

**Philosophy 240**  
**Introduction to Formal Logic**  
**Fall Term, 2008**

**Time:** 10:00–11:20 Tues., Thurs.  
**Place:** DWE 1515  
**Professor:** David DeVidi  
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When people arrive at implausible conclusions, it is common to say they are being “illogical.” This everyday use of the word takes being illogical to be the same thing as engaging in bad thinking. Roughly speaking, bad thinking comes in two flavours: relying on bad information (“DeVidi is a platypus, platypuses originate in Australia, therefore his ancestors are from Australia”) and making bad inferences (“DeVidi is a philosopher, therefore he is brave and good looking”), though the two are often combined (“DeVidi is a platypus, therefore he’s brave and good looking”). Being logical, then, would seem to amount to avoiding these two sorts of errors. But a more careful use of “logic” restricts it to avoiding the second sort of error, and that’s what we’ll do in this course. It is a course about good inferences, not about getting good information. We’ll be looking especially at those inferences which are, in a certain sense, the best possible—*deductive inferences*. These are the ones where the truth of the information we’re working with would *guarantee* the truth of the conclusions we draw from it. The systematic study of deductive inference is called *formal logic*.

Formal Logic is an ancient subject, going back at least to Aristotle, but for over 2000 years there was relatively little progress in logic, at least compared to other equally ancient subjects such as physics or mathematics. In the past 130 years or so, though, it has evolved and grown rapidly. Innovations and discoveries in formal logic lie at the heart of important developments in many disciplines, including cognitive science and artificial intelligence, theoretical computer science, linguistics, the foundations of mathematics, and others. Moreover, it is virtually impossible to read and understand large parts of the philosophical literature of the past 100 years without a good grasp of at least the basics of formal logic; this is most obvious in philosophy of science, philosophy of language, and epistemology, but is also true in areas like metaphysics, including meta-ethics and aesthetics.

In his *Organon*, Aristotle distinguishes two different reasons to study formal logic. You can regard it as a *tool* that helps you do a better job evaluating the reasoning of others and for improving your own. Or you can regard it as a *science* in its own right, the *science of correct inference*. This course will primarily be concerned with formal logic regarded as the science of correct inference. The systems of logic we will consider are *theories* about correct inference. As with any theory, the first step is to gain an *understanding the theory*, and the bulk of our efforts will be devoted to helping students gain such an understand. But, as theories, it is appropriate to ask about them the sorts of questions one can ask about any theory: What evidence do we have that they are correct? To what range of phenomena do they apply? What idealizations are we making in supposing

them to apply? If we produce a justification for belief in the correctness of the system, how do we know that the reasoning we use in our justification is correct if the inferences in the justification are part of the system? We shall also devote some attention to such theoretical and philosophical issues along the way.

We will begin with a short introduction to the basic concepts of logic, such as *consistency*, *validity*, and *logical truth*. The bulk of the course will introduce students to the two most widely used and discussed logical systems, namely classical propositional logic (which is also called classical *sentential* logic, or *truth-functional* logic) and classical predicate logic. If an ideal logical system would capture all (and only) the correct patterns of inference, each of these systems can be regarded as an approximation to this ideal which captures *some* but *not all* valid patterns of inference. For each system we will study: the relationship between the language of the system and ordinary languages like English; the relationship between validity in the system and logical validity; and various methods for showing validity (such as proof procedures) and invalidity (including semantic methods for producing counter-examples) of patterns of inference. We will conclude with a brief introduction to some of the metalogical concepts, such as *soundness* and *completeness*, that are the core of many more advanced studies in logic.

### **Required Text:**

Merrie Bergman, James Moor and Jack Nelson, *The Logic Book* (Fifth Edition), McGraw-Hill, 2008.  
(The text comes with a CD that includes answers to many questions from the text.)

### **Course Requirements:**

There will be four equally weighted in-class tests (Sept 25, Oct 14, Oct 30, and Nov. 18) and a final exam (during the final exam period). Each of the four in-class tests will cover material from the corresponding section of the course. The final will cover material from section five of the course, but also material from the earlier sections of the course.

Four in class tests:	60%
Final exam:	40%

Each week several exercises will be suggested as homework, and a large part of most Thursday session will be devoted to working through examples. Much of the material we will cover is most easily learned by doing exercises, so students should not expect to do well on the tests or exam if they are not doing this homework regularly. Note that much of the material in this course is cumulative, so students should be sure to clear up any confusions as soon as they arise—otherwise they might find that the confusion is cumulative, too!

### **Course Structure:**

The course is in five parts. The goal is to deal with each part in the corresponding time slot defined by the four tests and the final exam, though this can only be an approximate guide as we will speed up and slow down depending on how class members are getting along with the material. The list of readings may be adjusted slightly early in the term, as this list was put together using the fourth edition of the text, as the instructor's copy of the fifth edition had not arrived yet when this outline was put together.

1. Basic logical concepts; Sentential logic: symbolization and syntax; truth-functional semantics

and truth-tables.

*Readings:* Chapter 1-3.

2. Proofs in sentential logic: Trees and derivations in SD.  
*Readings:* Chapter 4 and 5.
3. Sentential Logic: Philosophical considerations and meta-theory.  
*Readings:* Chapter 6.
4. Predicate logic: symbolization, syntax, semantics.  
*Readings:* Chapters 7 and 8.
5. Proofs in Predicate Logic, philosophical considerations.  
*Readings:* Chapter 9, selections from Chapter 11.

### **Rescheduling of quizzes, tests and exams:**

If a student cannot write a test or exam at the scheduled time, he or she should be prepared to supply documentation that gives a legitimate excuse, or a mark of zero will be given for that test or exam. For medical excuses, the rule of thumb will be that if you are too sick to write, then you are ill enough to go to the doctor, so a note *from a doctor* will be expected. In the case of students who have legitimate reasons for not writing at the scheduled time, appropriate alternative arrangements will be worked out between the instructor and the student. **In all such cases, students should be in touch before the test or exam to make special arrangements unless there are compelling reasons for not doing so.**

This term, **the final exam period runs from Dec. 5 to Dec. 19.** Exactly when the exam for this course will be will not be determined until some time in the middle of the term. Note that UW practice is that student travel plans are not acceptable grounds for granting an alternative final examination time (see <http://www.registrar.uwaterloo.ca/exams/finalexams.html>).

**Note on Avoidance of Academic Offenses:** Because the University of Waterloo and the Faculty of Arts are committed to maintaining high standards and an atmosphere of free inquiry, we are committed to defending academic integrity and trust. One part of this is that cheating or other academic misconduct are regarded as very serious matters with serious consequences. It is therefore a requirement that all course outlines in the Faculty of Arts include the following statements:

**Academic Integrity:** in order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility.

**Grievance:** A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70 - Student Petitions and Grievances, Section 4, <http://www.adm.uwaterloo.ca/infosec/Policies/policy70.htm>

**Discipline:** A student is expected to know what constitutes academic integrity, to avoid committing academic offenses, and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offense, or who needs help in learning how to avoid offenses (e.g., plagiarism,

cheating) or about “rules” for group work/collaboration should seek guidance from the course professor, academic advisor, or the Undergraduate Associate Dean. When misconduct has been found to have occurred, disciplinary penalties will be imposed under Policy 71 – Student Discipline. For information on categories of offenses and types of penalties, students should refer to Policy 71 - Student Discipline, <http://www.adm.uwaterloo.ca/infosec/Policies/policy71.htm>

**Appeals:** A student may appeal the finding and/or penalty in a decision made under Policy 70 - Student Petitions and Grievances (other than regarding a petition) or Policy 71 - Student Discipline if a ground for an appeal can be established. Read Policy 72 - Student Appeals, <http://www.adm.uwaterloo.ca/infosec/Policies/policy72.htm>

**Note for students with disabilities:**

The Office for Persons with Disabilities (OPD), located in Needles Hall, Room 1132, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the OPD at the beginning of each academic term.