

# Introduction to Logical Reasoning

<b>Units</b>	9.0	<b>Instructor</b>	David Emmanuel Gray
<b>Time</b>	Sunday, Tuesday, Thursday: 11:00–11:50AM	<b>Contact</b>	CMUQ 1039, <a href="mailto:degray@qatar.cmu.edu">degray@qatar.cmu.edu</a>
<b>Location</b>	CMUQ 2152	<b>Office hours</b>	walk in or by appointment
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## Course Overview

### Description

Most people like to think of themselves as logical. Telling someone “You are not being logical” is normally not a complement. To be illogical is to be foolish, confused, muddled, irrational. But what does it mean to be logical? The word itself, ‘logic’, comes from the Greek word ‘*logos*’, or reason, and logic can be broadly construed as the study of what counts as a good reason for what, and why.

Understanding logic is important because we reason all the time. We try to figure out what might hold, reasoning on the basis of what we already know. Is it the aspirin or the glass of water it is taken with that stops a headache? What are the odds that Qatar will win the World Cup? What would have happened had George W. Bush never been President of the United States? We reason about events occurring in time or space; we reason about knowledge and belief; we reason about moral responsibility and ethical behavior. We then try to persuade others by giving them reasons.

Rather than examine all these types of reasoning, this course focuses on a concern common to them all: identifying and evaluating arguments. We begin the course by informally examining the structure and various components of an argument. We then make explicit the structure of argumentation and learn how to organize the claims within an argument into a structure called an argument diagram. Following that, we explore how modern propositional logic helps identify the logical form of many everyday claims and assess the validity of an argument. Then we consider classical categorical logic, which allows us to identify claims and assess arguments of a slightly different sort. Finally, we conclude by looking at several common fallacies and other barriers to good reasoning that may occur when a person is not thinking logically.

### Readings

The following is the required textbook for the course:

- Lewis Vaughn. *The Power of Critical Thinking*, 3<sup>rd</sup> edition. Oxford: Oxford University Press. 2010.

Additional readings will be made available on the course webpage. You are expected to read all the required reading according to the schedule.

### Objectives

By the end of this term, I expect that you will be able to:

- Visually represent the inferential structure of an argument,
- Determine when the premises of an argument entail its conclusion,
- Translate ordinary language statements into formal structures revealing their logical form, and
- Avoid using faulty definitions and logical fallacies in your own writing.

Each course requirement is designed with these objectives in mind.

### Announcements and Other Communication

Important information will be posted on the course webpage, so please routinely check for updates at

<http://www.andrew.cmu.edu/user/degray/logic/>

Otherwise, I am glad to answer your questions, discuss your work, or respond to you concerns. Please see me at office hours or get in touch via email.

### Requirements and Grading

Classes will typically follow an interactive lecture format, with certain days set aside for skill-building workshops. As a result, the quality of the course depends critically on each individual’s attention and participation. The purpose of coming together as a class is to engage in these activities together.

I strongly encourage you to practice the course’s skills outside of class with your fellow classmates, friends, and family, as well as with myself. However, all work must be done independently, unless otherwise noted. You are all expected to be familiar with the university policies on cheating and plagiarism. If you have any questions, please ask; do not assume.

**Assignments** include 14 problem sets, 11 quizzes, and 3 exams. Please refer to page 2 for details.

The total points will vary from assignment to assignment. However, each is ultimately scaled to a score from 0 to 6. Unless you are notified of otherwise, the grading distribution will be as follows:

5.00–6.00	A	3.00–3.99	C	0.00–1.99	R
4.00–4.99	B	2.00–2.99	D		

(For example: the total number of points may be 42; and I may announce that 34 and above is an A, 26 and above is a B, 19 and above is a C, etc. In that case, a score of 32 translates to  $3 + 6/8 = 4.75$ , which is a high B.) If you wish to know how you are doing in more specific terms than what you can infer from this information, do not hesitate to meet with me. Please note, however: due to Family Educational Rights and Privacy Act (FERPA) regulations, *I will not transmit grade information over email*. All discussion of grades must be done face-to-face with me.

Grades are determined based on *clarity* as well as correctness. You may submit an answer to a question that, arguably, has all the components of a correct answer; but if I have to struggle to understand what you are saying, or read between the lines, or weed out false or irrelevant information, you are unlikely to receive full credit.

### Late Policy

In general, no late submissions will be accepted unless a prior reasonable accommodation by the instructor has been requested and granted. Exceptions are made for extreme circumstances, but you must make arrangements with me in advance whenever possible.

### Participation and Attendance

Logic is learned by doing, and so we will work in and out of class with a lot of examples. Class attendance and participation is therefore very important in understanding and retaining class material. You are expected to show up to class on time, participate thoughtfully, ask questions when you are confused, take notes, and have a grasp of what was accomplished in each meeting. *Attendance is therefore required and anyone showing up more than 15 minutes late will be politely asked to leave and come back (on time) to our next class meeting.* To enforce this policy, I will promptly take attendance at the beginning of each class (that is, at 1:00PM). If you arrive after I have called your name, then you will be marked as tardy. However, I recognize I recognize that not everybody is comfortable speaking in class, and so only absences (in body or mind) will lower your grade. Nevertheless, active class participation can increase your grade. Please refer to page 2 for details.

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# Assignments

## Reading

Most days of class will have an assigned reading (see the schedule on pages 3 and 4) that you will be expected to have read and thought about *before* class. This will allow us to devote our time to understanding and practicing the skills it is trying to teach. Hence, you need to do more than merely peruse the readings: you must endeavor to understand what the text is trying to convey. Keep in mind that reading the course material is not like reading a novel. There will be times when you have to read slowly and carefully. Sometimes you may have to stop and think about things; and you should be prepared to go back and reread a paragraph if necessary. However, reading assignments are relatively short so that this is feasible. In addition, it is good to take notes while reading, so that you can remember the text's main points. Finally, feel free to bring questions to class. This material is hardly obvious and it challenges the most intelligent of people.

## Participation (10% of Final Grade)

Your base participation grade will consist of your overall grade on all graded assignments (e.g., if the weighted average of your quizzes and exams is a 4.67, then your base participation grade is also 4.67, or a B). Each class absence will lower your participation grade by 1.0 points (i.e., one letter grade), while each time you are tardy will lower it by 0.5 points (i.e., one-half of a letter grade). Being caught sleeping in class, using your cell phone, leaving the classroom, or similar behavior will be treated as an absence or as tardiness depending on the particulars of the circumstances. Note that it is possible that your participation grade can go negative because of these penalties.

On the other hand, active class participation can boost your participation grade by up to 2.00 points (i.e., two letter grades). In addition, if you have perfect attendance and no penalties on your participation grade, then your participation grade will be automatically boosted an additional 1.00 point. Consequently it is possible that your participation grade could go well above 6.00 points. Strive for this—it is the easiest way to increase your final course grade if you are in a borderline situation!

## Extra Credit

Opportunities for extra credit will be provided at my discretion. If provided, extra credit will only count towards your overall quiz grade. If there are any community lectures, documentaries, television specials, news reports, podcasts, web content, and so forth on topics related to course material, please bring them to my attention. I may provide extra credit opportunities for the class based upon them.

## Problem Sets

Each week, a problem set will be assigned, but it will be neither collected nor graded. The purpose of these problem sets is to allow you to practice the skills you are learning in class as much or as little as you would like. Solutions to most of these problems will be available, so you can check your answers or see me for help as necessary. I do highly encourage you to work on these problems with your classmates in groups. You are held individually accountable for this material, however: the overwhelming majority of problems presented on quizzes and exams will be functionally identical to problems given on the problem sets. As a result, if you do not devote time to the problem sets, you are extremely unlikely to do well on the graded material.

## Quizzes (30% of Final Grade)

Throughout the semester, there will be eleven short quizzes, with the lowest three being dropped, so your highest eight will each count for about 3.75% towards your final course grade. These quizzes will assess your understanding of both the reading and what we have covered in class. Generally, they will consist of two or three problems assessing your proficiency with the skills you have been practicing on the problem sets and in the weekly workshops.

Each quiz will be given promptly at the start of class at 11:00AM and collected ten minutes later. If you come in late before they are collected, you will not be given extra time. If you come in after they are collected, you will have missed your chance to take the quiz. *So arrive promptly for class.* Quizzes are announced in advance (see the schedule), but cannot be made up. The reason that two of your quizzes are dropped is so you have the freedom to miss or do poorly on a couple quizzes with no questions asked. To summarize: *there will be no make-up quizzes.*

## Exams (60% of Final Grade)

There will be three fifty-minute exams, each of which will count for 20% towards your final course grade. Each exam will test your comprehension of the course material and the skills you have been practicing on problem sets, workshops, and quizzes. Exams will be cumulative, though with a significant emphasis on the material and the skills covered since the previous exam.

# Schedule

wk	Date	Topic/Readings	Assignments
1	1/9 (Sun)	<b>Introduction</b>	Problem set #1 handed out
	1/11 (Tue)	<b>What is an Argument? (Unit #1)</b> Irving M. Copi and Carl Cohen, "Propositions" (handout).	
	1/13 (Thu)	<b>What is an Argument?</b> <b>Workshop on Statement Classification</b>	
2	1/16 (Sun)	<b>What is an Argument?</b> <i>The Power of Critical Thinking</i> , pp. 9–17.	Quiz #1 Problem set #2 handed out
	1/18 (Tue)	<b>What is an Argument?</b> <i>The Power of Critical Thinking</i> , pp. 17–20.	
	1/20 (Thu)	<b>What is an Argument?</b> <b>Workshop on Parsing an Argument</b>	
3	1/23 (Sun)	<b>Understanding an Argument (Unit #2)</b> Irving M. Copi and Carl Cohen, "Emotive Language, Neutral Language, and Disputes" (handout). Irving M. Copi and Carl Cohen, "Disputes and Ambiguity" (handout).	Quiz #2 Problem set #3 handed out
	1/25 (Tue)	<b>Understanding an Argument</b> <i>The Power of Critical Thinking</i> , pp. 96–101	
	1/27 (Thu)	<b>Understanding an Argument</b> <b>Workshop on Dispute Analysis and Diagramming Arguments</b>	
4	1/30 (Sun)	<b>Understanding an Argument</b> Irving M. Copi and Carl Cohen, "Diagramming Arguments" (handout).	Quiz #3 Problem set #4 handed out
	2/1 (Tue)	<b>Review of Units #1 and #2</b>	
	2/3 (Thu)		<b>Exam #1</b>
5	2/6 (Sun)	<b>Assessing Arguments (Unit #3)</b> <i>The Power of Critical Thinking</i> , pp. 68–73.	Problem set #5 handed out
	2/8 (Tue)	<b>Assessing Arguments</b> <i>The Power of Critical Thinking</i> , pp. 74–79.	
	2/10 (Thu)	<b>Assessing Arguments</b> <b>Workshop on Deductive versus Inductive Arguments</b>	
6	2/13 (Sun)	<b>Modern Propositional Logic (Unit #4)</b> <i>The Power of Critical Thinking</i> , pp. 219–228.	Quiz #4 Problem set #6 handed out
	2/15 (Tue)	<b>Modern Propositional Logic</b> Reread <i>The Power of Critical Thinking</i> , pp. 219–228.	
	2/17 (Thu)	<b>Modern Propositional Logic</b> <b>Workshop on Translating Natural Language and Creating Truth Tables</b>	
7	2/20 (Sun)	<b>Modern Propositional Logic</b> <i>The Power of Critical Thinking</i> , pp. 231–238.	Quiz #5 Problem set #7 handed out
	2/22 (Tue)	<b>Modern Propositional Logic</b> <i>The Power of Critical Thinking</i> , pp. 88–93.	
	2/24 (Thu)	<b>Modern Propositional Logic</b> <b>Workshop on Assessing Arguments and Argument Patterns</b>	
	2/27, 3/1, 3	 <b>Spring Break</b>	

wk	Date	Topic/Readings	Assignments
8	3/6 (Sun)	<b>Natural Deduction (Unit #5)</b> Irving M. Copi and Carl Cohen, "The Elementary Valid Argument Forms" (handout).	Quiz #6 Problem set #8 handed out
	3/8 (Tue)	<b>Natural Deduction</b> Irving M. Copi and Carl Cohen, "Formal Proofs of Validity Exhibited" (handout).	
	3/10 (Thu)	<b>Natural Deduction</b> <b>Workshop on Identifying Valid Argument Forms</b>	
9	3/13 (Sun)	<b>Natural Deduction</b> Irving M. Copi and Carl Cohen, "Constructing Formal Proofs of Validity" (handout).	Quiz #7 Problem set #9 handed out
	3/15 (Tue)	<b>Natural Deduction</b> Irving M. Copi and Carl Cohen, "Constructing More Extended Formal Proofs" (handout).	
	3/17 (Thu)	<b>Natural Deduction</b> <b>Workshop on Natural Deduction</b>	
10	3/20 (Sun)	<b>Natural Deduction</b> Reread Irving M. Copi and Carl Cohen, "Constructing More Extended Formal Proofs" (handout).	Quiz #8 Problem set #10 handed out
	3/22 (Tue)	<b>Review of Units #3, #4, and #5</b>	
	3/24 (Thu)		<b>Exam #2</b>
11	3/27 (Sun)	<b>Basic Categorical Reasoning (Unit #6)</b> <i>The Power of Critical Thinking</i> , pp. 252–262.	Problem set #11 handed out
	3/29 (Tue)	<b>Basic Categorical Reasoning</b> <i>The Power of Critical Thinking</i> , pp. 264–268.	
	3/31 (Thu)	<b>Basic Categorical Reasoning</b> <b>Workshop on Translating and Diagramming Categorical Statements</b>	
12	4/3 (Sun)	<b>Basic Categorical Reasoning</b> Irving M. Copi and Carl Cohen, "The Traditional Square of Opposition" (handout).	Quiz #9 Problem set #12 handed out
	4/5 (Tue)	<b>Basic Categorical Reasoning</b> <i>The Power of Critical Thinking</i> , pp. 269–276.	
	4/7 (Thu)	<b>Basic Categorical Reasoning</b> <b>Workshop on Reasoning with Categorical Statements and Syllogisms</b>	
13	4/10 (Sun)	<b>Ineffective Reasoning (Unit #7)</b> <i>The Power of Critical Thinking</i> , pp. 176–194.	Quiz #10 Problem set #13 handed out
	4/12 (Tue)	<b>Ineffective Reasoning</b> <i>The Power of Critical Thinking</i> , pp. 194–200.	
	4/14 (Thu)	<b>Ineffective Reasoning</b> <b>Workshop on Identifying Fallacies</b>	
14	4/17 (Sun)	<b>Ineffective Reasoning</b> <i>The Power of Critical Thinking</i> , pp. 130–139.	Quiz #11 Problem set #14 handed out
	4/19 (Tue)	<b>Ineffective Reasoning</b> <i>The Power of Critical Thinking</i> , pp. 152–161.	
	4/21 (Thu)	<b>Review of Units #6 and #7</b>	
TBA			<b>Exam #3</b>

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# Policies

## Reasonable Accommodations

I recognize that you are a human being with occasional human problems associated with human finitude. Illness, family emergencies, job interviews, other professors, etc. . . will inevitably lead to legitimate conflicts over your time. If you expect that you will be missing class or be unable to turn in an assignment on time, please notify me (either in class or via email) *in advance* and we can agree on a reasonable accommodation. Arrangements after the fact will only be made in extraordinary, documented circumstances.

## Challenging an Assignment Grade

Please recognize that I am human also: mistakes will occasionally occur when grading your assignments. Therefore, you have *one week* after an assignment is handed back to challenge its grade. To do so, you must return the assignment to me along with a clearly written explanation of your reason for challenging its grade. I will promptly and seriously consider all such requests and meet with you, if necessary, to resolve them. Assignments without a written explanation will not be considered. After one week, no challenges will be accepted, except in extraordinary, documented circumstances. Of course, if you are not satisfied with your grade, but recognize that it was not due to a fault in the grading, I encourage you to talk with me to learn how to improve on future assignments.

## Students with Disabilities

In compliance with university policy and equal access laws, I am available to discuss appropriate academic accommodations that you may require as a student with a disability. Request for academic accommodations should be made during the first week of the term, except for unusual circumstances, so arrangements can be made. Students are required to register for disability verification and for determination of reasonable academic accommodations. For more information, visit

<http://www.cmu.edu/hr/eos/disability/students/index.html>

## Sexual Harassment Policy

It is the policy of the university that no male or female member of the university community (i.e., students, faculty, administrators, or staff) may sexually harass any other member of the community. Sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature constitute harassment when:

- Submission to such conduct is made or threatened to be made, either explicitly or implicitly, a term or condition of an individual's employment or education; or
- Submission to or rejection of such conduct is used or threatened to be used as the basis for academic or employment decisions affecting that individual; or
- Such conduct has the purpose or effect of substantially interfering with an individual's academic or professional performance or creating what a reasonable person would sense as an intimidating, hostile, or offensive employment, educational, or living environment.

For more information, visit

<http://www.cmu.edu/policies/documents/SexHarass.html>

## A Note on Classroom Courtesy

Classes begin at 11:00AM. You are expected to be seated by that time and to remain seated until the class is dismissed. If you must leave before the class ends because of a medical appointment, or similar commitment, notify me before class begins and sit near the door. Students who leave without providing such notice and have not suddenly taken ill will be expected to drop the course and not to return.

## Video Taping and Audio Recording

Your classmates and I have a reasonable expectation to not be recorded in this course. Therefore, videotaping and audio recording are prohibited without our expressed, unanimous permission.

## Cell Phones, Laptops, and Other Related Technologies

Student interactions with portable technology devices can harm the dynamics of the classroom. Therefore, I expect you to silence your cell phones prior to class and to not text-message during class. *All laptops should be closed unless you have made prior arrangements with me and have demonstrated that using a laptop is necessary for your learning.*

## Cheating and Plagiarism

**plagiarism** (plā'jē-rīz'ēm) *n* 1: a piece of writing that has been copied from someone else and is presented as being your own work. 2: the act of plagiarizing; taking someone's words or ideas as if they were your own.

Plagiarism is bad. Do not do it. It amounts to lying, cheating, and stealing. Anyone caught doing it can fairly assume that they will not pass this course.

It is the responsibility of each student to be aware of the university policies on academic integrity, including the policies on cheating and plagiarism. This information is available at

<http://www.cmu.edu/policies/documents/Cheating.html>

Also see the section on "University Policies" in the most recent edition of *The Word: Undergraduate Student Handbook*.

Students who cheat or plagiarize face serious sanctions at both the course level, and the university level. At the course level, faculty at Carnegie Mellon University have significant discretion to determine the sanctions that are appropriate to individual cases of cheating and plagiarism. Within the Philosophy Department, it is customary to give plagiarized assignments a failing grade and, where appropriate, to fail students for the course. Additionally, a letter is sent to the Dean of Students indicating that the student in question has submitted plagiarized material and received a course-level sanction. Plagiarism is also a violation of the community standards of Carnegie Mellon University. As such, allegations of plagiarism may be brought before a University Academic Review Board, which will determine whether a violation of community standards has taken place and level additional sanctions if appropriate. Although this body also has significant discretion over the sanctions that it levels, plagiarism can result in academic probation, suspension, and even expulsion.