

Intermediate Logic (PHIL/CS/MATH 4/51038)

Deborah (Dr. Deb) Smith, Professor of Philosophy

Fall, 2024

TR 3:45-5:00 EST

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Office Hours: TR 3:00-3:45, 5:00-5:30, and by appointment

<http://www.kent.edu/philosophy>

Required Texts and Readings:

John Nolt, *Logics* (Revised and Updated 2022)-available in Canvas
Course Handouts

Course Description: This course is a detailed, systematic study of symbolic logic for philosophy majors, mathematics majors, computer science majors, and anyone else interested in advanced study in logic. The aim of the course is twofold: first, to develop a facility in understanding and using symbolic logic for various purposes, and second, to understand and appreciate symbolic logic as an area of study in itself. Topics will include the definition of a well-formed formula, the syntax/semantics distinction, the distinction between object-level (syntactic) and meta-level (semantic) proofs, and the soundness, completeness, and undecidability of the predicate calculus. Although the language of first-order predicate calculus will be our main focus, we will also explore various ways to enrich the language with identity, function symbols, and with modal operators. Time permitting, we will also examine the motivations for and details of various non-classical logics.

Learning Outcomes: Students will become fluent in the syntax and semantics of first-order predicate calculus with identity and function symbols. Students will learn how to construct object-level (syntactic) proofs that a given sequent composed of sentences of the logical language is derivable and learn how to use semantic trees as a (quasi) decision procedure. Students will learn how to construct meta-level proofs demonstrating that expressions are (or are not) well-formed formulas, that well-formed formulas are (or are not) true on a given interpretation, and that sequents are (or are not) valid. Students will also become fluent in the syntax and semantics of various systems of modal logic.

NOTICE OF MY COPYRIGHT AND INTELLECTUAL PROPERTY RIGHTS.

Any intellectual property displayed or distributed to students during this course (including but not limited to PowerPoints, recordings of lectures, notes, content handouts, quizzes, examinations) by the professor remains the intellectual property of the professor. This means that the student may not distribute, publish or provide such intellectual property to any other person or entity for any reason, commercial or otherwise, without the express written permission of the professor. Additionally, students may not distribute or publish recordings and/or links to live classroom presentations, lectures, and/or class discussions.

Course Requirements:Reading:

- You are to have completed the assigned reading before class on the day for which it is assigned.
- Most of the reading assignments are listed in the Schedule of Readings and Assignments below, although I may add some additional reading assignments.
- The material we will be reading in this course is dense and can be quite technical. Expect to spend a relatively long time doing the reading.
- You should read the assigned material at least twice (once before we discuss it in class and once after) to make sure that you understand it.
- It is a good idea to work all of the problems that occur as examples in the readings as they occur. Read over the problem and Nolt's comments. Write down the problem, shut your book, and attempt the problem. Check your result against the result in the book, and continue your reading.
- It is highly recommended that you take notes on the reading and write down any questions you have so that I can answer them in class.
- *You are responsible for all material covered in the assigned readings whether or not it is explicitly covered in class.*
- You are expected to have all relevant reading materials available (including relevant handouts) during class.

Attendance:

- Attendance in this class is crucial, as it can be very difficult to pick up this material on your own. In order to motivate you to come to class regularly, I will hand out a sign-up sheet or otherwise take note of those present at the beginning of class.
- Do not make a habit of coming to class late or leaving early. This is not only disruptive to the other students, but may also cause you to miss an important part of the lecture.
- It is worth noting that mere attendance is not sufficient for success in this class; it is also extremely important that you ask questions when you have them or let me know when something I have said makes little or no sense to you.
- Make sure that phones and other electronic devices are turned off prior to the start of class. Tablets or laptops should be used only for the purpose of taking notes or accessing course materials.
- Unless you have received my explicit permission to do so, refrain from recording the lecture in any way.
- If, for any reason, you cannot avoid missing a class meeting, it is your responsibility to contact me before the class so that we can arrange for you to make up any assignments scheduled for that day. I also highly recommend that you borrow lecture notes from a classmate should you miss a class.
- In the event of a campus closure or instructor quarantine/isolation, we will meet virtually via Teams. You will be informed of such an occurrence via email and provided a Teams link.
- From time to time and for various reasons (e.g., university closure, instructor illness, to catch up if we fall too far behind, to cover material required for 51038 students), I may record a lecture and post it in Canvas. Students will be notified of any posted recordings via email and are expected to view such recordings prior to the next in-person class.

- *You are responsible for all material covered in lecture whether or not it is explicitly covered in the readings.*

Graded Material for Phil/Math/CS 41038:

Homework Assignments:

- There will be 12 homework assignments each worth 20 points.
- Problems will be handed out at least one week in advance of the due date.
- Due dates for each are listed below and included on the homework set.
- Hard copies of the homework assignments are to be handed in at the beginning of class on the day on which they are due.
- Unexcused, late homework will be docked 5 points if handed in one class day late and will not be accepted for credit afterward.

Exams:

- There will be two unit exams and a final each worth 120 points.
- The unit exams will likely be take-home exams handed out at least one week in advance of the due date.
- Due dates for each are listed below.
- Late take-home exams will not be accepted.

Graded Material for Phil/Math/CS 51038:

The graded material for the 51045 course consists of a super set of the graded material for the 41038 course (see the above description). The differences and additions are as follows:

- *Reading:* In at least a few cases, reading that is merely recommended for students in 41038 will be required of students in 51038. These additional required readings are clearly marked in the schedule of readings and assignments.
- *Homework:* In at least a few cases, students in 51038 can expect slightly different homework questions (usually more challenging ones) than those given to 41038 students.
- *Unit Exams and Final Exam:* There will be a great deal of overlap between the exams for 41038 and those for 51038. However there will be additional exam questions on material covered by the readings for students in 51038.

Grades and Grading:

Final grades will be based on the curve determined by the 600 possible points and influenced somewhat by the standard scale where 90-100%=A range, 80-89%=B range, 70-79%=C range, 60-69%=D range, and 0-59%=F.

Please note that I do not use Canvas' grade book function. If you have any questions about your grade at any time, don't hesitate to ask me.

While there are no explicit points toward the final grade for attendance and participation, both will factor into my decision concerning, e.g., whether to give a borderline student an A- or a B+.

There are no extra credit points available. *Come see me during office hours or schedule an appointment as soon as you feel that you are having difficulty with any of the course material.*

Schedule of Readings and Assignments:

(This schedule is tentative. You are responsible for knowing about any announced changes.)

Week 1 (August 18-24):

T *Introductions and Preliminaries; What is Logic?*
Reading: *Logics*, Chapter 1

PROPOSITIONAL LOGIC:

R *Basic Syntax and Semantics*
Reading: Chapter 2
Homework 1 (see handout): Due at the beginning of class on Thursday of Week 2

Week 2 (August 25-August 31):

T *Continue Basic Syntax and Semantics; Primitive Rules of Derivation*
Reading: Chapter 3.1

R *Continue Primitive Rules of Derivation*
Reading: Chapter 4.1-4.3
Homework 2 (see handout): Due at the beginning of class on Thursday of Week 3

Week 3 (September 1-7):

T *Complex Strategies for Derivations*
Reading 51038: Chapter 5.1 (see the definition of ‘consistent’ on p. 46)

R *Continue Complex Strategies for Derivations*
Reading 51038: Chapter 5.2-5.4

Week 4 (September 8-14):

T *Theorems and Derived Rules*
Reading: Chapter 4.4
Homework 3 (see handout): Due at the beginning of class on Tuesday of Week 5

R *Continue Theorems and Derived rules*
Reading 51038: Chapter 4.5, 5.5 and 5.6

Week 5 (September 15-21):

T *Valuation Rules and Decision Procedures*
Reading: Chapter 3

Week 5 continued:

- R *Continue Decision Procedures; Catch-up and Review*
Reading 51038: Chapter 5.7-5.10
Homework 4 (see handout): Due at the beginning of class on Tuesday of Week 6
Take Home Exam 1: made available—due Tuesday, October 1st

FIRST ORDER PREDICATE LOGIC WITH IDENTITYWeek 6 (September 22-28):

- T *Formation Rules*
Reading: Chapter 6
- R *Continue Formation Rules*
Reading 51038: Chapter 9.4
Homework 5 (see handout): Due at the beginning of class on Tuesday of Week 8

Week 7 (September 29-October 5):

- T *Continue Formation Rules; Primitive Quantificational Rules of Derivation*
Take Home Exam 1 due at the beginning of class October 1st
- R **No Class October 3rd—Fall Break**

Week 8 (October 6-12):

- T *Continue Primitive Quantificational Rules of Derivation*
Reading: Chapter 8.1-8.4
Reading 51038: Chapter 10.1-10.2
- R *Primitive Quantificational Rules of Derivation; Rules Governing the Identity Predicate and Function Symbols*
Reading: Chapter 8.5-8.6
Homework 6 (see handout): Due at the beginning of class on Thursday of Week 9

Week 9 (October 13-19):

- T *Continue Rules Governing the Identity Predicate and Function Symbols*
Homework 7 (see handout): Due at the beginning of class on Tuesday of Week 10
Reading 51038: Chapter 10.4-10.5
- R *Set Theoretic Semantics*
Reading: Chapter 7.1-7.2
Reading 51038: Chapter 10.6-10.7
Homework 8 (see handout): Due at the beginning of class on Tuesday of Week 11

Week 10 (October 20-26):

T *Continue Set Theoretic Semantics*
Reading: Chapter 7.3

R *Quasi Decision Procedures*
Reading: Chapter 7.4
Reading 51038: Chapter 9.1-9.3
Homework 9 (see handout): Due at the beginning of class on Thursday of Week 11

Week 11 (October 27-November 2):

T *Continue Quasi Decision Procedures; Soundness, Completeness, Undecidability*
Take Home Exam 2: made available—due Tuesday, November 7th

EXTENSIONS OF CLASSICAL LOGIC

R *Leibnizian Modal Logic*
Reading: Chapter 11

Week 12 (November 3-9):

T *Continue Leibnizian Modal Logic*
Reading 51038: Chapter 15.1
Homework 10 (see handout): Due at the beginning of class Tuesday of Week 13

R *Kripkean Modal Logic*
Reading: Chapter 12.1-12.2
Take Home Exam 2 due at the beginning of class November 7th

Week 13 (November 10-16):

T *Kripkean Modal Logic*
Reading 51038: Chapter 15.2-15.3

R *More on Kripkean Modal Logic*
Reading 51038: Chapter 16.1
Homework 11 (see handout): Due at the beginning of class on Tuesday of Week 15

Week 14 (November 17-23):

- T *More on Kripkean Modal logic; Strict Conditionals*
 Reading: Chapter 12.3
- R *Continue Strict Conditionals; Lewis Conditionals (time permitting)*
 Reading: Chapter 12.4
 Homework 12 (see handout): Due at the beginning of class on Tuesday of Week 16

Week 15 (November 24-30):

- T *Intuitionistic Logic*
 Reading: Chapter 16.2
- R **No Class November 28th—Thanksgiving Break**

Week 16 (December 1-7):

- T *Continue Intuitionistic Logic*
 Reading 51038: Chapter 14
- R *Catch Up and Review*

Final exam: Friday, December 13th 7:45-10:00 am

(If I give a take home final exam, it will be due in class by 9:00 am. We will have a meaningful class meeting at this time. It is recommended, but not required that you read Chapters 15.1-3, 16.1, and 16.3-5.)

Official Syllabus Statements
PHIL/MATH/CS 4/51038: Intermediate Logic
Fall 2024: TR 3:45-5:00 EST

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Email: dcsmith1@kent.edu

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Course Specific Statements:

Attendance Policy: I will hand out a sign-up sheet or otherwise take note of those present at the beginning of class. You are responsible for all material covered in lecture whether or not it is explicitly covered in the readings. While there are no explicit points toward the final grade for attendance and participation, both will factor into my decision concerning, e.g., whether to give a borderline student an A- or a B+.

Final: The final exam will largely focus on the material covered since the last midterm and on which you have not previously been tested. The final exam will be worth 20% of your final grade in the class.

For more information about course content and requirements, see the detailed course syllabus.

General Statements:

Notice of My Copyright and Intellectual Property Rights: Any intellectual property displayed or distributed to students during this course (including but not limited to PowerPoints, recordings of lectures, notes, content handouts, quizzes, examinations) by the professor remains the intellectual property of the professor. This means that the student may not distribute, publish or provide such intellectual property to any other person or entity for any reason, commercial or otherwise, without the express written permission of the professor. Additionally, students may not distribute or publish recordings and/or links to live classroom presentations, lectures, and/or class discussions.

Students with Disabilities: University policy 3-01.3 requires that students with disabilities be provided reasonable accommodations to ensure their equal access to course content. If you have a documented disability and require accommodations, please contact the instructor at the beginning of the semester to make arrangements for necessary classroom adjustments. Please note, you must first verify your eligibility for these through Student Accessibility Services (contact 330-672-3391 or visit www.kent.edu/sas for more information on registration procedures).

Academic Complaints: The Philosophy Department Grievance Procedure for handling student grievances is in conformity with the Student Academic Complaint Policy and Procedures set

down as University Policy 3342-16 in the *University Policy Register*. For information concerning the details of the grievance procedure, please see the departmental chairperson.

Academic Dishonesty: University policy 3-01.8 deals with the problem of academic dishonesty, cheating, and plagiarism. None of these will be tolerated in this class. The sanctions provided in this policy will be used to deal with any violations. If you have any questions, please read the policy at http://www.kent.edu/policyreg/policydetails.cfm?customel_datapageid_1976529=2037779.

Religion Accommodations: The University welcomes individuals from all different faiths, philosophies, religious traditions, and other systems of belief, and supports their respective practices. In compliance with University policy and the Ohio Revised Code, the University permits students to request class absences for up to three (3) days, per term, in order to participate in organized activities conducted under the auspices of a religious denomination, church, or other religious or spiritual organization. Students will not be penalized as a result of any of these excused absences.

The request for excusal must be made, in writing, during the first fourteen (14) days of the semester and include the date(s) of each proposed absence or request for alternative religious accommodation. The request must clearly state that the proposed absence is to participate in religious activities. The request must also provide the particular accommodation(s) you desire.

You will be notified by me if your request is approved, or, if it is approved with modification. I will work with you in an effort to arrange a mutually agreeable alternative arrangement. For more information regarding this Policy you may contact the Student Ombuds (ombuds@kent.edu).

Diversity, Equity, and Inclusion Statement: Kent State University is committed to the creation and maintenance of equitable and inclusive learning spaces. This course is a learning environment where all will be treated with respect and dignity, and where all individuals will have an equitable opportunity to succeed. The diversity that each student brings to this course is viewed as a strength and a benefit. Dimensions of diversity and their intersections include but are not limited to: race, ethnicity, national origin, primary language, age, gender identity and expression, sexual orientation, religious affiliation, mental and physical abilities, socio-economic status, family/caregiver status, and veteran status.

Land Acknowledgement Statement: We acknowledge that the lands of Kent State University were the previous homes of people who were removed from this area without their consent by the colonial practices of the United States government. Before removal, these groups created networks that extended from Wyoming to the Florida Coast and Appalachia and to the northern reaches of Lake Superior. These societies included people of the Shawnee, Seneca-Cayuga, Delaware, Wyandots, Ottawa and Miami. We honor their lives – both past and present – and strive to move beyond remembrance toward reflection and responsibility through honest accounts of the past and the development of cultural knowledge and community.