

Introduction to Logic

PHIL 240
Sections 501 – 509
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What is Logic?

Logic has often been called the study of reason, but that isn't entirely correct. Logic does not concern itself with the study of reason broadly, but rather with the methods and principles which distinguish correct from incorrect reasoning. The primary focus of this study is the argument.

What is an argument?

An argument is a collection of two things:

1. A set of statements, which are known as *premises*.
2. A single statement, which is known as a *conclusion*.

The statements involved need to be propositions, that is *declarative* sentences, which are sentences which may be classified as either true or false. Further, it is implied that there is a relationship between 1 and 2 such that the truth of 2 follows from 1. It is this relationship, along with the larger property it reveals, which we will explore this semester.

Induction vs. Deduction

Logicians usually differentiate two different types of arguments:

1. **Inductive:** This involves probabilistic reasoning, i.e. the truth of the premises makes the conclusion *probable*.
2. **Deductive:** This involves necessary reasoning, i.e. the truth of the premises makes the truth of the conclusion *necessary*. Deduction will be the focus of this course.

Validity

The primary objective of this course will be to explore the notion of validity. Validity is defined as follows:

An argument is valid *if and only if* it is NOT possible for the conclusion to be false when ALL the premises are true.

Entailment and Soundness.

In a valid argument, the premises are said to entail the conclusion. Whereas validity is a *property* of arguments as a whole, entailment is a *relation* that holds between the premises and conclusion of a valid argument.

Soundness is a property of a valid argument *with* all true premises. Only a sound argument is a “good” argument, as validity only speaks to the *potential* of the argument to yield a true conclusion.

Examples of valid arguments

Premise 1: If Bill ate tainted chicken, Bill will be sick.

Premise 2: Bill ate tainted chicken.

Conclusion: Bill will be sick

Premise 1: If Bill ate tainted chicken, he will be sick.

Premise 2: Bill is not sick.

Conclusion: Bill did not eat tainted chicken.

Premise 1: Either Fred will go to the Rec, or to the Chicken.

Premise 2: Fred will not go to the Rec.

Conclusion: Fred will go to the Chicken.

An interesting feature

With deductive arguments that are valid, the validity of the argument is really just a function of the underlying form of the argument. It is for this reason that we introduce a formal language for analyzing arguments. The formal language allows us to isolate the underlying form, and become better at recognizing those structures in natural language.

A formal language for Sentential Logic

• **Vocabulary:** The “building blocks” of the language consist of the following:

- Sentence Letters
- Connectives
- Parentheses

Sentence Letters

- We will use capital letters to represent simple sentences. So the following are “sentence letters:”

A, B, C, ... Z

(If we need more than 26 options, we can add subscripts.)

Connectives

- Sentential connectives, called “connectives,” are used to represent words in natural language that serve to connect declarative sentences. They include the following:

• $\sim, \&, \vee, \rightarrow, \leftrightarrow$
