Philosophy 320: Symbolic Logic II

University of British Columbia, Department of Philosophy
Winter 2013-14
MWF 9:00, Buchanan B315

Instructor	Office	Telephone	E-mail	Office Hours
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Description: This course has two themes: computability and logic. In the first part of the course (chapters 1-8 of our text), we characterize what it means for a function to be *computable*. We develop three different definitions of computability, using Turing machines, abacus machines and recursive functions. This part of the course concludes by demonstrating that all three definitions are equivalent: any function that counts as computable on one of the definitions also counts as computable on the other two as well. This equivalence result provides some support for *Church's Thesis* (which states that all effectively computable functions are recursive functions).

The second part of the course (chapters 9-14) develops some of the main ideas of intermediate logic. For this part, we assume that you have a solid grasp of predicate logic. That is, you should understand truth-functional connectives and quantifiers; you should be able to symbolize English sentences in a formal language; and you should know how to construct proofs in first-order predicate logic. Rather than doing proofs within a system of predicate logic, our principal aim in this course is to prove important facts about our system of predicate logic itself.

We begin this second part with a careful formulation of two essential elements of first-order predicate logic:

- *Syntax*, the language and formation rules for formulas of predicate logic; and
- *Semantics*, the definition of valid (logically true) formulas in terms of *interpretations*.

We develop the notion of interpretations and models for sets of sentences and prove some important facts about models. We then discuss a third essential element of first-order predicate logic:

- *Proof theory*, the definition of valid formulas in terms of *deductions*.

That these two notions of validity coincide is established by the *soundness* and *completeness* theorems of chapters 13 and 14. Chapters 11-14 also demonstrate other important properties of first-order predicate logic, including the *undecidability* of first-order predicate logic (chapter 11), the (downward) *Lowenheim-Skolem Theorem* and the *Compactness Theorem* (chapter 12).

Chapters 1-14 constitute the core course material. If time permits, we shall discuss additional material from later chapters.

Text: G.S. Boolos, J.P. Burgess and R.C. Jeffrey, *Computability and Logic, 5th edition* (Cambridge, 2007). Available in bookstore. (Note: Used copies of 4th edition are almost identical and are fine for the course, but not 3rd edition or earlier.)

Evaluation: Four problem sets (20%); best four of five quizzes (15%); mid-term test (25%); final exam (40%).

Note: Keeping up with the material by reading the text and working through problems is the key to success in this course. This explains the large number of assignments.

Problem sets: You will have at least two weeks for each problem set (which will be distributed and posted on the web page). Working through the problems independently is the best way to learn the course material. I encourage you to try the problems on your own, but if you work with other students please indicate this on your submitted work. Problem sets must be submitted **before or in class on the due date**. Solutions will be posted on the web page.

Quizzes: On many Fridays when there is no problem set due, we will have a short (15-minute) quiz. The quizzes ensure that you keep up with the reading and help you to identify problem areas quickly.

Missed-quiz policy: there will be no make-up quizzes. If you miss a quiz, the next quiz will be counted at double value. Note that a quiz can only be used to make up the grade for the immediately preceding missed quiz (so try not to miss two consecutive quizzes). If you expect to miss the last quiz, please let me know.

Web Page: Copies of all handouts and announcements will be posted on the course web page, faculty.arts.ubc.ca/pbartha/phil320.htm. I will also post solutions on the web page. The web page provides some useful links (including some problem hints by one of the textbook authors).

Pre-requisites and Preparation: The pre-requisite for the course is Phil 220, or equivalent background in logic. You should feel comfortable with a mathematical style of lecturing and a mathematical style of problem-solving. If you have any doubts, please see me.

Important: The concepts and problems in Phil 320 are *significantly harder* than in Phil 220. We move at a fast pace. My lectures cannot cover every detail or work through as many examples as I might wish to do. You must be able to learn the material **independently** through reading and solving problems, using the lectures (and handouts) as a basis. I suggest that you read the material before it is covered in the lectures, and then return to the text for a more thorough examination afterwards. You may need multiple readings to grasp these ideas.

Tentative Schedule of Readings and Assignments

Week of	Chapters covered
Jan. 6	1-2
Jan. 13	2-3; **Quiz 1**: ch. 1 (Jan. 17)
Jan. 20	3-4; **Quiz 2**: ch. 2 (Jan. 24)
Jan. 27	4-5; **PS #1**: ch. 1-4 (Jan. 31)
Feb. 3	6-7 (only **§**7.1); **Quiz 3**: ch. 5 (Feb. 7)
Feb. 10	7 (only **§**7.1)-8 (only **§**8.1 and **§**8.2) **No class Feb. 10 (Family Day)**
Feb. 17	**Mid-term break**
Feb. 24	9; **PS #2**: ch. 5-8 (Feb. 28)
Mar. 3	10; **Mid-term test: chapters 1-8** (Mar. 7)
Mar. 10	11-12; **Quiz 4**: ch. 9-10 (Mar. 14)
Mar. 17	12; **PS #3**: ch. 9-11 (Mar. 21)
Mar. 24	13
Mar. 31	13-14 (only **§**14.1 and **§**14.2); **Quiz 5**: ch. 12 (Apr. 4)
Apr. 7	14 and Review; **PS #4**: ch. 12-14 (Apr. 11 – mailbox in Buch E370) **Last day of class Apr. 7**