



**UNIVERSITY OF CALGARY**  
FACULTY OF ARTS  
Department of Philosophy

# Logic I

Phil 279 LO2  
May 6–June 17 2020

April 28, 2020

**Instructor:** Dr. Gillman Payette

Office: SS 1208  
Email: [ggpayett@ucalgary.ca](mailto:ggpayett@ucalgary.ca)  
Office Hours: Wednesday 10:00–12:00 or by appointment.

**Lecture Time and Place:** Tuesday & Thursday 9:00–11:45 (See D2L for More Specific Meeting Times via Zoom)

**Teaching Assistant: WeiDong Sun**

Email: [weidong.sun1@ucalgary.ca](mailto:weidong.sun1@ucalgary.ca)  
office hours:

**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 lectures during the 10:00-11:30 section of 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. This is my plan, and it may work, but it may be problematic. If it doesn't work well, I will switch to something else. There will always be message boards for you to post questions on.

**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. There is also a proof checker accessible on the website for the book. Its url will be posted on the course website.

**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):	May 15, 27; June 4, 17	60
Final Test:	Aug 15	40
Buddy Bonus:		5

**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 may be submitted to D2L—I might use Turnitin. I want the assignments to be anonymous, so do not put your name on things that you hand in, D2L (or Turnitin) 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.

There are a few options to submit the assignments. Here they are:

1. Write it on paper as you normally would. Then take **very** clear photos of each page separately, combine them into a pdf and upload the pdf. If the photos are not clear, that is on you.
2. Write it in a word processor of some sort. I will provide some details on how to do that in a video. When it comes to proofs, screen shots will be needed from the proof checker, and I will put together a video of how to do that.
3. If you are proficient in  $\text{\LaTeX}$ , use it to write the assignments with proper notation and submit the pdf. I will provide some templates for typesetting proofs. (If you do not know what  $\text{\LaTeX}$  is now or don't know how to use it now, you should not use this option.)

**Final Test:** The test will be a two day take-home test. It will be like a longer assignment and will cover all the material from the term. It will be submitted just like an assignment with all of the same rules and conditions.

**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 five 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.

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

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

## Schedule

This schedule is tentative, but should give you a rough idea 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.

### May 7: Introduction and Key Notions of Logic

Introductory and philosophical remarks: What is logic? The field of logic and its applications. Arguments, intuitive validity and what we are doing. Introduction to Formal Languages.

*Logic:* Learning Objectives: Identifying parts of arguments and relations between natural language sentences.

## May 12: Truth-Functional Languages

*Between Natural and Formal Languages* Learning Objectives: Constructing formalizations of natural language sentences using the truth-functional connectives. Recognize the limits to the formalization process.

## May 14: Truth Tables

*Semantics of Propositional Logic* Learning objectives: Constructing complete truth-tables for formulas using  $\wedge, \vee, \neg, \rightarrow, \leftrightarrow$ . **Assignment 1 due Friday May 15, by 17:00.**

## May 19: More Truth Tables

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

## May 21: Natural Deduction

*Proof theory of Boolean Connectives* Learning objectives: Using the formal rules of the connectives  $\vee, \neg, \wedge, \rightarrow$  to construct natural deductions.

## May 26: More Natural Deduction

*Proof theory of Boolean Connectives* Learning objectives: Using natural deduction to test whether proof theoretic concepts apply to sets of sentences in propositional logic. **Assignment 2 due Wednesday May 27, by 17:00.**

## May 28: The Language of Elements

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.

## June 2: More of the Language of Elements

Perform complex formalizations of natural language into FOL with multiple quantifiers, using identity and definite descriptions.

## June 4: Interpretations of First Order Languages

*Interpretations* Learning objectives: Constructing interpretations for FOL. Explaining and showing satisfaction of first-order formulas. **Assignment 3 due Friday June 5, by 17:00.**

### **June 9: Interpretations and Logical Concepts**

*Semantics Concepts* Learning objectives: Using interpretations to identify and test for connections between formulas of first order logic.

### **June 11: Natural Deduction for 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

### **June 16: Metatheory, Outlook, Review**

*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. Sketch a soundness proof.

*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 Wednesday June 17, 17:00**

### **June 19–21: Final Take Home Test, Due 17:00 Sunday June 21**

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](http://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](http://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](http://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](http://ucalgary.ca/Registrar/registration/course-outlines)

- Wellness and Mental Health Resources
- Student Success Centre
- Student Ombuds Office
- Student Union (SU) Information Graduate 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](https://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](https://phil.ucalgary.ca). Further academic guidance is available by contacting David Dick (Undergraduate Program Director [dgdick@ucalgary.ca](mailto:dgdick@ucalgary.ca)) or Jeremy Fantl (Honours Advisor [jfantl@ucalgary.ca](mailto:jfantl@ucalgary.ca)). If you have questions regarding registration, please email Rebecca Lesser (Undergraduate Program Administrator [phildept@ucalgary.ca](mailto:phildept@ucalgary.ca)).

## **Writing Assessment and Support**

The assessment of all written assignments and, to a lesser extent, written exam responses is 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](https://ucalgary.ca/ssc).

## **Online Resources and Electronic Devices**

Important information and communication about this course may be posted on D2L (Desire2Learn), UCalgary's online learning management system. Visit [ucalgary.service-now.com/it](https://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 Calgary's 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](http://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](http://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](http://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](http://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](http://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](http://laws-lois.justice.gc.ca/eng/acts/C-42/index.html)).