Logic I

Phil 279 LO2

June 29–August 12 2020

June 23, 2020

Instructor: Dr. Gillman Payette

Office:	My Home via Zoom
Email:	ggpayett@ucalgary.ca
Office Hours:	Tuesday 10:00–12:00 or by appointment.

Lecture Time and Place: Monday & Wednesday 13:00–15:45 (See D2L for More Specific Meeting Times via Zoom)

Teaching Assistant: WeiDong Sun

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Course Description: 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. The content of the course will focus on using what is known as First-Order Logic (FOL): a mathematical model that can help us to think about things. This system is your

first step into a larger world, and is the basis for understanding how computers work and how we make proofs in mathematics very precise. The goal is to have you understand when and when not to use FOL to model an argument, what the "formal language" of FOL represents, and how to construct proofs for FOL sentences.

The lectures will be delivered via Loom videos. Links to the videos will be posted on D2L. There will be tutorial-style Zoom tutorials during the the scheduled lecture time. That will be time for you to ask questions about the material or about the class in general. I will be doing some examples in that time; however, I do expect you to participate, if you join us. I will generally conduct the tutorial by posing a question, allowing you to discuss it in break-out groups, work on it for a bit, then we will look at the solution together after hearing your thoughts on it. There will be the D2L discussion board to ask questions as well. I will also have additional tutroial videos that you should watch.

Prerequisites: There are no prerequisites for this course.

Text: The textbook is *Forall x–Calgary Remix* It can be found on the course D2L website where you can download a pdf for free, or it can be found on Amazon where you can get a printed copy.

Contacting the Instructor: The way to contact me is via email. When you write an email ***please include 'Phil279–your name–' in the subject line.*** If you don't get an email back from me, check to see if you have included this. **If you email me after 4:30 pm or on the weekend, do not expect me to reply until the next day or Monday, respectively.**

Requirements and Evaluation

Task	Due	%
Assignments (4):	July 10, 21, 31; Aug 13	60
Final Test:	Aug 16-18	35
Reflection:	June 30, Aug 13	5
Buddy Bonus:		3

Assignments: There will be four assignments. They are due on various days of the week by 17:00 (see the due dates above or below). These will be submitted via a mixture of D2L

and the Carnap.io website—more on that below. I want the assignments to be anonymous, so do not put any identifying information on things that you hand in, D2L or Carnap will take care of that.

You may work together with others. If you work with others, please only hand in **one** version of the assignment, and email me the names of those you worked with. You will all get the same mark for the assignment. Please do not leave disagreements over working together until the last minute, be upfront and respectful with your colleagues, and treat each other fairly. Of course that does not mean letting people free ride, it just means dealing with free riding, if it arises, early on.

You will need to sign up to the Carnap website, and it is probably easiest if you have a gmail account. There will be more details about the Carnap website on D2L.

Final Test: The test will be a two day take-home test. It will be like an assignment and will cover whatever material from the term I decide to put on it. It will be submitted just like an assignment with all of the same rules and conditions.

Reflection: This evaluation involves providing me with a written reflection on your thoughts about what logic is. It is evaluated as pass/fail and you must pass both reflections to get the 5%. What I want is between 100 and no more than 400 words, written coherently, on what you think logic is and is about/does. I want one written before you know anything about what I say in this course and one recording your thoughts after you have completed the lectures.

Buddy Bonus: You will each be randomly assigned at least one buddy—no, you do not get to choose your buddy. This is someone who you can get in touch with and talk about the questions with, ask them questions, do some Zooming, or whatever. In the end, there will be a chance for you to give your buddy(ies) up to three percentage points on the term. You will also have to give me a short justification—description of how you worked together—for why your buddy deserves the points you are giving them. These are bonus marks, so it can pay to help out your peers.

Policies

Late Work and Extensions: The due dates for submitted work are strict. If the work is not submitted by the due date and time, it will not be marked and receive 0. Make sure to take **screen shots** of your submissions in case something goes wrong! Extensions and

missed assignments will only be granted for medical or other valid reasons. Too much work is not a valid reason.

Part Marks: The questions on the assignments and take-home final test will be assessed as either right or wrong. There will be no part marks. And being a logic class, syntax is very important.

Letter Grades: The following is how percentages will be transformed into letter grades; marks will not be rounded.

		A+	$\geq$	98	$>$	A	$\geq$	90	$>$	A-	$\geq$	85
85	$>$	B+	$\geq$	82	$>$	B	$\geq$	78	$>$	B-	$\geq$	75
75	$>$	C+	$\geq$	72	$>$	C	$\geq$	68	$>$	C-	$\geq$	65
65	$>$	D+	$\geq$	60	$>$	D	$\geq$	55	$>$	F		

Schedule

This schedule is tentative, but should give you a rough idea of what we are doing when or at least the sequence of the subjects, and what skills will be required. We will be following the textbook closely, and I will try to stick to timing below as closely as possible. The assignment and test dates are firm. I have not packed the schedule, but if we find ourselves ahead, we will simply cover more topics that the textbook deals with. 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.

June 29: Introduction and Key Notions of Logic

Introductory and philosophical remarks: What is logic? The field of logic and its applications. Arguments, intuitive validity, possibility and necessity. Introduction to the language and semantics of propositional logic.

Logic: Learning Objectives: Identifying parts of arguments and logical relations/concepts applied to natural language sentences.

Language and Semantics of Propositional Logic: Learning Objectives: Constructing well-formed sentences of propositional logic. Constructing complete truth-tables for formulas using $\wedge, \vee, \neg, \rightarrow, \leftrightarrow$.

July 6: Truth-Functional Languages

Formalization and Semantic Concepts Constructing formalizations of natural language sentences using the truth-functional connectives. Recognize the limits to the formalization process.

Constructing partial truth-tables. Using truth-tables to identify logical connections and properties of propositional formulas.

July 8: Proof Theory of Propositional Logic

Proof theory of Boolean Connectives Learning objectives: Using the formal rules of the connectives $\vee, \neg, \wedge, \rightarrow$ to construct natural deductions.
Assignment 1 due July 10, by 17:00.

July 13: Proof Theory and Metatheory

Proof theory of Boolean Connectives Learning objectives: Using natural deduction to test whether proof theoretic concepts apply to sets of sentences in propositional logic.

Basic metatheory 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—". Explain the significance of soundness and completeness proofs.

July 15: The Language of Elements FOL

Learning objectives: Identifying and constructing formulas involving quantifiers: well-formed formulas, free and bound variables. Perform simple formalizations of natural language into FOL with quantifiers.

Interpretations Learning objectives: Constructing interpretations for FOL. Explaining and showing satisfaction of first-order formulas.

July 20: Complex FOL Formalization

Perform complex formalizations of natural language into FOL with multiple quantifiers, using identity and definite descriptions. **Assignment 2 due July 21st, by 17:00.**

July 22: Interpretations and Logical Relations in FOL

Semantic Concepts Learning objectives: Using interpretations to identify and test for logical connections between formulas of first order logic: validity, equivalence, satisfiability, contradiction

July 27: Proofs in FOL

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.

Identity and More Learning objectives: Applying the proof rules for the identity predicate. Using derived proof rules for FOL

Assignment 3 due July 31st, by 17:00.

July 29: Modal Language and its Semantics

How to construct sentences in modal propositional logic. How to specify models for propositional logic.

Aug 5: Modal Arguments

How to use models for modal languages to evaluate the semantic concepts in modal logic: modal validities, argument validity, contradiction

Aug 10: The various Modal Logics

The relationship between FOL and modal logic. Conditions on Frames and their relation to modal validity.

Aug 12: Metatheory, Outlook, Review

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 4 due August 13, 17:00**

Aug 16-18: Final Take Home Test, Due 17:00 Aug 18

IMPORTANT DEPARTMENTAL, FACULTY AND UNIVERSITY INFORMATION

Academic Accommodations

It is the students responsibility to request academic accommodations according to the University policies and procedures. The student accommodation policy can be found at ucalgary.ca/policies/files/policies/student-accommodation-policy.pdf.

Students needing an Accommodation because of a disability or medical condition should communicate this need to Student Accessibility Services in accordance with the Procedure for Accommodations for Students with Disabilities:

ucalgary.ca/policies/files/policies/procedure-for-accommodations-for-students-with-disabilities.pdf.

Students needing an Accommodation in relation to their coursework or to fulfil requirements for a graduate degree, based on a protected ground other than disability, should communicate this need, preferably in writing, to their instructor.

Absence or Missed Course Assessments

Students who are absent from class assessments (tests, participation activities, or other assignments) should inform their instructors as soon as possible. Instructors may request that evidence in the form of documentation be provided. If the reason provided for the absence is acceptable, instructors may

decide that any arrangements made can take forms other than make-up tests or assignments. For example, the weight of a missed grade may be added to another assignment or test. For information on possible forms of documentation, including statutory declarations, please see ucalgary.ca/pubs/calendar/current/m-1.html

Student Support and Resources

Full details and information about the following resources can be found at ucalgary.ca/Registrar/registration/course-outlines

- Wellness and Mental Health Resources

- Student Success Centre

- Student Ombuds Office

- Student Union (SU) InformationGraduate Students Association (GSA) Information

- Emergency Evacuation/Assembly Points

- Safewalk

Academic Advising

If you are a student in the Faculty of Arts, you can speak to an academic advisor in the Arts Students Centre about course planning, course selection, registration, program progression and more. Visit the Faculty of Arts website at `arts.ucalgary.ca/advising` for contact details and information regarding common academic concerns.

For questions specific to the philosophy program, please visit `phil.ucalgary.ca`. Further academic guidance is available by contacting David Dick (Undergraduate Program Director dgdick@ucalgary.ca) or Jeremy Fantl (Honours Advisor jfantl@ucalgary.ca). If you have questions regarding registration, please email Rebecca Lesser (Undergraduate Program Administrator phildept@ucalgary.ca).

Writing Assessment and Support

The assessment of all written assignmentsand, to a lesser extent, written exam responsesis based in part on writing skills. This includes correctness (grammar, punctuation, sentence structure, etc.), as well as general clarity and organization. Research papers must include a thorough and accurate citation of sources. Students are also encouraged to use Writing Support Services for assistance (one-on-one appointments, drop-in support and writing workshops). For more information, and other services offered by the Student Success Centre, please visit `ucalgary.ca/ssc`.

Online Resources and Electronic Devices

Important information and communication about this course may be posted on D2L (Desire2Learn), UCalgarys online learning management system. Visit `ucalgary.service-now.com/it` for how-to information and technical assistance.

The instructor reserves the right to establish specific course policies regarding the use of electronic devices. If permitted, the use of devices must be exclusively for instructional purposes, and without disruption to the instructor or fellow students. Devices should be set to silent mode during lectures. Audio or video recording of lectures is not permitted without the written permission of the instructor. Students violating this policy are subject to discipline under the University of Calgarys Non-Academic Misconduct policy.

Academic Misconduct/Honesty

Cheating or plagiarism on any assignment or examination is as an extremely serious academic offense, the penalty for which will be an F on the assignment or an F in the course, and possibly a disciplinary sanction such as probation, suspension, or expulsion. For information on academic misconduct and its consequences, please see the University of Calgary Calendar at ucalgary.ca/pubs/calendar/current/k.html.

Intellectual honesty requires that your work include adequate referencing to sources. Plagiarism occurs when you do not acknowledge or correctly reference your sources. If you have questions about referencing, please consult your instructor.

University Policies

The Instructor Intellectual Property Policy is available at ucalgary.ca/policies/files/policies/Intellectual%20Property%20Policy.pdf

The University of Calgary is under the jurisdiction of the provincial Freedom of Information and Protection of Privacy (FOIP) Act, as outlined at ucalgary.ca/legalservices/foip. The instructor (or TA) must return graded assignments directly to the student UNLESS written permission to do otherwise has been provided.

All students are required to read the University of Calgary policy on Acceptable Use of Material Protected by Copyright
(ucalgary.ca/policies/files/policies/acceptable-use-of-material-protected-by-copyright.pdf) and requirements of the copyright
(ucalgary.ca/policies/files/policies/acceptable-use-of-material-protected-by-copyright.pdf) and requirements of the copyright act (laws-lois.justice.gc.ca/eng/acts/C-42/index.html).