01
INTRODUCTION

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Formal Logic
Let’s kick off with a murder:

Poor Lady Agatha. She’s found murdered in the library. But, Inspector Bucket is on the case. After having done his preliminary investigation, he gathers everyone in the dining room and does the following reasoning:

*Either the butler or the gardener murdered Lady Agatha. Whoever murdered her was in the library. If the gardener was in the library he must have left dirty footprints. But there are no dirty footprints there. So the gardener wasn’t in the library. So he did not murder Lady Agatha. Therefore, the butler did it!*
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Most of you probably agree that this is an example of a good argument. But what makes an argument a good one? We don’t know whether Inspector Bucket did his preliminary investigation careful enough, but something like this seems correct: it follows from the premises (that is, assuming they are true) that the butler did it. But what does that mean?
The component *Formal Logic* has three specific learning outcomes. During this semester you will:

(A) learn how to translate sentences in natural language into the formal languages of propositional and predicate logic;
(B) learn how to check the validity of arguments in propositional and predicate logic using the tree method;
(C) learn how use formal methods for philosophical ends, focusing on vagueness, indeterminacy, existence and a puzzle about reasoning as examples.
What is *logic*?

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- We are interested in one particular use of the term *logic*. We’ll say something more precise later on, but here’s a good starting point:

  Logic is the study of **arguments** (of the kind used in philosophy), and in particular, what makes such arguments **good**.
What is an *argument*?

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- As we are using the term, an *argument* is an abstract thing.

  An argument is a pair $\langle X, A \rangle$, where $X$ is a set of propositions (the premises) and $A$ is a single proposition (the conclusion).
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**Plausibility**  You’re presenting an argument during a discussion about what would happen if we legalized marijuana. We could then call your argument *good* if it gave *intuitive* support for some belief or conferred on that belief a relatively high degree of *plausibility*. 
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**Probability**  You’re presenting an argument at a science convention about the number of degrees, given current anthropogenic factors, the temperature will have increased by 2050. We could then call your argument good if it gave strong **probabilistic reasons** for believing your conclusion.
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- Interesting as all these are, none of them will be our focus.
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**Validity: generic**  
An argument \(\langle X, A \rangle\) is **valid** iff in every case, if all the premises \(X\) are true then the conclusion \(A\) is also true.

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An argument \( \langle X, A \rangle \) is **valid** iff it is *impossible* that all the premises \( X \) are true but the conclusion \( A \) is not true.
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Zelda floats on water

Therefore, Zelda is a witch
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John saves Ashley or he saves Kaidan
If John saves Ashley then he makes a mistake
John doesn’t make a mistake

Therefore, John saves Kaidan
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- To see why it's valid start with the third premise and reason upwards.
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All cats have four legs.
I have four legs.
Therefore, I am a cat.
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We must do something
This is something
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Therefore, we must do it
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We must do something
This is something

Therefore, we must do it

All men are mortal
Socrates is mortal

Therefore, all men are Socrates
What does it mean to say that logic is *formal*?

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Tubby is a teddybear that hugs every child

Therefore, all children are hugged by someone

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The liquid in this bottle turns litmus paper red

Therefore, the liquid in this bottle is acidic.
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What we want is an explanation of why the argument on the left is valid.

Logic, in our sense, is a *formal* discipline. Here are three important things philosophers have meant by saying that logic is formal:

1. Logic provides constitutive rules for thought *as such*.
2. Logic is indifferent to the particular identities of objects.
3. Logic is abstracted away from the semantic content of thoughts.