Introduction to *Introduction to Logic*

PHIL 500

August 26, 2019

Outline

What is logic?

What will we learn in this class?

How should I take a class with Dmitri?

Yeah, yeah, but what about grades?

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Logic

- Logic is the study of *arguments*.

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- An *argument* is a collection of reasons to believe that some claim is true.

Sample Arguments

We must give up some privacy in the name of security. For if the homeland is not secure, terrorist attacks orders of magnitude larger than 9/11 will find their way to our shores. And no amount of privacy is worth enduring an attack like this.

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If the homeland is not secure, terrorist attacks orders of magnitude larger than 9/11 will find their way to our shores.

No amount of privacy is worth enduring an attack like this.

$\therefore$ We must give up some privacy in the name of security.

Sample Arguments

Premise

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$\therefore$ Conclusion

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Sample Arguments

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No one is aware of their own death.

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∴ No one is harmed by their own death.

Sample Arguments

Every contingent being is caused.

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Every contingent being is caused.

Nothing is caused by itself.

Sample Arguments

Every contingent being is caused.

Nothing is caused by itself.

∴ A necessary being exists.

Sample Arguments

Immanuel Kant:

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∴ Moral theory is not studied empirically.

Sample Arguments

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It's possible for me to survive the death of my body.

∴ Me and my body are two different things.

Logic

- The goal of logic is to give a *theory* of when arguments are good, when they are bad, and why they are good and bad.

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∴ Climate change is a Chinese hoax.

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- ▹ We will call an argument with this feature a *valid* argument.

Logic: Validity

An argument is *valid* if and only if it's necessary that, if its premises are true, then its conclusion is true also.

An argument is *invalid* if and only if it's not necessary that, if its premises are true, then its conclusion is true also.

Logic: Validity

An argument is *valid* if and only if it is impossible for its premises to be true while its conclusion is false.

An argument is *invalid* if and only if it is possible for its premises to be true while its conclusion is false.

Logic: Soundness

An argument is *sound* if and only if it is both valid and all of its premises are true.

- So: if an argument is sound, then its conclusion is true.

Logic

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- However, it *can* teach us which arguments are valid—and this is something worth knowing. It's not trivial.

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A cause of a cause is a cause itself (if c causes d and d causes e, the c causes e).

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Every contingent being is caused.

Nothing is caused by itself.

A cause of a cause is a cause itself (if c causes d and d causes e, the c causes e).

Nothing has infinitely many causes.

$\therefore$ A necessary being exists.

Logic

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- Studying logic will put you in a better position to think this through.

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- Familiarity with *sentence logic* and *predicate logic* is important to understanding topics and debates in all areas of philosophy; it also has important applications in mathematics and computer science.
- Learning sentence logic and predicate logic won't only put you in a position to study these other topics.
- The skills we will acquire here will be helpful with reasoning about arguments in a wide variety of contexts, about a wide variety of subject matters—even if the arguments are too complex for either *sentence logic* or *predicate logic* to handle.

Sentence Logic

If moral theory is studied empirically, then examples of conduct will be considered.

If examples of conduct are considered, then principles for selecting examples will be used.

If principles for selected examples are used, then moral theory is not studied empirically.

$\therefore$ Moral theory is not studied empirically.

Sentence Logic

$$E \rightarrow C$$

$$C \rightarrow P$$

$$P \rightarrow \neg E$$

$$\therefore \neg E$$

Sentence Logic

E	C	P	$E \rightarrow C$	$C \rightarrow P$	$P \rightarrow \neg E$	$\neg E$
T	T	T	T	T	F	F
T	T	F	T	F	T	F
T	F	T	F	T	F	F
T	F	F	F	T	T	F
F	T	T	T	T	T	T
F	T	F	T	F	T	T
F	F	T	T	T	T	T
F	F	F	T	T	T	T

Sentence Logic

1	$E \to C$		
2	$C \to P$		
3	$P \to \neg E$		
4	E	A($\neg$I)	
5	C	$\to$E	1, 4
6	P	$\to$E	2, 5
7	$\neg E$	$\to$E	3, 6
8	$\bot$	$\bot$I	4, 7
9	$\neg E$	$\neg$I	4–8

Predicate Logic

Something can only harm you if you are aware of it.

No one is aware of their own death.

$\therefore$ No one is harmed by their own death.

Predicate Logic

$$\forall x\,(Hx \rightarrow Ax)$$

$$\neg\exists x\,Ax$$

$$\therefore\ \neg\exists x\,Hx$$

Predicate Logic

1		$\forall x\,(Hx \to Ax)$	
2		$\neg\exists x\,Ax$	
3	|	$\exists x\,Hx$	A($\neg$I)
4	| |	Hc	A($\exists$E)
5	| |	$Hc \to Ac$	$\forall$E 1
6	| |	Ac	$\to$E 4, 5
7	| |	$\exists x\,Ax$	$\exists$I 6
8	| |	$\bot$	$\bot$I 3, 7
9	|	$\bot$	$\exists$E 3, 4–8
10		$\neg\exists x\,Ax$	$\neg$I 3–9

Modal Logic

It's possible for me to survive the death of my body.

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Modal Logic

$$\Diamond(\exists x\, x = m \wedge \neg\exists y\, y = b)$$

$$\therefore\ m \neq b$$

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- Prof. Carol Dweck: there are two ways that people think about abilities—two different kinds of *mindsets*.
  - Fixed mindset: abilities are fixed, innate, and unchangeable.
  - Growth mindset: abilities can be acquired and improved through practice, failure, and learning.

Fixed Mindsets and Failure

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  - If you have difficulty with Logic, get a bad grade early on, guess the wrong answer,..., that's because you're not cut out for the study of Logic.

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  - If you fail at some kind of task, that's because you're not innately skilled at that kind of task.
  - If you have difficulty with Logic, get a bad grade early on, guess the wrong answer,..., that's because you're not cut out for the study of Logic.
  - "My brain just doesn't work this way".

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  - If you fail at a task, that's a lesson that you should find a new way of approaching the task.
  - If you have difficulty with Logic, get a bad grade early on, guess the wrong answer, ..., that's just a part of learning a new subject. If you already knew all the answers, taking the class would be a waste of time.
  - "My brain may not work that way now—but if I keep learning from my failures, it will work that way by the time the class is done."

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  - If you guess and get the answer wrong, that's evidence that you're not cut out for this.
  - If you try a difficult task and fail, that's evidence that you don't have what it takes.

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Growth Mindsets and Failure

- If you can always learn and improve, then failure is a way of discovering what you need to learn, and how you need to improve.
  - If you guess and get the answer wrong, that's an exciting opportunity to learn and come to a deeper understanding.
  - If you attempt a difficult task and fail, you've gotten valuable feedback about how to approach the difficult task next time.

The Importance of Failure

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  - repeatedly guesses the wrong answers,

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The Importance of Failure

- Everyone who learns anything difficult:
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  - gets difficult problems wrong,
  - goes through periods of confusion,
  - asks questions, and sometimes doesn't fully understanding the answers

How to take this class

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- Adopt a growth mindset.

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- Adopt a growth mindset.
- Expect to guess the wrong answers, get difficult problems wrong, and go through periods of confusion.
- If you get confused, ask questions.
- If my answers don't make sense, realize that that's my fault, not yours—but keep trying to understand, anyway.

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- Problem Sets (30%)

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- Recitation (10%)

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- Midterm (25%)

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- Recitation (10%)
- Midterm (25%)
- Final (35%)

Problem Sets (30%)

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- ▹ But: don't fall into the trap of just copying other people's work. You'll need to understand this material for the midterm and the final.

Recitation (10%)

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- You'll be given exercises to complete in recitation section.
- These will be collected and graded.
  - But: you'll be given the correct answers in class before the assignments are collected.

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- The midterm and final are mandatory.
  - If you never complete a midterm or a final, you will fail the class.
  - Of course, if you have an excuse, you can make up the midterm of the final at a later time.

Overview

- First two weeks: basic concepts of logic

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- First two weeks: basic concepts of logic
- Next 5 weeks: sentence logic

Overview

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- Next 5 weeks: sentence logic
- Midterm (on sentence logic)

Overview

- First two weeks: basic concepts of logic
- Next 5 weeks: sentence logic
- Midterm (on sentence logic)
- Next 5 and a half weeks: predicate logic

Overview

- First two weeks: basic concepts of logic
- Next 5 weeks: sentence logic
- Midterm (on sentence logic)
- Next 5 and a half weeks: predicate logic
- Final (on predicate logic)