

INTRODUCTION TO SYMBOLIC LOGIC

PHIL012.002 • Fall 2012 • MWF 10.10–11 • 265 Willard Bldg

PHIL012.003 • Fall 2012 • MWF 12.20–1:10 • 132 Electrical Eng East

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COURSE DESCRIPTION

This is an introductory course in symbolic logic. *Logic* is the science of correct reasoning. *Symbolic logic* is a particular branch of logic that studies correct reasoning using a formal language. This course will articulate the symbols, syntax, semantics, and proof procedures of two different formal languages: the language of propositional logic and the language of predicate logic. That is, we will learn (i) the key symbols of each language along with the grammatical (syntactic) rules for forming expressions in these languages, (ii) how to interpret the meaning of these symbols, (iii) how to represent English sentences in these formal languages, (iv) how to use these formal languages to test whether arguments are valid (or invalid), and (v) how to prove that a conclusion follows from a set of premises using a set of inferential (derivation) rules.

COURSE OVERVIEW

REQUIRED TEXTS

1. Agler, David W. *An Introduction to Symbolic Logic: Syntax, Semantics, and Proof*. Check course website for further details (available at the [Student Book Store](#)).

COURSE OBJECTIVES

- **Critical Reasoning Skills:** Students will learn certain fundamental features of language and argument analysis, which will allow them to identify arguments, isolate the premises and conclusion of these arguments, and represent language using a formal language.
- **Analytical Reasoning Skills:** Students will develop a specialized set of skills that will allow them to reason using a formal language. This language will also allow them to mechanically determine various logical properties of sentences, sets of sentences, and arguments. Students will develop a general set of skills that allow them to analyze and assess a variety of different arguments, deciding whether the arguments are properly supported, fallacious, or valid.
- **Dialogue:** Students will engage in respectful conversation with classmates as well as collaborate with their peers to better learn logic.
- **Oral Expression:** Students will learn how to clearly articulate and represent various arguments as well as convey the process (or strategies) by which certain conclusions are reached.

COURSE WORK

- **Five Exams (15% each):** The course will have five exams throughout the semester. A sample exam and additional test questions are available via ANGEL. It is strongly advised that you review the practice exam before each exam to prepare.
- **Five Examinations of Homework Notebooks (5% each):** On the day each exam is due, you are required to submit an organized set of your homework (e.g. in a *notebook* or a *stapled set of papers*). Homework consists of a set of exercises that are distributed via ANGEL (the folder is titled *Weekly Agenda Handout*). Your 'logic notebook' will be graded primarily for *completeness*. That is, full credit will be awarded provided you put forward an effort on *every* problem in the set of exercises. Partial credit will be awarded provided you completed the majority of the exercises.

EXTRA CREDIT

- **The Logic Murder Mystery Game & Logic Review Games, TBD:** These are various review games that we will play in class. You will have the opportunity to gain extra credit.
- **Board Wars, TBD:** Before a number of exams (particular Exam 3), students will be divided into groups, two groups will be asked to come to the board, will be assigned a somewhat difficult problem to solve, and will race to complete the problem before the other group completes theirs. As soon as a group is confident that they have completed a problem, a representative from the group says “done” and the rival group will be given the opportunity to review the answer. If the rival group cannot find any mistake in the problem, then the group that has completed their problem first is awarded points. If the rival group finds a mistake in the problem, then the rival group is awarded points.
- **Electric Switching Circuit (Logic Gates), 5pts to any Exam Score:** One practical application of logic is that the truth-conditional language of propositional logic can be used to represent complex electrical switching circuits. An *electric switching circuit* is a circuit consisting of a power source (e.g. a battery), a resistor (e.g. a light bulb), a set of switches, and a set of wires that connect the power source, the resistor, and the switches. If we consider a circuit with a light bulb, when there is current flowing through the circuit, the light bulb is *on* and when current is not flowing through the circuit, the light bulb is *off*. Similarly, a propositional formula is *true* or *false* given the valuation of its parts and the truth-functional rules associated with truth-functional operators. For example, take a simple circuit that consists of only one switch. This sort of circuit can be represented by ‘P’ for when ‘P’ is true (that is the switch is down), the light bulb is *on*. When ‘P’ is false (that is the switch is up), the light bulb is *off*. Now suppose a complex circuit consisting of two switches such that then the light bulb is *on* if and only if at least one switch is down. Representing the first switch as ‘P’ and the second switch as ‘R’, the conditions under which the light bulb is *on* can be represented by the conditions under which the formula ‘ $P \vee R$ ’ is true. A third example is a complex circuit consisting of two switches where the circuit is *on* if and only if both switches are in the down position. The conditions under which the circuit in on are analogous to the conditions under which ‘ $P \wedge R$ ’ is true. Students can receive ten points added to their grade if and only if (i) they build a complex electrical switching circuit and (ii) they show how the circuit can be represented using the language of propositional logic. This project must be completed *before* taking Exam 5. FYI: Many step-by-step tutorials that are designed to teach children electricity are available on the web.

YAMMER & OFFICE HOURS

- *To Sign Up For Yammer:* Go to www.yammer.com/psu.edu and using your Penn State ID, join Yammer. Once you have joined yammer, join the “PHIL 012 Symbolic Logic” group. There you will be able to access and post materials, ask questions, and interact with other students taking the course.
- *Office Hours:* Your instructor will hold office hours in his office (see above) and also via *Chat* available in Yammer.com. You can find my name by searching for me or by joining the “PHIL 012 Symbolic Logic” and finding me as one of the participants.

THREE TIPS FOR SUCCESS IN PHIL012

I have a couple suggestions to help you do well in this course:

1. Practice, Practice, Practice! I can't stress how important it is to set aside some time to do the readings and practice problems *on a regular basis*. Learning logic is a lot like lifting weights (or learning a language): you can't get strong after one intense bout of lifting, you need to work at it *regularly*. Perhaps this is common sense but here are some suggestions about how to get ready for a big exam:

- a. Set aside a couple times a week where you sit down with the textbook and a pencil & paper
- b. Read a couple pages until you get to an exercise set.
- c. Try to do a problem or two without looking at the answers.
- d. Check your work to see if you were on the right track.
 - d1. If you find that you did the problems correctly. Congratulations! Now try one where there isn't an answer (if you can, contact a classmate to compare your answers).
 - d2. If you find that you didn't do the problem correctly, review the answer, figure out where you went

astray, and then take a 5 minute break to "clear your mind." Once your mind is clear, try the problem again without looking at the answer.

e. Review the *Practice Exam* and try to simulate the experience of taking the Exam. For example, sit down in a quiet room, set your watch for 50minutes, and then take the Practice Exam. Once you have completed it, contact a classmate to compare answers, or flag any problems (or sections) you were unsure about.

If you do Steps *a–d2* on a regular basis (at least 3x or 4x a week, for an 1hr), you are likely to do excellent in this course.

2. Working Hard Early in the Course Pays Off Later. The chapters in the book are not distinct modules. What you learn in one chapter will form the basis of what you learn in the next chapter. Thus, if you *really learn* the fundamentals (chapters 1–5), you will do better in the latter half of the course and you won't have to work as hard to grasp the material. Think of the beginning of the course as an investment: the harder you work at the outset, the less difficulty you will have later in the course. In fact, you may even find the latter half of the course easy!

Special Note: Chapter 5 is the most difficult chapter in this course. In managing your time, you should allot extra time and effort to this chapter.

3. Collaborate as Much as Possible: Studying with a friend or classmate can enhance your learning. They can provide a different perspective on material. I suggest that if you have any content-related questions, you post them to Yammer (<https://www.yammer.com>). You will have to search for the "PHIL012 Logic" group and request to join. Once you've done this, feel free to post content-related questions, answers to problems that you'd like feedback on, and definitely respond to the posts of your classmates.

COURSE SCHEDULE

A *Weekly Agenda Handout* will be provided via ANGEL after each exam. This handout gives detailed information about what pages to read and what exercises to complete on each day of class.

Aug 27–Sept 7	Introduction Chapter 1: Propositions, Arguments, and Logical Properties Chapter 2: Language, Syntax, and Semantics Due: Logic Notebook 1, Exam 1 (Sept 10)
Sept 10–Sept 21	Chapter 3: Truth Tables Chapter 4: Truth Trees Due: Logic Notebook 2, Exam 2 (Sept 26)
Sept 24–Oct 26	Chapter 5: Propositional Logic Derivations Due: Logic Notebook 3, Exam 3 (Oct 26)
Oct 29–Nov 16	Chapter 6: Predicate Language, Syntax, and Semantics Chapter 7: Predicate Logic Trees Due: Logic Notebook 4, Exam 4 (Nov 16)
	<i>Nov 18 – Nov 24, No Class: Thanksgiving Holiday</i>
Nov 27–Dec 14	Chapter 8: Predicate Logic Derivations Due: Logic Notebook 5, Exam 5 (Dec 14)

COURSE POLICIES

ACADEMIC MISCONDUCT

The general principles and policy relating to cheating and plagiarism, which are enforced in this class, can be found in the Penn State policy on academic misconduct. *Academic Integrity*: Academic dishonesty encompasses a wide range of activities, whether intentional or unintentional, that includes, but is not limited to: all forms of fraud, plagiarism, and any failure to cite explicitly all materials and sources used in one's work. Sanctions for these activities include, but are not limited to, failure in a course, removal from the degree program, failure in a course with an explanation in the permanent transcript of the cause for failure, suspension, and expulsion. If you are unclear about whether you or someone you know is engaging in academic misconduct, read the following: [University Statement on Academic Integrity](#). For more information, see [PSU Academic Integrity](#), [PSU ITS](#), [Plagiarism Tutor](#), [Turnitin](#), [PSU Teaching & Learning with Technology](#)

GRADE ROUNDING

Grades will be rounded up from the *second* decimal point, e.g. 90.95 rounds up to 91.0 while 90.94 rounds down to 90.90. In the event that eLION does not allow for a particular grade (e.g. D+), you will simply be given the letter grade (e.g. if you have a D+ then you will receive a D, and if you have a C-, you will receive a C).

A: 91–100%;	C+: 79.0–79.9	F: 0–59.9
A–: 90.0–90.9	C: 71.0–78.9	INCOMPLETE
B+: 89.0–89.9	C–: 70–70.9	DROP
B: 81.0–88.9	D+: 69.0–69.9	
B–: 80–80.9	D: 60.0–68.9	

LATE WORK

If you are planning on taking a **Test/Notebook** late, you will need to clear this with the instructor *before* the day and time of the test. If the instructor is not informed that you will be taking the test late, a grade reduction of one letter grade is incurred for every day the test is late. So if the due date is Tuesday at 3PM and you email me on Tuesday at 3.01PM you will lose a letter grade. You will not lose an additional letter grade until 3.01PM the next day (i.e. Wednesday).

ACCESSIBILITY STATEMENT & FURTHER STUDENT GUIDANCE

Penn State welcomes students with disabilities into the University's educational programs. If you have a disability-related need for reasonable academic adjustments in this course, contact the Office for Disability Services (ODS) at 814-863-1807 (V/TTY). For further information regarding ODS, please visit the Office for Disability Services Web site at: <http://equity.psu.edu/ods/>.

In order to receive consideration for course accommodations, you must contact ODS and provide documentation (see the documentation guidelines at <http://equity.psu.edu/ods/guidelines/documentation-guidelines>). If the documentation supports the need for academic adjustments, ODS will provide a letter identifying appropriate academic adjustments. Please share this letter and discuss the adjustments with your instructor as early in the course as possible. You must contact ODS and request academic adjustment letters at the beginning of each semester.

If you are in need of psychological counseling, please do not hesitate to contact Penn State's [Counseling & Psychological Services](#) (phone: 814-863-0395). For any problem related to your studies, university policies and procedures, do not hesitate to seek the help of the [Student Affairs Services](#), your Academic Advisor, or arrange a meeting with your instructor who will help you obtain assistance through one of the above, or another, agency.

USE OF ANGEL AND EMAIL COMMUNICATION

Please check the webpage on the [ANGEL](#) website regularly. An online version of the syllabus is available there, and you will be notified of any cancellation of a course meeting there. If you need to contact me, send a well-constructed email to my email address with an appropriate subject line (e.g. P120 Question) and with an appropriate address (e.g. "Dear David"). Failure to do either, or emailing me with multiple links attached ("check this youtube link") will result in your instructor deleting your email. Students are responsible for activity on their computer accounts so only send emails pertinent to the course. Also, please do not send correspondence from cellular telephones (e.g. Blackberries, etc.).

TUTORING, DROP PROCEDURES, AND INCOMPLETES

Through the course of the semester, you may decide you need additional tutoring. There are two ways to receive additional assistance in this course. The *first* is to request a private tutor through [Penn State Learning](#). At their website, go to the “Resources” page, and click “Engage a Private Tutor” to request a tutor for this course. Unfortunately, there is not always a tutor available for this course. The *second*, and more likely, is to contact one of the following students (who have taken this course in the past) and negotiate a price for private tutoring:

Dan Freed: djf5145 [a t] psu.edu

Jianghanhan Li (“Han”): jql5503 [a t] psu.edu

Students who simply stop attending class, for whatever reason, without officially withdrawing from the course, will receive the grade of F. If you expect a refund, be aware that the date the withdrawal form is processed by Penn State registrar’s office determines the amount of refund. Consult the Register site for [drop procedures](#). Consult the Handbook for taking an [Incomplete \(D/F\)](#). Before considering dropping the course or taking an incomplete, you might consider getting additional help: [Information Literacy Tutorial](#), [University Learning Center](#), [Writing Center](#)

CLASSROOM ENVIRONMENT

A number of factors figure into creating a healthy classroom environment. In order to facilitate such an environment, I ask you to obey the following: (1) the use of cell phones in any capacity is prohibited (please turn ringers/buzzers off, no text-messaging during class), (2) please do not begin to ‘pack up’ your belongings before your instructor has *explicitly* dismissed you, (3) please come to class rested, sleeping in class is strictly prohibited, (4) please do not do other work in class. If you are incapable of performing (1)–(4) or are disruptive in class, you will kindly be asked to leave the classroom.

CHALLENGE EXAMINATION

For some courses, students may request a [challenge examination](#) as a substitute for completing the usual requirements of a course. If the examination is successfully completed the credits received are described as “credits by examination” ([policy 42-50](#)).

First Update: 8/13/2012; Second Update: 8/21/2012; 9/13/2012