Department of Philosophy

Phil 220: Symbolic Logic 2 — *Katalin Bimbo*

[Course description — Winter term (2027)]

2-valued first-order logic (FOL, for short) has been thoroughly investigated in the last 150 years or so, and it is a very well-understood logic. FOL gains its importance from its wide applicability and from its place in the landscape of logical calculi and formal languages, and in turn, from the importance of logic in philosophy, mathematics, informatics and in the theory of computing.

Some elements of 2-valued logic are studied in Phil 120, which is a prerequisite for this course. (The prerequisite can be waived upon request in certain cases.) This course is a *quicker* but *more detailed* and *more rigorous* study of some of the same topics that were touched upon in Phil 120, together with *new and more complex questions* and methods from FOL and beyond. For example, in this course, we will look at some first-order theories, which are concrete *applications of* FOL often discussed and referenced in the philosophy of mathematics and in mathematics itself, as well as in analytic philosophy.

The course intends to *develop* and *advance* your understanding of FOL through a study of its building blocks and how they fit together. Some of these components are the truth-functional connectives, the quantifiers, the identity predicate, as well as *proof systems* and *models*. The course will enhance your ability to comprehend and formalize some subtle natural language sentences. During the course, you will have a chance to learn about the first-order *resolution calculus*, which is a proof system for FOL that is widely used in computer applications. Toward the end of the course, we will to take a glimpse at two formal FO-theories, namely, the Dedekind–Peano arithmetic and the Zermelo–Fraenkel axiomatization of set theory.

We will use a textbook that was written by *world-class logicians* who aimed at providing an *excellent text* and *superior tools* for learning logic. The textbook is accompanied by a software package that contains *Boole*, *Fitch* and *Tarski's world*. (A fourth program called *Submit* allows you to get rapid, practically instantaneous feedback on your solutions to most of the exercises.)

1. *Boole* makes it easier and speedier the construction of *truth tables*.
2. *Fitch* implements a so-called Fitch-style natural deduction calculus. Using this program, you can prove FOL theorems and check your proof at each step.
3. Tarski's world allows you to construct a small *model* comprising Platonic solids and then to evaluate sentences. You can vary the model and the sentences, and you can play games with *Tarski's world* to clarify and visualize the truth condition of a sentence in a concrete model.

The programs provide a lot of opportunity for *learning*, *experimentation* and *exploration*.

Time: T, R 11:00 am–12:20 pm

Textbook: Barker-Plummer, D., Barwise, J. and J. Etchemendy, *Language, Proof and Logic*, 2nd ed., CSLI Publications, Stanford, CA, 2011. (required, together with a fresh access code)

For *further information*, please contact the instructor at <bimbo@ualberta.ca>.
The (official) **course outline** will be available in the canvas class during the course.