminars, everyone will give a short talk in which they present their essay topic. This means that you will have to choose your essay topic by mid November. Depending on the number of students, these presentations will last 5–10 minutes. You should make a handout for your presentation.

Here is a useful general guide for giving philosophy presentations:

`http://www.koksvik.net/talk.php`

We will also set aside some time in class later in the semester to discuss how to write an essay and how to give a presentation.

The final essay should be 8–10 pages long (2300 characters per page, literature list not included). You will only be able to submit the essay if you have:

- given a presentation on the essay topic, and
- submitted at least nine (out of eleven) assignments.

The final essay is to be submitted by 12.12. at 14:00 via fronter. The essays will be graded anonymously, and your essay grade will be your course grade.

Further Materials

We will only go through the first seven chapters of Enderton in class. But I encourage you to read the rest of the book (chapters 8 and 9) on your own after we come to the end of chapter 7. Have a look especially at the first two sections of chapter 8, on transfinite recursion and alephs, and the second section of chapter 9, on natural models.

For information about further books on logic and set theory, the following is a useful study guide:

`http://www.logicmatters.net/tyl/`

See especially sections 1.5 and 3 if you are looking for a book to refresh your memory on predicate logic, and section 4.3 if you are looking for further books on set theory.

For further papers on specific philosophical topics, see philpapers.org, e.g.:

`http://philpapers.org/browse/set-theory`

For a reliable online encyclopedia in philosophy, see:

`http://plato.stanford.edu/index.html`