

SYMBOLIC LOGIC: PHIL 220-002 (3) SYLLABUS

SUMMER TERM 2, 2020

INSTRUCTOR INFORMATION

Instructor	Email	Office Location & Hours
Matthew Smithdeal (they/them)	matthew.smithdeal@alumni.ubc.ca	Collaborate Ultra General Course Room Monday and Wednesday 1-2pm starting week 2 (or by appointment)

GENERAL INFORMATION

DESCRIPTION

Logic, broadly construed, is the study of reasoning. More specifically, it is the study of reasoning. What might we mean when we classify an argument as a “good” one? What makes one argument good and another poor? What do good arguments have in common? Formal logic aims to study these questions from a content-free perspective by abstracting away from the specific meanings of particular sentences and arguments and focusing instead on their underlying structures.

This course will meet in Collaborate Ultra (accessed through Canvas) during the scheduled class times.

COURSE GOALS

By the end of the course, you should be able to:

- Understand the basics of analyzing, evaluating, and symbolizing arguments
- Grasp the basic concepts of first-order logic and truth-functional logic
- Translate sentences and arguments into formal languages
- Understand and utilize the main inference rules of first-order logic and truth-functional logic
- Construct proofs in first-order logic and truth-functional logic
- Identify common, informal fallacies of reasoning

COURSE MATERIALS

REQUIRED TEXT

- *For All X, Calgary Edition* by P. D. Magnus and Tim Button, adapted by Thomas-Bolduc and Richard Zach
- This is a **free, open source** textbook. There are several different editions of *For All X*. Please ensure you are using the Calgary Edition.
- Please use the PDF that is posted in the files section of the canvas site rather than searching for a version on the web. There are frequently slight modifications to the version posted on their website and we want to ensure you have the exact same version. There is also an accessible version of the textbook in the files section.
- You may wish to print the textbook. There is a black and white version of the textbook formatted for printing in the canvas files. You can also purchase a printed version of the book on amazon (which may be cheaper than printing it yourself) -- <https://www.amazon.ca/dp/1077319851>
- We will also use carnap.io for homework. More information will be provided the first week of class.

COURSE SCHEDULE

Please note that this schedule may change at the instructor's discretion to suit the pace of the course and the interests of the students. Please also note that all readings are to be read *before* the date listed.

Day	Topic and Reading	Work Due
Monday, July 6 th	<i>Introductions and Logic Basics</i> Part 1 (Chapters 1-3)	
Wednesday, July 8 th	<i>Formal and Informal Fallacies</i> https://www.youtube.com/watch?v=VDGp04CfM4M&list=PLtKNX4SfKpzWShEUtNiV1QhKG2cP9vbXg Watch "Fallacies: Formal and Informal Fallacies" then watch one video from the Fallacies playlist on a fallacy of your choice	Introductory Survey and post due Sunday, July 12 th at 11:59 pm PST
Monday, July 13 th	<i>Symbolization Introduction</i> Part 2 (Chapters 4-7)	
Wednesday, July 15 th	<i>Truth Tables</i> Part 3 (Chapters 8-13)	Homework 1, EC 1, and Quiz 1 Assigned Due: July 19 th at 11:59 pm PST
Monday, July 20 th	<i>Natural Deduction: Basic Rules</i> Part 4 (Chapters 14-16)	
Wednesday, July 22 nd	<i>Natural Deduction: Additional Rules, Soundness, and Completeness</i> Part 4 (Chapters 17-20)	Homework 2, EC 2, and Quiz 2 Assigned Due: July 26 th at 11:59 pm PST
Monday, July 27 th	<i>Extra Practice with Deduction in TFL</i>	
Wednesday, July 29 th	<i>Introduction to First-Order Logic</i> Part 5 (Chapters 21-26)	Homework 3 and EC 3 Assigned Due: Aug. 2 nd at 11:59 pm PST
Monday, Aug. 3 rd	--- No Class (Holiday) ---	
Wednesday, Aug. 5 th	<i>FOL Interpretations</i> Part 6 (Chapters 26-31)	Homework 4, EC 4, and Quiz 3 Assigned Due: Aug. 9 th at 11:59 pm PST
Monday, Aug. 10 th	<i>Natural Deduction for First Order Logic</i> Part 7 (Chapters 32-37)	
Wednesday, Aug. 12 th	<i>Extra Practice with Deduction in FOL</i>	Homework 5, EC 5, and Quiz 4 Assigned Due: Aug. 16 th at 11:59 pm PST
TBD (Aug. 17-21)	Final Exam	

ASSESSMENT

You have a lot of flexibility in choosing which assignments to complete throughout the course. Students who come to this class with prior exposure to logic or who are particularly self-motivated to complete the course on their own may choose to not complete the homework, extra credit assignments, or attend class - these can all be skipped ***without penalty***. Students that have no background in logic or who would prefer to have more oversight and external motivation to keep up with the course should plan to complete all of the homework, attend classes, and complete the extra credit assignments.

The final exam will be live proctored by myself through Collaborate Ultra. This will require you to have your camera and microphone turned on during the exam. If you do not have a camera, cannot attend during the scheduled class period, or have privacy concerns, please reach out for alternatives.

PROFICIENCY BASED ASSESSMENT

This course will use a proficiency-based assessment structure. It is a rather unusual system, so please read the following description carefully and do not hesitate to reach out for clarification at any point.

Short Description:

There are 9 main topics of the course. Your grade will come from demonstrating proficiency in these topics. You only receive credit for completely correct responses, but you will get many chances throughout the semester to display proficiency.

Long Description:

There are 9 main topics for the course (listed below and on Canvas). For each topic, you will find several sub-topics listed in order from foundational to advanced. Your overall course grade will be based on how many of these you have demonstrated proficiency in and how strong your proficiency in each topic is (both during the course and at the completion of the course).

You will have multiple attempts to demonstrate proficiency for a topic during the course. The end goal is that you are proficient in the topics by the end of the course, and you will not be penalized for becoming proficient later in the course rather than earlier.

You will also be granted tokens throughout the course for performing extra tasks. These tokens can be used to alter the course guideline in several ways explained below.

Each assignment will have several questions per topic (at least one covering each of the subtopics for that topic). **The grading of each question on all assignments will be strict. You either get the question correct or incorrect. There is no partial grading of questions.** Rather than a single overall grade on an assignment, you'll receive a ranking of your proficiency on each topic tested on that assignment based on the number of questions you get *entirely* correct, as follows:

- **Excellent:** full proficiency in the concept; 100% accuracy on questions for this concept. There are no non-trivial errors. This work could be used as a classroom example. You need not retest on this concept in future quizzes.
 - This correlates with work in the A range
- **Meets Expectations:** >50% accuracy on questions for this concept. Understanding of the concepts is evidence through correct work. Some revision or expansion is needed, but no significant gaps or errors are present. May retest this concept in future quizzes, but this is not necessary.
 - This correlates with work in the B range

- **Revision Needed:** <50% accuracy on questions for this concept. Partial understanding of the concepts is evident, but there are significant gaps that remain. Needs further work and more review then attempt again on a future quiz.
 - This correlates with work in the C/D range.
- **Not Assessable:** 0% accuracy. Not enough information is present in the work to determine whether there is understanding of the concepts. *Please come discuss this concept with me in office hours so we can strategize how to improve.* Should certainly retest on a future quiz.
 - This correlates with work in the F range.

THE BREAKDOWN

Your overall grade is computed as follows: your score on each primary topic accounts for 10% of your final grade (9 topics x 10% = 90%) and the remaining 10% is awarded based on the completion of an introductory survey and forum post, midterm survey, and final survey (an informal final survey written by me).

Your score for each topic comes from three main sources: 1) quizzes, 2) homework, and 3) the final exam. The homework is optional but will function to decrease the weight of the quiz grade for each topic. These elements are broken down as follows for each topic:

- 60% -- level of proficiency demonstrated on the final exam
- 20% -- level of proficiency demonstrated throughout the course via quizzes
 - This will come *solely* from the **highest** proficiency score on a topic
 - E.g. if you score a 1/3 on topic 1 on quiz 1, your score on this topic is 1/3. If you then score a perfect 3/3 on topic 1 on quiz 2, your score on this topic is 3/3.
 - In other words, there is no penalty for becoming proficient in a skill later in the course.
- 20% -- level of proficiency demonstrated throughout the course via homework
 - **If you chose not to complete homework on a topic, the entire 40% will come from the proficiency demonstrated on your quiz**

HOMEWORK

Again, homework is optional. It functions to reduce the weight of your quiz score on a particular topic. Homework will be assigned every Wednesday starting in week 2 and will always be due the following Sunday at 11:59pm (Vancouver time). You may redo the homework assignment as many times as you'd like within this period. Only the highest score will count. Note that subsequent iterations of the homework assignments may not have exactly the same questions as the first iteration. You are welcome and encouraged to collaborate with other students on the homework via the Canvas forums. You should complete the homework before attempting the quizzes.

The deadline for a homework assignment can be extended by 48 hours by redeeming 1 token. No questions asked or reasons needed. (The only exception to this may be the final homework assignment, depending on when the final exam is scheduled. I won't allow homework to be extended beyond the final exam.)

QUIZZES

You will be assigned 4 quizzes throughout the course. Quizzes will be assigned on a Wednesday and must be completed by the following Sunday at 11:59pm (Vancouver time). The quizzes can be taken at any point in this period.

The first 3 quizzes will each cover 3 new topics plus all previous topics. The 4th quiz will cover all 9 topics. ***You only need to complete the questions on topics for which you have not previously demonstrated adequate proficiency.*** The quizzes will be structured as follows:

- Quiz 1: Topics 1-3 (Logic and Symbolization Fundamentals)
- Quiz 2: Topics 1-6 (Truth-functional Logic)
- Quiz 3: Topics 1-9 (First-order Logic)
- Quiz 4: Topics 1-9
- For each quiz, you only need to complete the questions designated for topics that you have not previously completely mastered. **You choose which topics you want to attempt on each quiz.**
- If you fully master all 9 topics on the first 3 quizzes, you need not attempt quiz 4 at all.

They will be timed and must be completed in a single sitting (if you frequently have internet connectivity issues, please reach out beforehand and we can make arrangements). **Note:** while each quiz covers 3 more topics than the previous quiz, the time allocated to each quiz will *not* increase proportionally (e.g. quiz 2 won't have double the amount of time as quiz 1). The reason for this is primarily that you should be focusing your practice on several skills that you wish to better understand and attempting to hone a deeper proficiency of those skills, rather than trying to attain more superficial mastery of many skills.

- For example, say you demonstrate full, E-level proficiency on topics 1 and 2 and M-level proficiency on topic 3 on the first quiz. You don't need to complete questions on topics 1 and 2 on quiz 2 since you've already demonstrated fully proficiency.
- You now need to choose which topics to attempt on quiz 2:
 - You may be happy with an E on topic 3, so decide to only attempt questions on topics 4-6 during quiz 2.
 - You may attempt all 4 that you haven't demonstrated full proficiency in (topics 3-6).
 - Given the time limit for quiz 2, you may decide that you want to focus on demonstrating full proficiency in topics 3-5 or just 3 and 4.
 - Ultimately, it depends on how much time you think you need to demonstrate proficiency in a topic by answering each question on that topic accurately.

FINAL EXAM

The final exam will take place during the officially designated final exam period (TBD). The format will mimic quiz 4 and it will cover all 9 units. Your proficiency of each topic will be ranked on the EMRN scale just like the quizzes. The depth of proficiency you demonstrate for each topic on the final exam will constitute 60% of your grade for that topic. You should attempt each topic, regardless of whether you demonstrated proficiency on the quizzes.

ATTENDANCE

Attendance is heavily encouraged, but not required. You will be granted a token for each full week of class you attend the full duration of the class and participate (5 possible full weeks). All lectures will be recorded and made available to watch on Canvas (through Collaborate Ultra).

FORUM POSTS

One objective of this course is the development of collaborative study habits. You are expected to ask clear questions about the course material and homework in class and on the discussion board, as well as to explain topics to and answer questions from your peers. For each response to a question you post on the forums that receives 3+ upvotes/likes, you will receive one token.

TOKENS

Tokens allow you to bend the rules of the course in several particular ways. **All students begin with 3 tokens** but can attain more in a variety of ways. I'll keep a running total of your tokens in the Canvas gradebook (in a column that doesn't impact your final grade).

You can spend tokens in the following ways:

- Extend any deadline (except for the final exam) by 48 hours. No questions asked. No explanations needed. Just email me to tell me you'd like to extend it and which assignment you want to extend.
- Retake questions on one topic from a quiz once, up to two weeks after the deadline (the exception being that you cannot extend beyond the final exam). You need to have previously attempted the quiz to retake it. Retakes will have different questions than the original. You will have one week to complete the retake. Email me with the quiz/topic you'd like retake.

You can earn additional tokens in the following ways:

- Successfully complete an extra credit problem (1 token per EC problem = 5 max)
 - Beginning in week 2, an extra credit problem will be assigned on Wednesday, which is due the following Sunday at 11:59pm PST
- Answer a question posed on the forums and receive 3+ upvotes on your response
- Attend a full week of live classes (Monday and Wednesday) and participate in asking/answering questions or doing practice problems (1 token for full week. 5 full weeks of class = 5 max)

COURSE PROFICIENCIES

The 9 core topics that you're expected to demonstrate proficiency in by the end of the course as listed below. The subtopics for each main topic are listed from foundational to advanced. Next to each main topic are the primary chapters that focus on that topic.

1. *Arguments and Validity in English (1-3)*

- a. Correctly state the definitions of sentences (and distinguish examples of sentences that are or are not examples in logic), logical consequence, validity, soundness, equivalence, and joint possibility of English sentences and arguments.
- b. Identify premises and conclusions
- c. Define necessary truth, falsehood, contingency, and necessarily equivalence
- d. Correctly assess an English argument for validity and English statements for necessary truth, falsehood, equivalence, and contingency
- e. Clearly and cogently explain why an argument is or is not valid.

2. *Informal Fallacies*

- a. Identify examples of each formal and informal fallacy and distinguish between formal and informal fallacies
- b. Correctly define any of the formal and informal fallacies discussed
- c. Construct novel examples of any of the formal and informal fallacies discussed

3. *Symbolization in Truth-functional Logic (4-7)*

- a. Correctly symbolize English sentences involving basic connectives (negation, conjunction, disjunction, conditional, biconditional) given a symbolization key
- b. Correctly symbolize English sentences involving more complex connectives (e.g. "unless", "neither...nor...", exclusive "or") given a symbolization key
- c. Correctly symbolize all of the English sentences in an argument and construct your own symbolization key
- d. Identify the main connective of a sentence and the scope of each connective in a sentence

- e. Recognize English sentences that are ambiguous and symbolize different readings in TFL
- 4. Core Logic Concepts in TFL (8-13)**
- a. Correctly state the definitions of truth functional, contradiction, entailment, equivalence, joint satisfiability, and tautology in TFL
 - b. Correctly and cogently explain relationships between entailment, satisfiability, equivalence, and tautologies.
 - c. Correctly and cogently explain and give examples of indicative conditionals vs subjective conditionals
- 5. Truth Tables (8-13)**
- a. Construct the complete truth table for a sentence or sentences in TFL
 - b. Use a truth table to determine entailment, satisfiability, equivalence, and tautologies, and to find satisfying valuations
 - c. Determine whether a complete or a partial truth table is needed to demonstrate the concepts in (b) and construct a partial truth table when appropriate
- 6. Proofs in TFL (14-20)**
- a. Correctly state the definition of formal proof, sub-proof, theorem, provably equivalent/inconsistent/consistent/valid, syntactic contradiction, and syntactically contingent
 - b. Give correct formal proofs of arguments involving and, or, if without nested sub-proofs
 - c. Give correct formal proofs of arguments and theorems involving and, or, if, not and nested sub-proofs, using proof construction strategies
 - d. Demonstrate whether a sentence or sentences is a theorem, contradiction, jointly consistent, valid using a derivation or a truth table.
 - e. Give correct formal proofs of theorems requiring the IP rule
- 7. Symbolization in FOL (21-26)**
- a. Correctly symbolize sentences and arguments without nested quantifiers and with many-placed predicates
 - b. Correctly symbolize sentences and arguments involving identity, at least, at most, exactly
 - c. Identify free and bound variables; explain scope in FOL
 - d. Correctly and cogently explain why a symbolization of a sentence or argument is a good symbolization or a bad symbolization
- 8. Interpretation in FOL (27-31)**
- a. Determine whether sentences are true or false given an interpretation (including a diagrammatic interpretation)
 - b. Provide interpretations of a sentence to demonstrate that the sentence is not a validity or a contradiction, that a pair of sentences are not logically equivalent or are jointly satisfiable, that an argument is invalid
 - c. Clearly and cogently explain why a single interpretation or counter-interpretation suffices or if we must reason about all interpretations to demonstrate validity, a contradiction, equivalence, satisfiability, validity, and entailment
- 9. Proofs in First-order Logic (31-37)**
- a. Correctly complete formal proofs with quantifiers given justifications or sentences.
 - b. Prove whether a pair of sentences is provably equivalent or give an interpretation to show that they are not. Prove whether an argument is valid or give an interpretation to show that it is invalid.
 - c. Correctly construct formal proofs of arguments not requiring IP.
 - d. Correctly construct formal proofs of requiring IP.

ADDITIONAL INFORMATION AND RESOURCES

LECTURE RECORDINGS

For a variety of reasons, including potential time zone issues or technical issues, each lecture will be recorded in Collaborate Ultra. Recordings will only be available to other students within the course and will not be distributed or used more broadly. If you wish to not appear in the recording, please keep your microphone and camera off during lecture.

CLASS STRUCTURE

Summer courses are dense, sadly, and require moving at a faster pace than a normal semester. Each class is meant to approximate a week of normal semester coursework, so staying on top of the readings, and attending every class is essential. While little is to be done about the structure, it must be recognized that doing any single task, much less logic, for three hours is nearly impossible.

While I ask that you be available for the entire class period, in practice, our classes will generally be closer to 1.5-2 hours with a short break in the middle.

OFFICE HOURS, AKA: COME CHAT WITH ME!

You are warmly encouraged to attend office hours. They will be held virtually, in the general course classroom in Collaborate Ultra. I am looking forward to discussing topics pertaining to the course, but also any other philosophical or intellectual issue that interests you. Talking in person is often a good way to clarify doubts or confusions you may have, it's quicker than emailing, and it's fun! If you can't come to regularly scheduled office hours, please email me and we'll find a time.

LATE ASSIGNMENT POLICY

It is important to submit your work on time; however, I am happy to consider reasonable requests for extensions (only if the request is approved before the assignment is due). Otherwise, late homework and extra credit assignments are not accepted. Quizzes and midterms must be completed during the scheduled period, unless prior arrangements are made. You may use tokens to extend deadlines for assignments, no questions asked.

ACCESSIBILITY

Academic accommodations help students with a disability or ongoing medical condition overcome challenges that may affect their academic success. Students requiring academic accommodations must register with the Centre for Accessibility (previously known as Access & Diversity). The Centre will determine that student's eligibility for accommodations in accordance with Policy 73: Academic Accommodation for Students with Disabilities. Academic accommodations are not determined by your instructors, and instructors should not ask you about the nature of your disability or ongoing medical condition, or request copies of your disability documentation. However, your instructor may consult with the Centre for Accessibility should the accommodations affect the essential learning outcomes of a course.

Please note that you are welcome to discuss accessibility related accommodations with me without official documentation and I will make every effort to accommodate.

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Instructor-generated course material (e.g., handouts, outlines, summaries, exam questions, etc.), including material posted on Canvas are protected by law and may not be copied or distributed in any form or in any medium without explicit permission of the instructor.

CONFLICTING RESPONSIBILITIES

UBC recognizes that students may occasionally have conflicting responsibilities that affect their ability to attend class or examinations. These may include: representing the University, the province or the country in a competition or performance; serving in the Canadian military; or observing a religious rite. They may also include a change in a student's situation that unexpectedly requires that student to work or take responsibility for the care of a family member, if these were not pre-existing situations at the start of term.

Students with conflicting responsibilities have a duty to arrange their course schedules so as to avoid, as much as possible, any conflicts with course requirements. As soon as conflicting responsibilities arise, students must notify either their instructor(s) or their Faculty Advising Office (e.g. Arts Academic Advising), and can request academic concession. Instructors may not be able to comply with all such requests if the academic standards and integrity of the course or program would be compromised.

Varsity student-athletes should discuss any anticipated and unavoidable regular-season absences with the instructor at the start of term, and provide notice of playoff or championship absences in writing as soon as dates are confirmed.

Religious observance may preclude attending classes or examinations at certain times. In accordance with the UBC Policy on Religious Holidays, students who wish to be accommodated for religious reasons must notify their instructors in writing at least two weeks in advance. Instructors provide opportunity for such students to make up work or examinations missed without penalty.

UBC VALUES STATEMENT

UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious and cultural observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions. Details of the policies and how to access support are available here (<https://senate.ubc.ca/policiesresources-support-student-success>)

PLAGIARISM

Plagiarism, which is intellectual theft, occurs where an individual submits or presents the oral or written work of another person as his or her own. Scholarship quite properly rests upon examining and referring to the thoughts and writings of others. However, when another person's words (i.e. phrases, sentences, or paragraphs), ideas, or entire works are used, the author must be acknowledged in the text, in footnotes, in endnotes, or in another accepted form of academic citation. Where direct quotations are made, they must be clearly delineated (for example, within quotation marks or separately indented). Failure to provide proper attribution is plagiarism because it represents someone else's work as one's own. Plagiarism should not occur in submitted drafts or final works. A student who seeks assistance from a tutor or other scholastic aids must ensure that the work submitted is the student's own. Students are responsible for ensuring that any work submitted does not constitute plagiarism. Students who are in any doubt as to what constitutes plagiarism should consult their instructor before handing in any assignments.

A link about Academic misconduct is below

<http://www.calendar.ubc.ca/Vancouver/index.cfm?tree=3,54,111,959>