



# Philosophy 220

## Basic Notions of Logic 2

# Inductive Arguments

- The text mentions (briefly) some argument patterns that are plausible, but that are not truth-preserving.
- We care not about these arguments. This is not to say that they are “inferior” or “wrong” or “useless”. Rather, these patterns of reasoning simply do not have the feature that is of interest to formal logic.

# Inductive Arguments

- Consider the argument:
  - Smoking is harmful to your health
  - You should not do that which is harmful to your health

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  - You should not smoke
- This is a truth-preserving argument, so we are interested in it in that sense, but the truth of the first premise is established by means of inductive reasoning. The truth of the second is presumably addressed by decision theory.

# ALERT! Departure from textbook!

1. The text uses some language that is non-standard. I think that the standard language is (besides being standard) clearer, so that is the language I shall use.
2. Also, the authors will make a distinction between (for example) a set of sentences being *logically* consistent, *truth-functionally* consistent, and *quantificationally* consistent. In my opinion, this specificity is unnecessary because the word 'consistent' means the same thing in each phrase.
  - a) We will drop the italicized qualifiers, and just talk of sets of sentences as being either consistent or inconsistent

# Consistency

- A set of sentences is consistent if and only if it is possible for all the members of that set to be true at the same time.
- There is no requirement for members of a set to be related to one another in any other way.
- Sets are represented by braces: { and }
- Logic will not determine whether a given sentence is true, but will determine when a given set of sentences is or is not consistent.

# Tautology (Logical Truth)

- Some sentences are what the text describes as *logically true*. The more common term for a logically true sentence is ‘tautology’.
- A sentence is a tautology if and only if it is not (logically) possible for the sentence to be false.
  - Sentences like “New York is east of Las Vegas” are always true on this Earth, but are not true of logical necessity. They *could* be false.
  - “Either I own a coffee cup or I don’t” *cannot* be false, and so it is a tautology.

# Contradiction (Logical Falsity)

- This is the opposite of a tautology. Sentences that cannot (logically) be true are called *contradictions*.
- Tautologies and contradictions are alike in that neither tells us anything about the world.

# Contingent (Logically Indeterminate)

- A sentence is contingent if and only if it is neither a tautology nor a contradiction.
- In other words, if it could have either truth value, then it is *contingent* on whatever is the fact of the matter.
- The text's terminology is confusing. If a sentence is 'logically indeterminate' that does not mean that it has neither truth value, that just means that its truth value is determined by means other than logic alone.

# Equivalence

- Any number of sentences are logically equivalent if and only if they must all have the same truth value (when one is true, they all are; when one is false, they all are).
- All tautologies are logically equivalent to one another (they are always true at the same time because they are always true). Each contradiction is equivalent to each other contradiction. Some contingent sentences are equivalent to other contingent sentences.

# Validity (review)

- An argument is valid if it is truth-preserving.
- In other words, an argument is valid if it is never the case that its premises are all true while its conclusion is false.

# Which of the following are impossible given our definitions?

1. A consistent set all of whose members are true
2. A consistent set with at least one true member and at least one false member
3. An inconsistent set all of whose members are true
4. A consistent set all of whose members are false

# Some (apparently) screwy results

- Consider:
  - My coffee cup is ceramic

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  - Mario and Luigi are either running for president or they are not running for president.
- Since this argument's conclusion is a tautology, there will never be a case in which the premise is true while the conclusion is false (because the conclusion can never be false). The argument is then technically valid.

# Some (apparently) screwy results

- Consider:
  - Godzilla is bigger than Mothra
  - Mothra is bigger than Ultraman
  - Ultraman is bigger than Godzilla
  - I like pie.
- Since this argument's premises are inconsistent, there will never be a case in which all of the premises are true while the conclusion is false (because there will never be a case in which all of the premises are true). That means that this argument too is technically valid.

## Screwy results (continued)

- Since a contradiction by itself is an inconsistent set, a contradictory premise will automatically render an argument technically valid.

# Why these results are not *that* screwy

- It is tempting to try and “fix” our definition of validity to exclude arguments whose premises are inconsistent or arguments whose conclusions are logically true.
- Resist this temptation. There is nothing wrong with our definition of validity. The previous arguments are all truth preserving. You will never start from a truth and end up with a falsehood on any valid argument.

# Usefulness of Arguments

- Whether a valid argument is *useful* is a further question, and is outside the scope of formal logic.
- Remember, inductive arguments are quite useful, but are not truth-preserving. The screwy arguments are truth-preserving, but are not useful.
- To be a good deductive argument, an argument should *at least* be valid, but a good argument must often be more than that.