FACULTY OF ARTS
DEPARTMENT OF PHILOSOPHY

PHIL 695.2 — "Graduate Directed Reading: Proof Theory"

Fall Term 2017

Course Outline

Instructor:	Richard Zach
Office:	1248A Social Sciences
Phone:	(403) 220–3170 **Email:** rzach@ucalgary.ca
Office Hours:	by appointment

Course Description

Formal proofs in logic and mathematical systems play an important role in several areas of analytic philosophy, including the philosophy of logic and the philosophy of mathematics. The study of formal proofs is the subject of proof theory. It investigates the structure, length, and complexity of formal proofs, operations on formal proofs, relationships between formal proofs in various different proof systems such as the sequent calculus and natural deduction, and special forms formal proofs can have. Formal proofs of theorems in mathematical systems have been used to account for the meaning and truth of these theorems. Proof theoretic results such as consistency proofs have been used for philo-sophical aims such as to account for the security of mathematical knowledge or to argue for or against various positions in the philosophy of mathematics such as in strumentalism or the so-called indispensability arguments.

In this course we will study some of the basic methods and results in proof theory. This will include a study of the sequent calculus and the cut-elimination theorem, of natural deduction systems and normal form theorems, and formalizations of mathematics and consistency proofs. The approach will be in part historical: we will study the pioneering work of Gerhard Gentzen in the 1930s and its context in the development of logic and metamathematics.

Proof theory also has important applications outside of philosophy: in mathematics, computer science, and linguistics. We will touch on some of these applications, depending on student interest.

Prerequisites

Phil 279 (Logic I) is a prerequisite for this course.

Readings

Readings will be made available electronically.

Requirements and Evaluation

Course Requirements. Two homework assignments (40%, 20% each) and a final paper (60%) are required to pass the course. There will be no exams.

Final Project. The final project will be due on Monday, December 12, 2017. A project will consist in either a worked out presentation of an advanced topic (e.g., a proof of a proof-theoretic result, a survey article on some application of proof theory in mathematics, computer science, or linguistics), or a philosophical paper on a topic related to proof theory. A technical project should run about 10–15 pages; a more philosophical paper 15–20 pages.

The evaluation of your final paper will take into account the difficulty of the chosen topic, the amount and quality of research evident in it, and the quality, clarity, and precision of your exposition. Your writing and the grading thereof is a factor in the evaluation of your work for this course.

Evaluation and Grades. On each assignment you will receive a letter grade reflecting the level of comprehension of the readings and your ability to assess philosophical arguments shown by the work you submit. There will be no $+/-$ grades, but "slash" grades (e.g., A/B) are possible. The meanings of letter grades are defined in the *Calendar* as follows:

A Excellent—superior performance, showing comprehensive understanding of subject matter.

B Good—clearly above average performance with knowledge of subject matter generally complete.

C Satisfactory—basic understanding of the subject matter.

D Minimal pass—marginal performance.

F Fail—Unsatisfactory performance.

In computing your final grade, your marks will be converted to grade points and averaged according to the weights given above. The correspondence of letter grades with grade points is defined in the *Calendar* (A = 4, B = 3, C = 2, D = 1, F = 0). "Slash" grades receive 0.5 below the value of the higher grade (e.g., A/B = 3.5).

The final grade will be the letter grade corresponding to the weighted average of your assignments, paper, presenation, and participation plus a margin of 0.1. For the final grade, $+$'s and $-$'s are possible, too; as defined in the *Calendar*, $+/-$ adds/subtracts 0.3 grade points. In other words, a course average of 3.9 or higher receives an A; at least 3.6 and less than 3.9, an A$-$; at least 3.2 and less than 3.6, a B+; at least 2.9 and less than 3.2,

a B; and so on. There is no D− grade; to earn a D you require a course average of at least 0.9. The A+ grade is reserved for "truly outstanding" performance.

Assignments and Policies

Late work and extensions. Assignments handed in late will be penalized by the equivalent of one grade point per calendar day, unless you can document a medical or other valid reason for why your assignment is late.

Plagiarism. You will find the University policy on plagiarism at the end of this outline. Plagiarism is a very serious academic offense. It is *not limited* to copying papers wholesale from the Internet; close paraphrase of the texts, of the lectures, or of anyone (other than you) without attribution constitutes plagiarism. Your assignments should only contain your own formulations. When in doubt, consult with the instructor. **Plagiarism will result in a failing grade on the assignment or in the course and a report to the Dean's office.**

Checking your grades and reappraisals of work. University policies for reappraisal of term work and final grades apply (see the *Calendar* section "Reappraisal of Grades and Academic Appeals"). In particular, term work will only be reappraised within 15 days of the date you are advised of your marks. Please keep track of your assignments (make sure to pick them up in lecture or in office hours) and your marks (check them on the website) and compare them with the graded work returned to you.

Academic Honesty

Cheating or plagiarism on any assignment or examination is regarded as an extremely serious academic offense, the penalty for which may be an F on the assignment, an F in the course, academic probation, or requirement to withdraw from the University. See the relevant sections on 'Academic Misconduct' in the current University Calendar. 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 correct referencing, consult your instructor.

Academic Accommodation

It is the student's responsibility to request academic accommodation. If you are a student with a permanent disability or temporary impairment who may require academic accommodation,you must first register with Student Accessibility Services, located in MacEwan Student Centre 452; phone 403–220–8237; email access@ucalgary.ca. Students who have not registered with Student Accessibility Services 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. Go to http://www.ucalgary.ca/access/for further information.

Blackboard Help

Go to http://www.ucalgary.ca/computersupport/onlineservices/blackboard for Student Help and FAQs about Blackboard. Troubleshooting tips and a tutorial are available at http://elearn. ucalgary.ca/blackboard/students.

Protection of Privacy

The University of Calgary is under the jurisdiction of the provincial Freedom of Information and Protection of Privacy (FOIP) Act. 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.

Safewalk

Call 403-220-5333 (24/7/365) for a Safewalk volunteer to accompany you safely to your destination on campus including parking lots, housing, and the LRT station or use a Campus Help Phone.