UNIVERSITY OF CALGARY
FACULTY OF ARTS
DEPARTMENT OF PHILOSOPHY
PHILOSOPHY 279 Lecture 02
Logic I
Winter 2011

Instructor: Gillman Payette

Office:	Social Sciences 1227
Phone:	220-7518
Email:	ggpayett@ucalgary.ca
Web Page:	http://www.phil.ucalgary.ca/profiles/gillman-payette?dir=72
Office Hours:	Wednesday 11:00–12:00, Friday 11:00–12:00 or by appointment.

Lecture Time and Place: Monday Wednesday Friday 10:00-10:50 in Education Classroom Block (EDC) 388

Tutorial Time and Place: Monday 11:00–11:50 and 15:–15:50, Tuesday 10:00–10:50 in Social Sciences (SS) 018

Teaching Assistant: Teppei Hayashi

Office:	1239
Phone:	220-6465
Email:	thayashi@ucalgary.ca
office hours:	Monday 12:30–14:30

Prerequisites: There are no official prerequisites for this course, but patience is a must. Not being afraid of math is helpful, so is having done some sodoku. This course, although it is a philosophy course, has more of the feel of a math course. Nonetheless, being in the sciences is not necessary to do well in this logic course.

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

1

Software: *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 (Tarskis 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 TRI Computer Lab in the basement of Social Sciences (018 SS)—that is also where the tutorials are—and you can have a look at the software and textbook there before buying a copy (or breaking the shrink-wrap).

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.

Contacting the Instructor: The way to contact me is via email. When you write an email *please include 'Phil 279–your name–' in the subject line.* If you don't get an email back from me, check to see if you have included this.

Why take this course: This is a first course in formal logic. Even though it is a philosophy course there will be little—but some—discussion of philosophical aspects of the material. However, this subject matter is of fundamental importance in philosophy, and every other discipline. What we are attempting to do is give criteria for what a really good argument should look like. The way I view this course is as a foundation for future work in computer science, philosophy and mathematics. It provides this foundation by providing a model or theory of what makes an argument good in a very strong sense.

Structure of the Course: The course will consist of lectures and tutorials. The lectures will be mostly dissemination of information, with opportunities for questions. In the tutorial sessions there will be mini in-class projects to be completed. The tutorial is also the perfect time to raise questions concerning specific practice problems, from the homework and

otherwise. There is also a discussion board on the blackboard website.

Grading:		Conversions:		
Homework	40%	A+ 98–100%	A 93–97.9%	A- 90–92.9%
Participation	15%	B+ 87–89.9	B 83–86.9%	B- 80–82.9%
Mid term	20%	C+ 77–79.9%	C 73–76.9%	C- 70–72.9%
Final Exam	25%	D+ 67–69.9%	D 60–66.9%	
		F < 60%		

Homework: Homework will be assigned on a regular basis (approximately every two weeks). Late homework will not be accepted (unless there is some officially accepted excuse). The homework will make up 40% of your grade. There will be 6 assignments, and only 5 of those 6 will be counted toward your final grade with the lowest mark being omitted. However, *you must hand in all assignments to pass the course*, and late assignments must be handed-in *within one week of the original due date*. Late assignments will not be marked. Assignments will be due by noon (12:00) on the Friday of the week that it is due. *There are drop boxes for your assignments in the philosophy department on the 12th floor of the social sciences building.* Please hand in your assignments there, not to me or the TA directly. **The assignments will be made available on blackboard two weeks before the due date of the assignment.**

Participation: Fifteen percent of your grade depends on participation. Half of that will be determined by the peer review from the group work in the tutorial, and the other half will be determined from your participation in the tutorial, class and from your posts on the discussion board.

Exams: There will be a midterm and a cumulative final scheduled by the registrar. Unexcused missed midterms cannot be rescheduled. For the final exam, the university's polices for deferrals apply.

Working Together: I encourage you to discuss the homework with your peers. However, what you hand in must be work that you have done yourself. So write up the final solution set on your own. If you do work with others on an assignment, please write down who it was that you worked with. Also note that the grade grinder can tell if your files for homework have been copied, so you should always start those files from scratch.

Expectations: The amount of work that one will have to put into this course to do well

will, of course, vary. But the average amount of work one should expect to do is 2-3 hours of work outside of class for every hour in class. This is fairly standard in North America. The assignments should take about 10-15 hours of work each. If you are trying to do everything the day before the assignment is due it will likely take longer, if you are not familiar with the subject matter in the assignment. I will say this again since it is worth repeating: ***you need to hand in every assignment to pass the course***!

Syllabus: This syllabus is tentative, but should give you a rough idea what we are doing when. I will try to stick to this as closely as possible. The assignment and midterm dates are firm. The phrasing of the learning objectives is in such a way that it will give you some guide as to what the important skills are so you can judge whether you can do what you need to be able to do.

Week 1: Introduction and the Language of First-order Logic (FOL) (Jan 10, 12, 14) Ch 1-2

Introductory and philosophical remarks: What is logic? The field of logic and its applications. Intuitive validity and what we are doing. Introduction of FOL. Examples of first-order languages.

FOL Learning Objectives: Identifying and constructing formulas of formal first-order languages using predicate symbols, individual constants, function symbols. Doing these things in the Blocks language and the language of arithmetic.

Week 2: The Logic of Atomic Sentences and Boolean Sentences (Jan 17, 19, 21)

The Logic of Atomic Sentences Learning Objectives: Understanding logical validity of arguments. Showing arguments are valid using formal and informal proofs. Using the properties of the identity predicate (reflexivity, principle of the substitutability of identicals) in proofs. Basic properties of other predicate symbols (transitivity, reflexivity, symmetry, inverse relations) in proofs. Constructing Fitch style proofs. Building counterexamples to show that arguments are not valid, e.g., in the Blocks language.

Introduction to the Boolean connectives Ch 3 Learning objectives: Identifying and constructing Boolean formulas of FOL, i.e., formulas using $\wedge, \vee, \neg$. Constructing truth-tables for boolean formulas.

Week 3: The Logic of Boolean Connectives (contd) (Jan 24, 26, 28)

Learning objectives: Translate sentences from English into FOL using the Boolean connectives. How to express complicated things using the blocks language and the Boolean connectives.

Logical Truths and Tautologies Learning objectives: Explain the differences between logical truths, tautologies, and TW-necessities. Explain the concepts of tautological equivalence, consequence, and validity. Applying the method of truth tables to prove tautological equivalence, consequence and validity. Ch. 4

Assignment 1 (Ch. 1–3) due Friday Jan 28, by 12:00 Noon. You must complete the "You try it" exercise on pp. 8-10 of the text and submit "World Submit Me 1" by Tuesday, Jan 25, midnight.

Week 4: Chains of Equivalences, Normal Forms, and Proof Theory (Jan 31, Feb 2, 4)

Tautological equivalences Learning objectives: Using De Morgan's Laws and other equivalent transformations in formal proofs. Proving tautological equivalence by a chain of equivalences. Negation, conjunctive and disjunctive normal forms. Ch. 4

Proof theory of Boolean Connectives Learning objectives: Identifying, stating and applying the formal rules for the formal rules for $\wedge$ and $\vee$. Using the formal rules to construct formal proofs, and constructing informal proofs. Ch. 5,6

Week 5: Formal and Informal Proofs Using Boolean Connectives (Feb 7, 9, 11)

Proof theory of Boolean Connectives cont'd Learning objectives: Identifying, stating and applying the formal rules for the formal rules for $\wedge$ and $\vee$. Using the formal rules to construct formal proofs, and constructing informal proofs. Ch. 5,6

negation Learning objectives: Identifying and stating the formal rules for $\neg$. Constructing indirect proofs and formal proofs with $\neg$. Arguments with inconsistent premises. Constructing formal proofs of tautologies. Using strategies for formal proofs. Ch. 5,6

Assignment 2 (Ch. 4, 5 and some of 6) due Feb 11, 12:00 Noon.

Week 6: The Conditionals and Truth-Functional Completeness (Feb 14, 16, 18)

Conditionals Learning Objectives: Construction of truth tables for $\rightarrow$ and $\leftrightarrow$. Translating from English to FOL using the conditionals. Using conversational implicature to help in translation. Constructing formal proofs involving $\rightarrow$ and $\leftrightarrow$. Prove the semantic deduction theorem. Ch. 7, 8

Truth-functional completeness Learning objectives: Explain the aims of meta-theory. Formulate the definition of and prove truth-functional completeness for $\wedge$, $\vee$, and $\neg$. Also for the truth-functional completeness of "neither . . . nor—". Show that the Boolean connectives can express "neither . . . nor—" and "not both. . . and—". Ch 7.4

Week 7: Introduction to Quantification (Feb 28, Mar 2, 4)

Learning objectives: Identifying and constructing formulas involving quantifiers: well-formed formulas, free and bound variables. Constructing interpretations for FOL. Explaining and showing satisfaction of first-order formulas. Identifying the Aristotelian forms. Perform simple translations into FOL with quantifiers. Ch. 9

Assignment 3 (Ch. 6, 7 w/o 7.4, 8) due Mar 4, 12 Noon.

Week 8: First-order Validity and Consequence (Mar 7, 9, 11)

Learning objectives: Applying the truth-functional form algorithm. Determining when sentences of FOL are tautologies. Applying the replacement method to test for tautology-hood. Explaining the definitions of first-order validity and consequence, and applying those definitions. Ch 10.1 and 2

Midterm exam in class Fri 11 Mar.

Week 9: First-order Validity, Interpretations and Translations of Multiple Quantifiers (Mar 14, 16, 18)

Interpretations Learning objectives: Using Venn diagrams to specify interpretations. Illustrating relations between logical notions. Ch. 10

Multiple quantification Learning objectives: 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. Applying the step-by-step method of translation. Illustrating why the order of quantifiers matters: ambiguity. Expressing complicated properties using quantifiers, in particular in the language of arithmetic. Ch. 11

Assignment 4 (Ch. 7.4, 9–10) due Mar 11, 12:00 Noon.

Week 10: Multiple Quantification (contd) and Quantifier Equivalences (Mar 21, 23, 25)

Multiple Quantification Learning objectives: Understanding and translating anaphora. Recognizing ambiguity and translating ambiguous sentences. Ch. 11.4–5

Quantifier Equivalences Learning objectives: Extending the FO equivalence of Well Formed Formulas (WFFs) to those with different quantifiers. Using DeMorgan's Laws for the quantifiers, and other equivalences. Ch. 10.3

Week 11: Prenex Form and Proof Theory (Mar 28, 30, Apr 1)

Prenex Form Learning objectives: Applying techniques for pulling quantifiers to the front of a sentence. Ch. 11.7

Formal proofs Learning objectives: Applying the proof rules for quantifiers $\forall$ and $\exists$. Applying strategies for proofs with quantifiers. Proofs with multiple and mixed quantifiers. Ch. 13

Assignment 5 (Ch. 10-11) due Mar 25

Week 12: Numerical Quantification, Definite Descriptions and some Metatheory (Apr 4, 6, 8)

Numerical quantification Learning objectives: Applying the identity predicate to express numerical quantification: 'there are exactly/at most/at least n things of a certain kind.' Explain Russell's and Strawson's analyses of definite descriptions. Explain how to express 'both' and 'neither' in FOL. Ch. 14.1, 14.3

Basic metatheory Learning objectives: Explain the significance of soundness and completeness proofs. Sketch a soundness proof. Ch. 8.3

Week 13: Outlook, Review (Apr 11, 13, 15)

Putting it all together Learning objectives: Explain the "big picture". Analyze the significance and application of logic. Discuss the limitations of logic: undecidability, incompleteness, richer logics and alternative logics.

Assignment 6 due Apr 15, 12:00 Noon.

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 ones 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 students 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 students 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 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 Representative

The Faculty of Arts 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 be returned to the student directly from the instructor unless other arrangements have been made in writing and filed with 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/7 days a week/365 days a year) or use one of the Help Phones located across campus (they are not just for emergencies).