FACULTY OF ARTS
DEPARTMENT OF PHILOSOPHY

PHIL 279 Lec 02/03 — "Logic I"

Fall Term 2010

Course Outline

Meetings:	**Lectures**	**Tutorials**	
L02:	MW 3–4:15	Th 4:30–5:20 (T04)	Math Sciences 205
	Education Block 388	F 12–12:50 (T05)	Science Theatres 61
		F 1–1:50 (T06)	Education Tower 920
L03:	MW 5–6:15	Th 4:30–5:20 (T07)	Engineering F 334
	Education Block 388	F 12–12:50 (T08)	Science Theatres 55
		F 1–1:50 (T09)	Science Theatres 61
		After the second week of classes, tutorials will meet concurrenty in one classroom and in the Arts Computer Lab, SS 018	

	Instructor	Teaching Assistants	
	Richard Zach	**Kimberly Brumble**	**Teppei Hayashi**
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Office Hours:	MW 2:00–2:45	W 12–2	Th 2–4

or by appointment. Office hours subject to change;
check BlackBoard for change notices.

Course Description

The course will introduce you to the semantics and proof-theory of first-order logic. We will learn how to "speak" the language of FOL, study the method of truth tables, become proficient in giving formal and informal proofs, and learn how to construct and argue about first-order interpretations. These methods will enable us to answer, in particular cases, the questions that logic is primarily concerned with: When does something follow from something else? What are logical truths? Which arguments are logically valid? We will also look at some results and notions which are important for the applications of formal logic, such as normal forms and expressive power of propositional and first-order logic, and prove, in outline, some important theorems relating semantics and proof theory (soundness, completeness). We will touch on some applications of logic to philosophy, mathematics, and computer science.

Evaluation

6 homework assignments, a midterm exam (on November 3, in class), a Registrar-scheduled final exam (2 hours, closed book), and participation in lecture, tutorial, and in discussions on BlackBoard. The lowest homework score will be dropped, the remaining 5 assignments each count 10% towards the final grade. The midterm counts 20%, the final 25%, and class participation counts 5%. You must hand in all 6 assignments, and you must take the midterm and final exams to pass the course. You must receive a D or better on the final exam to receive a D or better in the course.

Each assignment will be assigned a raw point score, which is then normalized to a score out of 100 points. The final score is then computed according to the percentages given above. The following table will be used to convert the final score to letter grades (the ranges include the lower score and exclude the upper, e.g., 83 earns a B, not a B–):

98–100	A+	87–90	B+	77–80	C+	67–70	D+
93–98	A	83–87	B	73–77	C	60–67	D
90–93	A–	80–83	B–	70–73	C–	< 60	F

The grades will not be curved.

Textbook and Software

Jon Barwise and John Etchemendy, *Language, Proof and Logic*, CSLI/Chicago University Press

The Grade Grinder. The text comes with a CD and a non-transferable use license for software (the "Grade Grinder") which you will be using to prepare your homework assignments. For this reason, **you have to buy a *new* copy of the text**. On the CD you find a registration ID. ***Write this ID down in a safe place***—without it, you will not be able to turn in your assignments.

Contents of Software CD. The software CD that comes with the text contains three programs (*Tarski's World*, *Boole*, and *Fitch*) which you will use to complete homework problems. The program *Submit* lets you turn in your completed solutions to the Grade Grinder. The CD also contains the entire textbook in PDF format. ***Please take the time to read the software manual.*** It contains useful information, in particular, keyboard shortcuts for logical symbols, which will make typing formulas much easier.

Because the text is bundled with software, the book cannot be returned once the seal is broken. But LPL software and textbook are available on the computers in the Arts Faculty Computer Lab (AFCL) in the basement of Social Sciences (018 SS), and you can use the software and read the textbook there before buying a copy (or breaking the shrink-wrap). You do have to buy a new copy of the book in order to submit your homework assignments.

LPL Website. The LPL team maintains a website with helpful information. Check it out at lpl.stanford.edu.

Among other things, the website contains hints and solutions to selected exercises, and a download area where you can obtain the contents of the CD with your registration ID. Thus, if you lose your CD, you will still have access to the software.

Assignments and Policies

Exercise sets will in general be due on Fridays at 4 pm. Written parts of the assignment should be dropped off in a box just inside the Philosophy Department (Social Sciences, 12th floor), electronic parts have to be turned in using Submit (one of the four programs in LPL). The written parts of the assignments must be submitted on paper; emailed copies will in general not be accepted.

Your TAs are in charge of the homework marking; please pick up your marked assignments during tutorial or in office hours from them.

Late work and extensions. The lowest homework score is dropped, this allows you to hand in one assignment late without penalty. Therefore, ***late assignments will not be accepted for credit and will not be marked***. However, ***you have to turn in each of the six assignments within one week of the due date to pass the class***.

There will be no make-up midterm exams under normal circumstances; for the final exam, university policies for deferral of exams apply.

Collaboration. Collaboration on exercises is encouraged. However, you must write up your own solutions. This means that for the electronic parts, ***you must create solution files completely from scratch.*** The LPL software can tell if you've copied someone else's exercise files. You are also required to list the names of the students with whom you've collaborated on the assignment. ***If the Grade Grinder flags an exercise on your assignment as not being created independently (i.e., it is "similar" or "identical" to another student's), your assignment and those of whoever you received the file from or gave the file to will receive a score of 0.***

You're not allowed to collaborate on the midterm and final exams, of course. Midterm and final will be closed-book. Be aware that cheating on an exam is a serious academic offense and can result in suspension or expulsion.

Participation. 5% of your grade will be determined by class participation. This includes participation in discussions on the class website. Five serious posts on the website (asking a question, giving a hint, providing an answer to someone else's question) over the course of the term will earn you full marks (5 points) for the participation part of your final grade. Only posts made before the time of the final exam count. If all your posts occur within one 7-day period, you will receive a maximum of 3 points. Consistent participation in class discussions during lecture or tutorials of course also counts.

Attendance. Some students find the material relatively easy to pick up on their own, and the software makes self-directed study particularly easy. Note, however, that only very good students can get away with that. Many students who don't attend lecture or tutorial just end up failing the class; thus, although attendance in lecture and tutorial is not mandatory,

it is highly encouraged. Although, generally, studying the textbook and class handouts is sufficient for completing the homework assignments and passign the exams, you are nevertheless responsible for knowing what is covered in lecture and tutorial. Conversely, you are also responsible for studying the assigned chapters in the textbook.

Tutorials and Lab Workshops

This class is accompanied by scheduled tutorials. Tutorials are led by the Teaching Assistants, who guide you through the material in a more in-depth manner than is possible in lecture. This is where you should go to pick up tips for the assignments, ask questions, and go over problems in detail.

Tutorials begin in the second week of classes. Starting the third week of classes, you will have a choice between a regular classroom tutorial led by a TA, and a workshop in the AFCL (SS 018), supervised by a TA. In the classroom tutorial, the TA will lead the discussion, review material from lecture, go over problems for the homework assignment. In the workshop, you will be able to work on the assignments in small groups, directly on the computer, and with a TA present who can help and explain things.

Course Website

A course website on U of C's BlackBoard server has been set up. You should be automatically registered on the first day of class if you're registered in the class. To access the BlackBoard site, you can either go directly to blackboard.ucalgary.ca and log in with your UCIT account name and password, or you can access it through the myUofC portal at my.ucalgary.ca. If you don't have an eID or IT account, see www.ucalgary.ca/it/gettingstarted/student. ***Please log on at least once by the end of the second week of classes.***

If you are not registered in the course on the first day of class, you will be added to the website within a day of registering.

We will use the email function on BlackBoard to send out important notices. Therefore, ***please make sure your email address in BlackBoard is current.*** For instructions on how to update your email address, see elearn.ucalgary.ca/blackboard/email.

What You Have to Do Now

1. Attend lecture and tutorial the first two weeks of classes (tutorial starts the second week).
2. Buy the textbook (remember, you need a new copy) or go to the Arts Faculty Computer Lab to view an electronic copy.
3. Make sure your email address is current on the myUofC portal.
4. Log on to the class website and familiarize yourself with the discussion board.
5. If you register your email address with *Submit*, make sure you choose an email address which will be working throughout the semester.

Three Most Frequently Asked Questions

This is a philosophy course at an introductory level. So it's really easy, right?

No. This is a course in formal logic. Some people find the material easy. Some people find the material very hard. In terms of work required and "feel" it is much more like a math course than a philosophy course. You don't need to know (much) math to do well here, but you do need a certain ability to think in abstract terms.

The average grade is about a C+/B–. In any given term, roughly 25% of registered students end up getting A-range grades; 25% between B– and B+; 20% between C– and C+; 5% a D or D+; 5% of those taking the final exam got F's; and about 20% withdraw. If you're worried that only science majors do well here: Some of the top students in previous classes majored in fine art, religious studies, philosophy, and management.

So how much work does it require?

It is not unusual for students to spend 10–15 hours on an assignment (including studying the material in the notes and reading the textbook). It takes less time if you keep on top of the reading and do the assignments as we cover the material in class. Some students aren't very good at budgeting time and leave assignments to a day before the due date. Then it certainly will take a lot of time, and it will be difficult to complete the assignment.

10–15 hours per assignment isn't that much on average. With six assignments, this works out to about 5–7 hours a week, or about 2 hours per hour spent in class. The rule of thumb for class work in North American universities is 2–3 hours of work outside of class for every hour in class.

What's with the grade scale? 60 points for a D, 93 for an A! That's harsh!

First of all, the scores assigned to the problem sets and exams are *not* percentages. The point values of individual problems and the conversion scale are designed to produce approximately the "right" marks. 80 points on a test does not mean that you got 80% of the answers right.

In many courses (including other sections of PHIL 279/377) the grade scale is set so that 50 is a D, and sometimes anything over 90 is an A. In those other courses, however, it is much harder to attain these scores. In this course, our assignments count for 50% of the final grade, in others it is usually much less. It is easier in general to score well on homework assignments: there is no time pressure, you have textbook and notes available, and you can talk to the instructors about the problems. In this course, in addition, you are encouraged to collaborate with your colleagues, and the final score is the average of your five best assignments (lowest score dropped). Also, since about 75% of the problems are done on the computer, you can have the computer check your solutions before you submit them. Thus, for 75% of your assignments, there is almost no reason other than lack of time for you not to get a perfect score. In addition, 5% of your grade consists in participation (in class, on the website). That is another 5% which are (almost) "free."

So, the grade scale, although it "looks" harsh, is in fact just as harsh (or lenient) as in other courses. Experience shows that the grade scale, as it stands, results in a perfectly average

grade distribution, and the final letter grades students receive on the whole correspond closely to the definitions of those letter grades in the University Calendar.

More questions and answers at www.ucalgary.ca/ rzach/279/faq.html.

Syllabus

This is a tentative syllabus to give you a rough idea what parts of the book we will cover when. The assignment and midterm dates are firm, however.

Week 1

Introduction (Sept 11)

Course aims, requirements and policies. History and relevance of formal logic. Syntax of FOL.

The Language of FOL (Sept 13); Chapter 1.

Learning goals: Understanding formal first-order languages. Syntax of FOL: Predicate symbols, individual constants, function symbols. Examples of first-order languages: the blocks language, the language of arithmetic.

Week 2

The Logic of Atomic Sentences (Sept 20); Chapter 2.

Learning goals: Understanding logical validity of arguments. How to show arguments are valid: Basic properties of the identity predicate: reflexivity, principle of the substitutability of identicals. Basic properties of other predicate symbols (transitivity, reflexivity, symmetry, inverse relations). Informal proofs. Fitch and formal proofs. How to show that arguments are not valid: the method of counterexamples.

Introduction to the Boolean Connectives (Sept 22); Chapter 3.

Learning goals: Syntax and semantics of Boolean connectives: Formation rules for sentences of FOL using $\wedge$, $\vee$, $\neg$. Truth tables for the Boolean connectives.

Tutorials start Thursday, September 23, and cover Chapters 1–3

Week 3

The Boolean Connectives and Expressive Power of FOL (Sept 27); Chapter 3.

Translating sentences from English into FOL using the Boolean connectives. Expressive power of the Boolean connectives: "neither ... nor —" and "not both ... and —"; how to express complicated things using the blocks language and the Boolean connectives.

The Logic of Boolean Connectives (Sept 29): Chapter 4.

Learning goals: Understanding logical truth, tautologies, and TW-necessities. Tautological equivalence, consequence, and validity. The method of truth tables.

You must complete the "You try it" exercise on pp. 8–10 of the text and submit "World Submit Me 1" by Tuesday, Sept 28, midnight.

Tutorial covers Chapters 3, 4.
Assignment 1 due Friday, October 1, at 4 pm (covers Ch. 1–3)

Week 4

Chains of Equivalences and Normal Forms (Oct 4): Chapter 4.

Learning goals: Tautological equivalences: De Morgan's Laws and other equivalent transformations. Proving tautological equivalence by a chain of equivalences. Negation, conjunctive and disjunctive normal forms.

Introduction to Informal and Formal Proofs (Oct 6): Chapters 5, 6.

Learning goals: Proving arguments valid by informal and formal proofs. Basic properties of $\wedge$ and $\vee$. Formal rules for $\wedge$ and $\vee$.

Tutorials cover Chapter 4, 5.

Week 5

Proofs for the Boolean Connectives (Oct 13): Chapter 6

Learning goals: Proof by cases ($\vee$Elim). Basic properties of $\neg$. Indirect proof and formal proofs with $\neg$.

Thanksgiving Monday Oct 11.
Tutorial covers Chapters 5, 6 (informal and formal proofs).

Week 6

Proofs for the Boolean Connectives (Oct 18): Chapter 6

Learning goals: Arguments with inconsistent premises. Informal proofs about FOL. Formal proofs of tautologies. Strategies for formal proofs.

The Conditionals (Oct 20): Chapter 7 and 8.

Learning goals: Truth tables for $\rightarrow$ and $\leftrightarrow$. Translations from English to FOL using the conditionals. Conversational implicature. Rules for formal proofs involving $\rightarrow$ and $\leftrightarrow$. The semantic deduction theorem.

Tutorial covers Chapters 5 and 6 (strategies, indirect proof).
Assignment 2 due Oct 22 (covers Ch. 4–5, parts of 6)

Week 7

Truth-functional Completeness (Oct 25): Section 7.4.

Learning goals: Understanding the aims of meta-theory. Definition and proof of truth-functional completeness for $\wedge$, $\vee$, and $\neg$. Truth-functional completeness of "neither . . . nor".

Introduction to Quantifiers (Oct 27): Chapter 9

Learning goals: Understanding syntax and semantics of quantifiers: well-formed formulas, free and bound variables, satisfaction. The Aristotelian forms. Simple translations.

Tutorials covers Chapters 6–8 (formal proofs including the conditionals, truth-functional completeness).
Assignment 3 due Oct 27 (covers Ch. 6–8, except 7.4)

Week 8

Single Quantifiers (Nov 1): Chapter 9

Learning goals: The Aristotelian forms. Expressing simple sentences involving no nested quantifiers.

Midterm exam in class, Wednesday Nov 3

Tutorial covers Chapter 9.

Week 9

First-order Validity and Consequence (Nov 8): Sections 10.1, 10.2.

Learning goals: The truth-functional form algorithm: when are sentences of FOL tautologies? The replacement method. First-order interpretations. First-order validity and consequence.

First-order Interpretations (Nov 10): Chapter 10.

Learning goals: Constructing first-order interpretations. Using Venn diagrams to specify interpretations. Relations between logical notions.

Reading days Nov 11–15. No tutorials.

Week 10

Multiple Quantification (Nov 15): Chapter 11

Learning goals: Meaning and use of multiple occurrences of the same quantifier. Translation mistakes: different variables does not mean different objects. Meaning and use of mixed quantifiers. The step-by-step method of translation. Understanding why the order of quantifiers matters, ambiguity. Expressing complicated properties using quantifiers, in particular in the language of arithmetic.

Anaphora and Ambiguity (Nov 17): Section 11.4, 11.5

Learning goals: Understanding and translating anaphora. Recognizing ambiguity and translating ambiguous sentences.

Tutorial covers Chapters 10 and 11.
Assignment 4 due Nov 19 (covers Ch. 7.4, 9–10)

Week 11

Quantifier Equivalences and Prenex Normal Form (Nov 22): Section 10.3, 11.7.

Learning goals: Understanding FO equivalence of WFF's, DeMorgan's Laws for the quantifiers, other equivalences. Pulling quantifiers to the front of a sentence.

Formal Proofs with Quantifiers (Nov 24): Chapter 13

Learning goals: Understanding and applying the introduction and elimination rules for $\forall$, $\exists$. Strategies for proofs with quantifiers.

Tutorial covers Chapters 10 and 11.
Assignment 5 due Nov 24 (covers Ch. 10–11)

Week 12

Advanced Formal Proofs with Quantifiers (Nov 29): Chapter 13

Learning goals: Proofs with multiple and mixed quantifiers. Proofs with equality.

Numerical Quantification and Definite Descriptions (Dec 1): Sec. 14.1, 14.3

Learning goals: Understanding numerical quantification: how to express 'there are exactly/at most/at least n things of a certain kind.' Russell's and Strawson's analyses of definite descriptions. How to express 'both' and 'neither' in FOL.

Tutorial covers Chapter 13.

Week 13

Basic Metatheory (Dec 6): Section 8.3

Learning goals: Understanding the significance of soundness and completeness. Sketch of a soundness proof.

Outlook, Review (Dec 8)

Learning goals: Understanding the 'big picture.' Significance and application of logic. Limitations of logic: undecidability, incompleteness.

Tutorial covers Chapters 13, 14.
Assignment 6 due Dec 10 (covers Ch. 13, Sec. 14.1–2, Sec. 8.3)

INTELLECTUAL HONESTY

Intellectual honesty is the cornerstone of the development and acquisition of knowledge and requires that the contribution of others be acknowledged. As a result, cheating or plagiarism on any assignment or examination is regarded as **an extremely serious academic offence,** the penalty for which may be an F on the assignment and possibly also an F in the course, academic probation, or requirement to withdraw. The University Calendar states that plagiarism exists when:

- the work submitted or presented was done, in whole or in part, by an individual other than the one submitting or presenting the work (this includes having another impersonate the student or otherwise substituting the work of another for one's own in an examination or test);
- parts of the work are taken from another source without reference to the original author;
- the whole work (e.g., an essay) is copied from another source; and/or
- a student submits or presents work in one course which has also been submitted in another course (although it may be completely original with that student) without the knowledge of or prior agreement of the instructor involved.

While it is recognized that scholarly work often involves reference to the ideas, data and conclusions of other scholars, intellectual honesty requires that such references be explicitly and clearly noted. Plagiarism is an extremely serious offence. Plagiarism occurs not only when direct quotations are taken from a source without specific acknowledgement, but also when original ideas or data from the source are not acknowledged. A bibliography is insufficient to establish which portions of the student's work are taken from external sources; footnotes or other recognized forms of citation must be used for this purpose.

CHEATING

Cheating is an extremely serious academic offence. Cheating at tests or examinations includes but is not limited to dishonest or attempted dishonest conduct such as speaking to other candidates or communicating with them under any circumstances whatsoever; bringing into the examination room any textbook, notebook, memorandum, other written material or mechanical or electronic device not authorized by the examiner; writing an examination or part of it, or consulting any person or materials outside the confines of the examination room without permission to do so, or leaving answer papers exposed to view, or persistent attempts to read other students' examination papers.

ACADEMIC ACCOMMODATION

It is the student's responsibility to request academic accommodation. If you are a student with a documented disability who may require academic accommodation and have not registered with the Disability Resource Centre, please contact their office at 403–220–8237. Students who have not registered with the Disability Resource Centre are not eligible for formal academic accommodation. You are also required to discuss your needs with your instructor no later than fourteen (14) days after the start of this course.

STUDENTS' UNION REPRESENTATIVES

The Humanities Representatives are Laura Golebiowski (arts1@su.ucalgary.ca), Bhuvana Sankaranarayanan (arts2@su.ucalgary.ca), Lara Schmitz (arts3@su.ucalgary.ca), and Vincent St. Pierre (arts4@su.ucalgary.ca).

FREEDOM OF INFORMATION AND PROTECTION OF PRIVACY (FOIP) ACT

The University of Calgary is under the jurisdiction of the provincial FOIP Act in all aspects of its operations as a publicly funded institution. The Department of Philosophy ensures the student's right to privacy by requiring all graded assignments, papers, and exams be returned to the student directly from the instructor unless other arrangements have been made in writing and approved by the Department Administrator.

SAFEWALK: PROMOTING CAMPUS SAFETY AND AWARENESS

Twenty four hours a day, seven days a week, Safewalk volunteers walk people safely to their destination on campus. This service is free and available to students, staff, and campus visitors. Safewalks are done in male/female pairs. The volunteers walk anywhere on campus (including McMahon Stadium, Health Sciences, Student Family Housing, the Alberta Children's Hospital and the University LRT station). To request a Safewalk volunteer to walk with you, call 403–220–5333 (24 hours a day/seven days a week/365 days a year) or use one of the Help Phones located across campus (they are not just for emergencies).