



Department of Philosophy

PHIL 2110-01
“Elementary Symbolic Logic”
Fall 2004
MWF 10:30–11:20, MacKinnon 121

COURSE OUTLINE

Please read this outline carefully and retain it for future reference.

Instructor: Andrew Bailey

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Office hours: Wednesday 9:30–10:20, Friday 11:30–12:30, or by appointment.

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SLG Leader: Eric Seaman

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Course prerequisites: 5.00 credits or one of PHIL*1000, PHIL*1010, PHIL*1050.

COURSE DESCRIPTION:

This course is an introduction to first-order logic. The syntax and semantics of some first-order languages (up to and including predicate logic with identity), tests of validity, and proofs of the correctness and completeness of these tests will be presented in class. Some of the philosophical applications of this material will also be considered.

Our primary objectives are to:

- develop some basic—but very important—logical skills, especially the practical ability to translate English arguments into symbolic logic and assess their validity;
- appreciate some components of the methods of proof used by logicians, such as arguing axiomatically from definitions; and to
- explore a few of the important implications of the logical results we will encounter (such as the undecidability of first-order logic with multiple quantification).

First-order logic with identity is the fundamental building block for all symbolic logic, and is powerful enough to deal with a wide range of arguments in philosophy, science, politics and everyday life. An understanding of symbolic logic is a prerequisite for many areas of study in analytic philosophy, and it is also important in (for example) computer science, mathematics and linguistics.

The study of logic is, by its nature, cumulative: for most people, it is extremely important to work steadily at the material throughout the semester, and to make sure that each building block is thoroughly understood before moving on to the next one. The best way to do this is to *practice* your skills until you are confident in them. Our textbook includes lots of exercises for you to practice on in addition to the assignments I will give you throughout the term. I strongly recommend that you form study groups with your classmates to work through this material.

Many people really enjoy their first exposure to symbolic logic, and you may find the experience of successfully doing logic problems highly satisfying. Other students feel intimidated by symbolization and struggle at first, but then find their feet and start enjoying themselves—so if this is you at first, don't despair! Finally, a third group of students find the initial material quite easy but are lulled into a false sense of security and underestimate the effort needed to understand the move from propositional to predicate logic. *If at any point in the course you feel yourself unsure of the material we are covering, please come and see me so that I can take you through the essential points again and help you with some extra practice.*

REQUIRED TEXTS:

- Bergmann, Moor and Nelson, *The Logic Book*, 4th edition, McGraw-Hill 2004 (ISBN: 0-07-240189-3).

There is also free accompanying software called *Bertie3* to help you practice logic exercises; this DOS program can be downloaded from www.ucc.uconn.edu/~wwwphil/software.html.

EVALUATION:

- Six take-home assignments, each worth 5% of the final grade. The *provisional* due dates for these can be found on the course schedule, page 5 of this outline; assignments will be handed out—and made available on the course website—about a week before they are due.
- An in-class mid-term exam worth 25% of the final grade. It will be held on **Friday, October 22nd**.
- A final exam, worth 45% of the final grade. This is scheduled to take place on **Thursday, December 9th**, from **8:30 to 10:30 AM**.

You do not need to pass all of the assignments or exams in order to pass the course, but students who do not sit the final exam and submit at least two assignments will be graded as “Incomplete.”

The assignments and examinations will involve two types of questions: those which test the depth of your knowledge of logical concepts, and those which pose logic problems. Logic problems, in turn, come in two basic flavours: they either assess your ability to translate English into a logical language (or vice versa), or your ability to test sets of symbolic sentences for important logical properties, such as consistency or validity.

The assignments and exams will be graded using standards described in Section VIII of the Undergraduate Calendar (http://production.web.uoguelph.ca/undergrad_calendar/co8/co8-grds-proc.shtml). Information on Academic Consideration and Appeals appears in the same section.

SUPPORTED LEARNING GROUPS (SLGS):

SLGs are regularly scheduled small group study sessions. Attendance is voluntary and open to all students enrolled in the course. The study groups are facilitated by successful senior undergraduate students who have recently taken this or similar courses. SLG Leaders attend all lectures, complete course readings and take notes. They work with faculty and staff to create

study activities that integrate course content with effective approaches to learning. Students who attend SLG sessions have an opportunity to apply and demonstrate their understanding of course concepts in a safe practice environment. These sessions have proven very helpful for students. The session times and locations for our SLGs will be announced during the first class meetings. For more information about the SLG program in general you can consult www.learningcommons.uoguelph.ca/SLG/.

E-MAIL COMMUNICATION:

As per university regulations, all students are required to check their <uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the university and its students.

WHEN YOU CANNOT MEET A COURSE REQUIREMENT:

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons, please advise the course instructor [or designated person] in writing, with your name, ID number, and e-mail contact. Where possible, this should be done in advance of the missed work or event, but otherwise, just as soon as possible after the due date, and certainly no longer than one week later. Note: if appropriate documentation of your inability to meet that in-course requirement is necessary, the course instructor, or delegate, will request it of you. Such documentation will rarely be required for course components representing less than 10% of the course grade. Such documentation will be required, however, for Academic Consideration for missed end-of-term work and/or missed final examinations. See the undergraduate calendar for information on regulations and procedures for Academic Consideration (http://www.uoguelph.ca/undergrad_calendar/co8/co8-ac.shtml).

My policy for late assignments in this course is the following: Unless I have granted an extension, late assignments will be penalized 5% for every day they are late. If students come and see me *before* the assignment is late, and if they have a good reason for their lateness, I will often grant deadline extensions of two or three days—but only a couple of times a term per student. Assignments handed in late without an adequate excuse will usually be given a grade of 0%. Answers to the assignments will be posted on the course website a week after their due date, so no student can be granted an extension of more than seven days except in very exceptional circumstances.

DROP DATE

The last date to drop one-semester Fall 2004 courses, without academic penalty, is Monday November 8th. For regulations and procedures for Dropping Courses, see the Undergraduate Calendar (http://www.uoguelph.ca/undergrad_calendar/co8/co8-drop.shtml).

COPIES OF OUT-OF-CLASS ASSIGNMENTS

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

ACADEMIC MISCONDUCT

The University of Guelph is committed to upholding the highest standards of academic integrity and enjoins all members of the University community—faculty, staff, and students—to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic

offences from occurring. The University of Guelph takes a serious view of academic misconduct, and it is your responsibility as a student to be aware of and to abide by the University's policy. Included in the definition of academic misconduct are such activities as cheating on examinations, plagiarism, misrepresentation, and submitting the same material in two different courses without written permission from the relevant instructors. To better understand your responsibilities, read the Undergraduate Calendar. (http://www.uoguelph.ca/undergrad_calendar/co1/index.shtml) for a statement of Students' Academic Responsibilities; also read the full Academic Misconduct Policy (http://www.uoguelph.ca/undergrad_calendar/co8/co8-amisconduct.shtml). You are also advised to make use of the resources available through the Learning Commons (<http://www.learningcommons.uoguelph.ca/>) and to discuss any questions you may have with your course instructor, TA, or academic counsellor.

Instructors have the right to use software to aid in the detection of plagiarism or copying and to examine students orally on submitted work. For students found guilty of academic misconduct, serious penalties, up to and including suspension or expulsion, can be imposed. Hurried or careless submission of work does not exonerate students of responsibility for ensuring the academic integrity of their work. Similarly, students who find themselves unable to meet course requirements by the deadlines or criteria expected because of medical, psychological or compassionate circumstances should review the university's regulations and procedures for Academic Consideration in the calendar (http://www.uoguelph.ca/undergrad_calendar/co8/co8-ac.shtml) and discuss their situation with the instructor and/or the program counsellor or other academic counsellor as appropriate.

STUDENTS REQUIRING ADDITIONAL SUPPORT:

Resources are available to you if you require additional support in the course (e.g. if you have a learning disability or are dealing with other issues that are impacting on your ability to meet the course requirements). I encourage you to come and discuss this with me, and to contact the appropriate university resource. The Centre for Students with Disabilities (which includes learning disabilities) is on Level 3 of the University Centre (www.counselling.uoguelph.ca/csd/), as is Counselling Services (www.counselling.uoguelph.ca/counselling/).

OTHER INFORMATION:

The best resource for general academic counselling (e.g. about degree requirements, or for approval to add/drop a course) is your program counsellor: these are listed in Section VII of the Undergraduate Calendar (http://www.uoguelph.ca/undergrad_calendar/co7/-sec_doe5753.shtml). The Philosophy Department's academic advisor for undergraduates is Prof. Peter Eardley, extension 53211, peardley@uoguelph.ca.

PROVISIONAL Class Schedule, PHIL 2110, Fall 2004

MONDAY	WEDNESDAY	FRIDAY
Sep. 13 th : SL Syntax Chap. 2	Sep. 15 th : SL Symbolization Chap. 2	Sep. 17 th : SL Symbolization Chap. 3
Sep. 20 th : SL Semantics Chap. 3	Sep. 22 nd : SL Semantics Chap. 3	Sep. 24 th : Definitions Chaps. 1 and 3
Sep. 27 th : Definitions Chaps. 1 and 3	Sep. 29 th : Natural Deduction: SD Chap. 5	Oct. 1 st : Natural Deduction: SD Chap. 5 FIRST ASSIGNMENT DUE
Oct. 4 th : Natural Deduction: SD Chap. 5	Oct. 6 th : Natural Deduction: SD+ Chap. 5	Oct. 8 th : Natural Deduction: SD+* SECOND ASSIGNMENT DUE
Oct. 11 th : Thanksgiving: NO CLASS	Oct. 13 th : Expressive Completeness Chap. 6	Oct. 15 th : Expressive Completeness Chap. 6 THIRD ASSIGNMENT DUE
Oct. 18 th : SL Metatheory Chap. 6	Oct. 20 th : Exam Review	Oct. 22 nd : EXAM
Oct. 25 th : PL Syntax Chap. 7	Oct. 27 th : PL Symbolization Chap. 7	Oct. 29 th : PL Symbolization Chap. 7
Nov. 1 st : PL Semantics Chap. 8	Nov. 3 rd : PL Semantics Chap. 8	Nov. 5 th : PL Semantics Chap. 8
Nov. 8 th : Natural Deduction: PD Chap. 10 <i>[Last day to drop]</i>	Nov. 10 th : Natural Deduction: PD Chap. 10	Nov. 12 th : Natural Deduction: PD Chap. 10 FOURTH ASSIGNMENT DUE
Nov. 15 th : Natural Deduction: PD+* Chap. 10	Nov. 17 th : PLE Syntax* Chap. 7	Nov. 19 th : PLE Semantics Chap. 8 FIFTH ASSIGNMENT DUE
Nov. 22 nd : PLE Semantics Chap. 8	Nov. 24 th : Numbers Chap. 7	Nov. 26 th : Definite Descriptions Chap. 7 SIXTH ASSIGNMENT DUE
Nov. 29 th : Natural Deduction: PDE Chap. 10	Dec. 1 st : Predicate Metatheory Chap. 11	Dec. 3 rd : Last Class!

Date of Final Exam: December 9th, 8:30–10:30.

[Classes marked with an asterisk (*) are those where I presently have a commitment to be out of town on those dates. Arrangements for these classes will be announced ahead of time.]

SOME CRUCIAL DEFINITIONS

A: SEMANTIC

1. LOGICAL CONSEQUENCE. Some sentence p is a logical consequence of a set of sentences Γ iff (if and only if) there is no possible interpretation which makes every sentence in Γ true and p false. (This is often written $\Gamma \models p$, and our text calls it “truth-functional entailment.”) Where Γ contains only a single sentence, the relation is sometimes called LOGICAL IMPLICATION.
2. TRUTH-FUNCTIONAL VALIDITY. An argument is truth-functionally valid iff there is no interpretation which makes all the premises true and the conclusion false. In cases where an argument contains *just one sentence* (i.e. for single sentences), the sentence is considered a conclusion and thus is valid iff there is no possible interpretation which makes the sentence false. (If a single sentence is valid, this can be written $\models p$. Our text calls this “logical truth.”) If an argument or sentence is not valid it is called INVALID.
3. SATISFIABILITY. A set of sentences Γ is satisfiable iff there is some interpretation on which all the sentences in Γ are true together. (This is often written $\text{Sat } \Gamma$.) Otherwise Γ is UNSATISFIABLE. Note that a set may have any number of members, including zero or one. Sometimes the term “truth-functional consistency” is used (as in our text—see p. 98), and sometimes unsatisfiable sets are labelled “inconsistent”; for an unsatisfiable set of one sentence our text uses the term “logically false.”
4. LOGICAL EQUIVALENCE. Two or more sentences are logically equivalent iff they are true in exactly the same interpretations in which all their atomic sentence letters are interpreted. (This is often written $p \simeq q$.)

B: SYNTACTIC

1. ARGUMENT. A structured, finite set of at least one sentence.
2. DEDUCIBILITY. P is deducible from Γ iff p can be derived from Γ using only a specified set of syntactic rules of inference. (This is often written $\Gamma \vdash p$. Such a derivation is often called a “deduction,” and our text calls this property “derivability.”)
3. THEOREMHOOD. Some sentence p is a theorem iff it is deducible from the empty (or “null”) set; i.e. $\emptyset \vdash p$. (This is often written $\vdash p$.)
4. CONSISTENCY. A set of sentences Γ is consistent iff there is no sentence p such that both $\Gamma \vdash p$ and $\Gamma \vdash \sim p$. (This is often written $\text{Con } \Gamma$.) If Γ is not consistent, then it is inconsistent.
5. DEDUCTIVE EQUIVALENCE. Two sentences p and q are deductively equivalent iff $p \vdash q$ and $q \vdash p$. (This is often written $p \sim q$.)