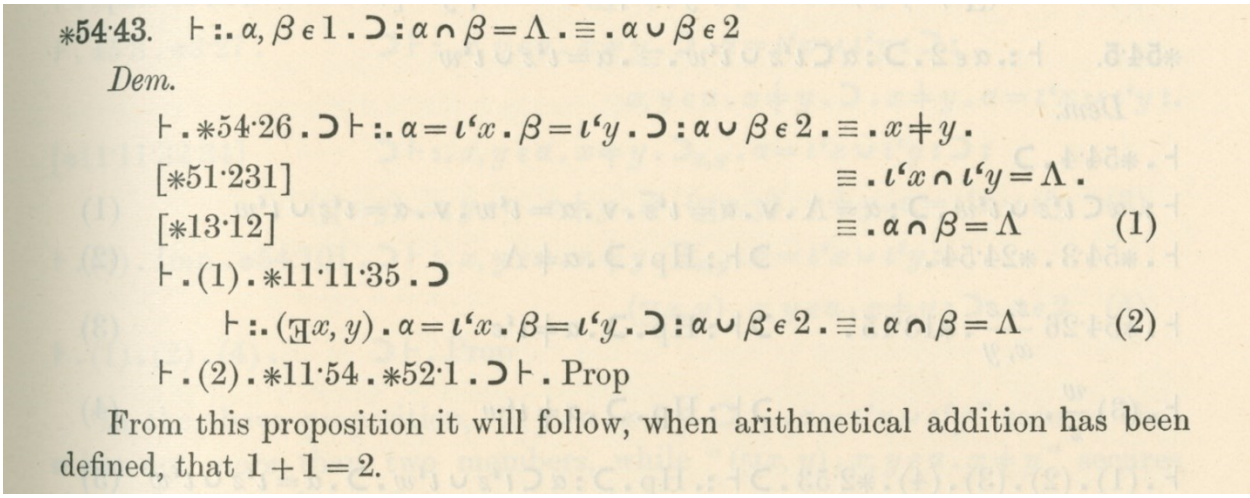
Symbolic Logic



$*54{\cdot}43.\quad \vdash :. \alpha, \beta \in 1 . \supset : \alpha \cap \beta = \Lambda . \equiv . \alpha \cup \beta \in 2$

Dem.

$\vdash . *54{\cdot}26 . \supset \vdash :. \alpha = \iota`x . \beta = \iota`y . \supset : \alpha \cup \beta \in 2 . \equiv . x \neq y .$

$[*51{\cdot}231] \qquad \equiv . \iota`x \cap \iota`y = \Lambda .$

$[*13{\cdot}12] \qquad \equiv . \alpha \cap \beta = \Lambda \qquad (1)$

$\vdash . (1) . *11{\cdot}11{\cdot}35 . \supset$

$\vdash :. (\exists x, y) . \alpha = \iota`x . \beta = \iota`y . \supset : \alpha \cup \beta \in 2 . \equiv . \alpha \cap \beta = \Lambda \qquad (2)$

$\vdash . (2) . *11{\cdot}54 . *52{\cdot}1 . \supset \vdash . \text{Prop}$

From this proposition it will follow, when arithmetical addition has been defined, that $1 + 1 = 2$.

Instructor:	Dr. Evan T. Woods
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E-mail:	woodse@denison.edu
Location of Class:	Knapp Hall 204
Time:	MWF 1:30–2:20

Course Description

This is a first course in logic. We're going to study some central concepts of deductive and inductive logic along with some philosophical issues that arise in connection with them. We'll begin with basic concepts of deductive logic, including *validity*, *soundness*, and *entailment*. From there, we'll turn to some ways used to determine whether an argument is valid. Next, we'll learn how to prove various things using a natural deduction system for sentential logic. We conclude our foray into deductive logic with a brief crash course on the significance of some metatheory. The main emphasis of the second half of the course is on inductive logic. Specifically, we're going to be studying some basic probability theory, Bayes' theorem, and the notion of expected value. In the final part of the course, we'll investigate some philosophical issues surrounding classical logic's ability to represent the world, including vagueness and paradox.

Required Text

The Logic Book. Sixth Edition. Merrie Bergmann, James Moor, and Jack Nelson.

All other readings will be distributed via Notebowl.

Learning Goals

After completing this course, students will be able to do the following:

- Define, explain, and use core concepts of logic, including validity, soundness, strength, and cogency in both evaluating and constructing arguments;
- Construct mathematical models to demonstrate the validity or invalidity of deductive arguments;
- Distinguish deductive from inductive reasoning;
- Recognize the applicability of the skills learned in this class to other coursework; and
- Articulate the importance and role of logic in autonomous thinking, discerning moral agency, and active citizenship both inside and outside of the classroom.

Method of Evaluation

Logic takes a lot of practice. To help you practice, there are *many* assignments in this class. There are weekly quizzes, homework assignments, and reviews. In addition, there are optional, online, ungraded quizzes. You will access these through Carmen. Your final grade will be calculated on the following basis:

- Homework/Exercises: 10%
- Exam 1: 20%
- Exam 2: 20%
- Exam 3: 20%
- Final: 20%
- Participation: 10%

Explanation of Method of Evaluation

Homework/exercises

The core competencies that you'll develop in this class require practice. Because of this, and because of our limited time in the classroom, you'll be expected to do work after almost every class. I'll do my best to make sure that this isn't onerous. For the most part, each assignment will have you do something like 10 problems; some of these will be able to be completed in ten minutes. Others will take longer, and there will be extensive feedback on your work; you'll need to incorporate feedback in the rest of the course. This is part of the four credit hours for this course.

Exams

In many ways, this is a skills-based course. To evaluate whether you have mastered the skills, I will rely pretty heavily on exams. Unless you have an accommodation, you will not be allowed to use your books or notes for these. This might seem overwhelming, but I am confident that you will be able to succeed in this course if you are conscientious in attending class, doing homework, and staying on top of the material.

Participation

There are a lot of different ways to participate in this class. The model of instruction that I like to work with in instructing logic is sometimes called "I do, we do, you do." *I* explain and illustrate a

concept. *We* work through an exercise together. *You* try it out on your own with my feedback. Participation in this format includes, but isn't limited to:

- Asking a clarifying question
- Correcting my mistakes
- Assisting a classmate in class
- Answering a question
- Doing your best to work through a problem
- Attending class and being engaged in the discussion and work
- Seeing me in office hours

So, everyone has ample opportunity to get full participation credit.

SCHEDULE

Here is a preliminary schedule; it's subject to change depending on a variety of factors. I'll update it as necessary.

	Class Meeting	Topic	Required Assignment
Basic Concepts of Deductive Logic			
Week 0	8/30	Introductions	After Class: • Read syllabus
Week 1	9/2	Core Concepts: Truth-values, Sentences, and Arguments	Before Class: • Read BMN 1.1–1.2 After Class: • Exercises: 1.2E.1–2 (Due at next class)
	9/4	Core Concepts: Validity and Soundness	Before Class: • Read BMN 1.2 After Class: • Exercises: Worksheet 1 (Due at next class)
	9/6		Before Class: • Read BMN 1.3 After Class: • Exercises: Worksheet 2 (Due at next class)

Now that we have some basic concepts of logic down, we'll turn to the *syntax* of a particular system of logic, classical sentential logic.

Sentential Logic: Syntax and Symbolization			
Week 2	9/9	Sentential Logic Syntax	Before Class: • Read BMN 2.1 After Class: • Exercises: 2.1E.1 - 2 (Due at next class)
	9/11		Before Class: • Read BMN 2.1–2 After Class: • Exercises: 2.2E (Due at next class)
	9/13	Symbolization	Before Class: • Read BMN 2.2 • Frege on Logic After Class: • Exercises: Worksheet 3 (Due at next class)
Week 3	9/16		Before Class: • Read BMN 2.3 After Class: • Exercises: 2.3E (Due at next class)
	9/18		Before Class: • Read BMN 2.3
	9/20	**Exam 1**	

Now that we know the syntax of sentential logic, we're going to check out the *semantics*.

Sentential Logic: Semantics			
Week 4	9/23	Truth-values	Before Class: • Read BMN 3.1 After Class: • Exercises: Worksheet 4 (Due at next class)
	9/25		Before Class: • Read BMN 3.1 After Class: • Exercises: 3.1E1–2 (Due at next class)
	9/27	Truth-functional Concepts .	Before Class: • Read BMN 3.2 After Class: • Exercises: 3.2E1

			(Due at next class)
Week 5	9/30		Before Class: • Read BMN 3.2 After Class: • Exercises: 3.2E3 (Due at next class)
	10/2	Truth-functional Equivalence	Before Class: • Read BMN 3.3 After Class: • Exercises: 3.3E1 (Due at next class)
	10/4	Truth-functional Consistency	Before Class: • Read BMN 3.4 After Class: • Exercises: 3.4E1 (Due at next class)
Week 6	10/7	Truth-functional Entailment and Validity	Before Class: • Read BMN 3.5 After Class: • Exercises: 3.5E1 (Due at next class)
	10/9	Additional Truth-functional Properties	Before Class: • Read BMN 3.6 After Class: • Exercises: 3.6E1 (Due at next class)
	10/11	**No Class—Dr. Woods at conference**	
Week 7	10/14	**Exam 2**	
	10/16	Some sort of paradox stuff. Class's choice.	
	10/18	**No Class—Autumn Break**	

Sentential Logic Derivations			
Week 8	10/21	The System	Before Class: • Read BMN 5.1 After Class: • Exercises: 5.1.1E (Due at next class)
	10/23		Before Class: • Read BMN 5.1 After Class:

			• Exercises: 5.1.2E (Due at next class)
	10/25	Basic Concepts	Before Class: • Read BMN 5.2 After Class: • Exercises: 5.1.3E (Due at next class)
Week 9	10/28	Harder Derivations	Before Class: • Read BMN 5.3 After Class: • Exercises: 5.3E.1 (Due at next class)
	10/30		Before Class: • Read BMN 5.3 After Class: • Exercises: 5.3E.2 (Due at next class)
	11/1		Before Class: • Read BMN 5.3 After Class: • Exercises: 5.3E.3 (Due at next class)
Week 10	11/4	Review/Flexibility. We'll likely have a review session the evening of 11/5.	
	11/6	**Exam 3**	
	11/8	Brief, Bonus Foray into Predicate Logic OR Metatheory—Students' Choice	Before Class: • Read TBA, depending on students' choice

We'll now turn to *inductive logic*.

Decision Theory			
Week 11	11/11	Elementary Probability	Before Class: • Read Hurley, "Elementary Probability" After Class: • Exercises: Worksheet 5 (Due at next class)
	11/13	Conditional Probability	Before Class: • Read Hacking, "Conditional Probability" After Class: • Exercises: Worksheet 6 (Due at next class)

	11/15		Before Class: • Read Hacking, "Conditional Probability" After Class: • Exercises: Worksheet 7 (Due at next class)
Week 12	11/18	Bayes' Rule	Before Class: • Read Hacking, "Bayes's Rule" After Class: • Exercises: Worksheet 8 (Due at next class)
	11/20		Before Class: • Read TBA
	11/22	Expected Value	Before Class: • Read TBA After Class: • Exercises: Worksheet 9 (Due at next class)
Week 13	11/25	**No Class—Thanksgiving Break**	
	11/27		
	11/29		
Week 14	12/2	Maximizing Expected Value	Before Class: • Read TBA After Class: • Exercises: Worksheet 10 (Due at next class)
	12/4	Decision Under Uncertainty	Before Class: • Read Pascal, "Pascal's Wager"

There are various philosophical issues that put pressure on some pretty central aspects of logic as we've investigated it so far. We're going to look at some in the final part of the class.

Week 14 Cont.	**Paradox and Logic**		
	12/6	Vagueness	Before Class: • Read Sainsbury, "Vagueness"
Week 15	12/9		Before Class: • Read Lewis, Selections from *On the Plurality of Worlds*

	12/11	Dialetheism	Before Class: • Read Sainsbury, "Are Contradictions Acceptable?"
	12/13		Before Class: • Read Priest, "Sylvan's Box: A Short Story and Ten Morals"
12/16		**Final Exam—6:30–8:30**	

ACADEMIC CREDIT POLICY

This course adheres to Denison's academic credit policy. I'm going to schedule some review sessions outside of classroom time before exams. In addition, there will be extensive written feedback on your work that I expect you to review and implement.—That's how you learn this stuff!

ACADEMIC INTEGRITY POLICY

Proposed and developed by Denison students, passed unanimously by DCGA and Denison's faculty, the Code of Academic Integrity requires that instructors notify the Associate Provost of cases of academic dishonesty. Cases are typically heard by the Academic Integrity Board which determines whether a violation has occurred, and, if so, its severity and the sanctions. In some circumstances the case may be handled through an Administrative Resolution Procedure. Further, the code makes students responsible for promoting a culture of integrity on campus and acting in instances in which integrity is violated.

Academic honesty, the cornerstone of teaching and learning, lays the foundation for lifelong integrity. Academic dishonesty is intellectual theft. It includes, but is not limited to, providing or receiving assistance in a manner not authorized by the instructor in the creation of work to be submitted for evaluation. This standard applies to all work ranging from daily homework assignments to major exams. Students must clearly cite any sources consulted—not only for quoted phrases but also for ideas and information that are not common knowledge. Neither ignorance nor carelessness is an acceptable defense in cases of plagiarism. It is the student's responsibility to follow the appropriate format for citations. Students should ask their instructors for assistance in determining what sorts of materials and assistance are appropriate for assignments and for guidance in citing such materials clearly. *For further information about the Code of Academic Integrity, see http://denison.edu/academics/curriculum/integrity.*

ELECTRONICS POLICY

To ensure a learning environment with minimal distractions, no electronic devices (e.g., laptops and smartphones) are to be used in class except in the accommodation of documented learning issues or when otherwise indicated (e.g., during course evaluations).

ATTENDANCE POLICY

Class attendance and participation are required. Absences will be recorded. Students with more than three unexcused absences will receive no marks for participation in the course. Constructive participation will positively impact your grade. For those who are disinclined to speak in class, discussion during office hours constitutes constructive participation. Participation grades will be determined by the extent to which your constructive participation contributes to the aims and environment of the course. Any reading quizzes count toward participation.

ACCOMMODATIONS

Students with a documented disability who wish to request reasonable academic accommodations based on the impact of a disability should complete a Request for Academic Accommodations/Faculty Notification form with the Academic Resource Center (ARC) located in 020 Higley Hall and contact me privately as soon as possible to discuss specific needs and arrangements. I rely on the Academic Resource Center (ARC) to verify the need for reasonable accommodations based on the documentation on file in that office. Reasonable accommodations cannot be applied retroactively and therefore ideally should be enacted early in the semester as they are not automatically carried forward from a previous term and must be requested every semester.

APPROPRIATE USE OF COURSE MATERIALS

As an institution which strives to inspire and educate our students to become discerning moral agents and active citizens of a democratic society, we are committed to complying with all laws regarding copyright throughout the University. This syllabus and all course materials used in this course may be copyrighted and accordingly will be governed by the provisions of the U.S. copyright law (for an overview see http://copyright.gov/circs/circ01.pdf and for fair use guidelines see http://copyright.gov/fair-use/more-info.html). In particular, posting any course materials on commercial sites or creating a bank of materials for distribution to other students may be considered a violation of the University's Code of Academic Integrity as well as a breach of copyright law. If you have any questions about these guidelines, please speak with your instructor.

REPORTING SEXUAL ASSAULT

Essays, journals, and other coursework submitted for this class are generally considered confidential pursuant to the University's student record policies. However, students should be aware that University employees are required by University policy and Title IX guidance to report allegations of discrimination based on sex, gender, gender identity, gender expression or sexual orientation, including sexual misconduct, sexual assault and suspected abuse/neglect of a minor, occurring on campus and / or involving current students at Denison University when they become aware of possible incidents in the course of their employment, including via coursework or advising conversations. There are others on campus to whom you may speak in confidence, including counselors at the Whisler Center for Student Wellness, and clergy. More information on Title IX and University policy guidance on gender identity / expression bias and sexual misconduct / assault,

including support resources, how to report, and prevention and education efforts, can be found at denison.edu/titleix; students may also contact Steve Gauger, Campus Title IX Coordinator, in Doane Administration 001, by email at gaugers@denison.edu, or by phone at 740-587-8660.

L2 OR MULTILINGUAL SUPPORT

In addition to the academic support services available to all Denison students, students who use English in addition to other languages can meet with Denison's Coordinator of Multilingual Learning, Kalynda Thayer. If English is not your first or only language, please consider utilizing this resource, which is available to ALL Denison students. Ms. Thayer offers a variety of support for L2 students, including consulting with you about your written language (grammar, syntax, word-choices), strategies to manage your reading assignments, assistance with class conversation and presentations, and to help devising ways to develop and effectively use all your skills in English. You can email her at thayerk@denison.edu to schedule an appointment.