01
INTRODUCTION

Paal Antonsen
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https://sites.google.com/site/paalantonsen/teaching/logic

Formal Logic
A murder investigation

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!*
Let’s kick off with a murder:

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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?
What will we learn in this course?

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.
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- Your mark in this course is based on:
  - A set of *homeworks* (30%) submitted during the semester.
  - A *logic test* (20%) at the end of this semester.
  - An *exam* (50%) at the end of the academic year.
What do we have to read?

When are the lectures?
Wed: 16.00 – 17.00, Regent House.
Thu: 16.00 – 17.00, Room 2043.

When are the student hours?
Thursdays at 11:00 – 12:00, Room 5005.

Who are you people anyway?
Paal Antonsen (antonsp@tcd.ie)
Zuzanna Gnatke (gnatekz@tcd.ie)
What is *logic*?

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“If it was so, it could be; and it were so, it would be; but as it isn’t, it ain’t. That’s logic!” – Tweedledee
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- We are interested in one particular use of the term \textit{logic}. We’ll say something more precise later on, but here’s a good starting point:

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

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> “An argument is a connected series of statements intended to establish a definite proposition.” – Monty Python

▶ 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)*.
What is a good argument?

- Relative to the purposes at hand, arguments can be classified as good by different parameters. Whether something is good or bad depends on what one is trying to achieve.
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Interesting as all these are, none of them will be our focus.
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Validity: generic
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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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- To get a grip on these definitions let’s see examples of valid arguments.

  - If Zelda floats on water then Zelda is a witch
  - Zelda floats on water
  - ————————————————————
  - Therefore, Zelda is a witch

  - Don’t get fooled by the fact that the first premise is obviously false. Our definition of validity only says “if all the premises are true.”

  - John saves Ashley or he saves Kaidan
  - If John saves Ashley then he makes a mistake
  - John doesn’t make a mistake
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All cats have four legs.  
I have four legs.  
Therefore, I am a cat.
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<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
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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
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Therefore, all children are hugged by someone

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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.