lecture 01, what is logic?

phil1012 introductory logic

overview

this lecture

- what is logic?
- what is logic for?
- central concepts of logic:
  - propositions and truth
  - arguments
  - validity and soundness

learning outcomes

- after doing the relevant reading for this lecture, listening to the lecture, and attending the relevant tutorial, you will be able to:
  - explain what logic is
  - determine whether a sentence expresses a proposition or not
  - explain what an argument is
  - represent ordinary language arguments in standard form
  - explain what it is for an argument to be valid
  - determine whether an argument is valid or invalid in an informal way

required reading

- sections 1.1, 1.2, 1.3, 1.4 and 1.5 of chapter 1

what is logic?

what is logic?

- what is logic?

a brief history of logic

- logic is a subject with a history
- this is not a course in the history of logic
- nonetheless . . .

- it is worth knowing the history in broad outline
- some of the major events in the history of logic:
  - aristotle, categorical propositions, and categorical syllogisms
  - the stoics, propositional logic, ‘if . . . then’, ‘and’, ‘or’, etc.
  - . . .
  - gotlob frege, quantified propositions, ‘for all’, ‘for some’
- it was only really in the 20th century that predicate logic received its canonical formulation

logic and the laws of truth

- so what is logic?
  - logic is the systematic study of the laws of truth
  - logic concerns itself with the laws which govern the truth of propositions
- you can think of these claims as saying that *this* is what we mean by 'logic' in this class
- don't worry if you don't know what propositions are yet, we will come to this

formal logic vs informal logic

- what are the varieties of logic?
  - formal/symbolic logic
  - informal/practical/applied logic or critical thinking
- both may deal with notions like (deductively) valid arguments
- formal logic is distinct in that it uses *formal methods* like translation into formal languages and formal proofs
- our aim might ultimately to be to understand ordinary arguments, but we might also study the formal languages and proofs themselves (metalogic)

logic and human reasoning

- what is logic not?
- logic is not the study of human reasoning
- logic concerns itself with the laws of truth, not the laws of thought
- a particular course of reasoning may be good because it accords with the laws of truth, but the laws of truth are explanatorily prior

logic and the laws of truth

- the subject matter of logic:
  - the laws of truth
  - the laws governing the truth of *propositions*
- laws of truth?
  - e.g. if a proposition has such and such a form, it must be true
  - e.g. if a set of propositions with such and such a form are all true, then a proposition with such and such a form must be true
  - we will develop more precise ways of formulating laws of truth as we go

what is logic for?

applications of logic

- logic has various applications
  - computer science
  - linguistics
  - philosophy
  - the foundations of mathematics

applications of logic

- we focus on its application to
  - making the logical form of a proposition explicit
  - formally representing the structure of arguments
  - testing for the validity of arguments
- that is, the main 'practical' skills we focus on in this class are these
- this should help if you find yourself asking 'what's the point of this?'

applications of logic

- this will involve
  - learning to translate English into a formal language
  - identifying the elements of arguments in English
  - learning how to *prove* that an argument is valid
- these applications are all very well
- but the aim of this course is to give you a much deeper understanding of what logic is
- so let's turn to some fundamental concepts

propositions

truth and propositions

- a **proposition** is something which can be **true** or **false**

propositions and sentences

- propositions are not sentences, even though sentences are the kind of thing that can be true or false
- sentences can be said to *express* propositions
- a declarative sentence is true (as used in a context) if it expresses a true proposition and is false if it expresses a false proposition

what is logic (again)?

- logic concerns itself with the laws which govern the **truth** of **propositions**

laws of truth for single propositions

- logic, as we will see will often not tell us whether a proposition is true or false but sometimes it will
- e.g. if a proposition has so-and-so a form, it must be true / it must be false

laws of truth for sequences of propositions

- we are often more interested in the question of whether a proposition with some form or another *must be true* if a sequence of propositions with some other form or another are true
- these sequences are what we call **arguments** . . .

arguments

what is an argument?

- an **argument** is a sequence of propositions
- a **sequence** is a collection of objects in a particular order
- the final proposition in the sequence is the **conclusion** of the argument
- the other propositions in the sequence (if any) are the **premises** of the argument

identifying conclusions

- in ordinary language, conclusions are often introduced by words like 'therefore', 'hence', 'thus', 'so', 'it follows that'

identifying premises

- in ordinary language premises are often introduced by words like 'because', 'since', and 'given that'

an argument

- all humans are mortal. socrates is a human. therefore, socrates is mortal
- what is the conclusion of this argument?
- what are its premises?

an argument

- since all humans are mortal and socrates is a human, socrates is mortal
- what is the conclusion of this argument?
- what are its premises?

standard form

- we can represent the argument (in **standard form**) as follows:

P1.	All humans are mortal
P2.	Socrates is a human
C1.	Socrates is mortal

- is this a good argument? why?
- this is a **valid** argument

an argument

- all humans are mortal. socrates is not a human. therefore, socrates is not mortal
- what is the conclusion of this argument? what are its premises?

an argument

- since all humans are mortal and socrates is a human, socrates is

not mortal
- what is the conclusion of this argument? what are its premises?

in standard form

- we can represent the argument as follows:

P1.	All humans are mortal
P2.	Socrates is not a human
C1.	Socrates is not mortal

- is this a good argument?
- this is an **invalid** argument
- bad arguments are arguments too

good and bad arguments

- there are good arguments and there are bad arguments
- there are **valid** arguments and there are **invalid** arguments
- there are **sound** arguments and there are **unsound** arguments
- validity and soundness have precise definitions in logic . . .

arguments and validity

validity

- an argument is **valid** if and only if, in virtue of its form, it is impossible for its conclusion to be false if its premises are true
- an argument is **valid** if and only if, because of its form, the conclusion cannot be false if the premises are true

validity

- an argument is **valid** if and only if, in virtue of its form, the conclusion must be true if the premises are true
- an argument is **valid** if and only if, because of its form, it is necessary for its conclusion to be true if its premises are true

validity

- we can develop our understanding of validity in two steps
- first: an argument is valid if and only if, in virtue of its form, *it is impossible for its conclusion to be false if its premises are true*
- second: an argument is valid if and only if, *in virtue of its form, it is impossible for its conclusion to be false if its premises are true*

necessary truth preservation

P1.	If Trump colluded with Russia, he will go to jail
P2.	Trump colluded with Russia
C1.	Trump will go to jail

- is it possible for the conclusion to be false if the premises of this argument are all true?

necessary truth preservation

P1.	If Trump colluded with Russia, he will go to jail
P2.	Trump will go to jail
C1.	Trump colluded with Russia

- is it possible for the conclusion to be false if the premises of this argument are all true?

argument forms

P1.	Either Trump will go to jail or he will be re-elected
P2.	Trump will not go to jail
C1.	Trump will be re-elected

argument forms

P1.	Either Bolsanaro will be deposed or he will be re-elected
P2.	Bolsanaro will not be deposed
C1.	Bolsanaro will be re-elected

argument forms

P1.	Either **A** or **B**
P2.	Not **A**
C1.	**B**

argument forms and the laws of truth

- any argument with this form is a valid argument
- this is a valid argument form
- we have discovered a law of truth: any argument with premises of the form above and with a conclusion of the form above is such that if the premises are true, then, in virtue of its form, it is not possible for its conclusion to be false

valid argument forms

P1.	If **A** then **B**
P2.	**A**
C1.	**B**

valid argument forms

P1.	If **A** then **B**
P2.	Not **B**
C1.	Not **A**

valid argument forms

P1.	If **A** then **B**
P2.	If **B** then **C**
C1.	If **A** then **C**

validity and form

- sometimes it is impossible for the conclusion of an argument to be false if its premises are all true, but not in virtue of the form of the argument

validity and form

P1.	This chair is red
C1.	This chair is coloured

- is it possible for the conclusion to be false if the premises of this argument are all true?

validity and form

P1.	**A**
C1.	**B**

- this is not a valid argument form
- to see why, we need only consider the following argument which has the same form, but whose conclusion can be false even when its premises are true

validity and form

P1.	This chair is red
C1.	This chair is blue

validity and form

- beware! In other areas of philosophy, validity is often defined without reference to the form of the argument
- the notion of validity we are interested in is sometimes called **formal validity** to distinguish it from this sense of validity

validity and form

- we are going to develop a more precise analysis of validity
- we are going to develop a more precise conception of the form of an argument
- we are going to look at methods for determining whether a particular argument is formally valid

soundness

what is soundness?

- an argument is **sound** if and only if (i) it is valid and (ii) all of its premises are true

an argument

P1.	If Australia is a republic then it has a president

P2.	Australia is a republic
C1.	Australia has a president

an argument

P1.	If Australia is a republic then it has a president
P2.	Australia is not a republic
C1.	Australia does not have a president

an argument

P1.	If Australia is a republic then the monarchists lost
P2.	If the monarchists lost then the republicans won
C1.	If Australia is a republic then republicans won

soundness

- while soundness is a very important feature of an argument, we will be focusing almost entirely on validity

wrapping up

this lecture

- what is logic?
- what is logic for?
- central concepts of logic:
  - propositions and truth
  - arguments
  - validity and soundness

upcoming lectures

- lecture 2, connectives and logical form
- lecture 3, the formal language PL