

# Deductive and Inductive Arguments

# Two Kinds of Arguments

- A **deductive argument** is an argument in which the conclusion is claimed to follow necessarily from the premises.
- An **inductive argument** is an argument in which the conclusion is only claimed to be probable given the premises.

# Deductive Arguments

A **deductive argument** is an argument in which the conclusion is claimed to follow necessarily from the premises.

The conclusion of an argument **follows necessarily** from the premises if it is impossible for the premises to be true and the conclusion false—if the truth of the premises *guarantees* the truth of the conclusion.

Example:

All politicians are horrible, corrupt sleazebags.  
Homer is a politician.  
∴ Homer is a horrible, corrupt sleazebag.

# Deductive Arguments

A **deductive argument** is an argument in which the conclusion is claimed to follow necessarily from the premises.

In many arguments (probably most arguments that you will hear), the conclusion does not follow necessarily from the premises. For example, consider this argument:

All politicians are horrible, corrupt sleazebags.  
Homer is a horrible, corrupt sleazebag.  
.∴ Homer is a politician.

# Validity

A **valid** argument is a deductive argument in which the conclusion follows necessarily from the premises (i.e., it is impossible for the premises to be true and the conclusion false); a deductive argument that gives logically conclusive support for its conclusion.

- Deductive arguments that are not valid are **invalid**.
  - For an invalid argument, it is possible (even if extremely unlikely) that the premises are true and conclusion false.
- Deductive arguments are one which *claim to be valid*.

# Validity

A **valid** argument is a deductive argument in which the conclusion follows necessarily from the premises (i.e., it is impossible for the premises to be true and the conclusion false); a deductive argument that gives logically conclusive support for its conclusion.

- Valid arguments always have a logical structure that guarantees their validity.
  - This refers not to content but to form.
- B/c of this, valid arguments are said to be **truth-preserving**.

# Examples

All deliberate killing of helpless persons is wrong.  
Euthanasia is a deliberate killing of a helpless person.  
Therefore, euthanasia is wrong.     Valid.

If Socrates has horns, he is mortal.  
Socrates is mortal.  
Therefore, Socrates has horns.     Invalid.

# Validity vs. Truth

In logic, ‘valid’ and ‘true’ have different meanings and must not be confused.

*They apply to different things:*

- Arguments are valid or invalid; they are not true or false.
- Statements are true or false; they are not valid or invalid.

Generally speaking, truth and validity have nothing to do with each other.

# Validity vs. Truth

Premises	Conclusion	Validity
T	T	??
T	F	Invalid
F	T	??
F	F	??

# Soundness

An argument is **sound** when it is valid and all its premises are true.

- Every sound argument has a true conclusion.
- A deductive argument that is either (a) invalid or (b) valid but has at least one false premise, is called **unsound**.

# Deductive Argument Types

Arguments of the following types are normally deductive:

**Argument based on mathematics:** The conclusion depends on some purely arithmetic or geometric computation or measurement.

**Argument from definition:** The conclusion is claimed to depend merely on the definition of some word or phrase.

# Exercises

The following arguments are deductive. For each argument, say whether it is valid and whether it is sound. False premises are in italics.

1. Since *Moby Dick was written by Shakespeare*, and *Moby Dick is a science fiction novel*, it follows that Shakespeare wrote a science fiction novel.

2. Since London is north of Paris and south of Edinburgh, it follows that Paris is south of Edinburgh.

3. If George Washington was beheaded then George Washington died. George Washington died. Therefore, George Washington was beheaded.

4. Since the *Spanish American War occurred before the American Civil War*, and the *American Civil war occurred after the Korean War*, it follows that the Spanish American War occurred before the Korean War.

# Inductive Arguments

An **inductive argument** is an argument in which the conclusion is only claimed to be *probable* given the premises.

- For purposes of convenience, ‘probable’ will generally mean something like “greater than 0.5 or 50%.”
  - Remember: probability ranges from 0 to 1, with 0 being logically impossible and 1 being logically certain/required.

# Strength

A **strong argument** is an inductive argument in which the truth of the premises make the truth of the conclusion probable or likely to be true.

- Arguments that are not strong are **weak**—the premises do not make the conclusion probably or likely.
- *Inductive arguments are not claimed to be valid, but are claimed to be strong.*
- There can be varying degrees of strength for an inductive argument.
- The structure of strong inductive arguments, unlike valid arguments, does not guarantee the truth of the conclusion, and thus are *not truth-preserving*.

# Examples

All crows observed so far have been black. Therefore, probably the next crow we see will be black.

Strong

Ninety-eight percent of humans are mortal. Socrates is human. Therefore, Socrates is probably mortal.

Strong

When a lighted match is slowly dunked into water, the flame is snuffed out. But gasoline is a liquid, just like water. Therefore, when a lighted match is slowly dunked into gasoline, the flame will be snuffed out.

Weak

# Strength vs. Truth

Premises	Conclusion	Strength
T	T	??
T	F	??
F	T	??
F	F	??

# Cogency

An argument is **cogent** when it is strong and has all true premises.

- An argument that is weak, or that has at least one false premise, is not cogent.

# Inductive Argument Types

Arguments of the following types are normally inductive:

**Prediction:** The premises deal with facts in the past or present and the conclusion is about what will happen in the future.

**Argument from analogy:** From the fact that A has a property, and B is similar to A in other ways, concludes that B also has this property.

**Inductive generalization:** From the fact that all observed members of a population have a property, concludes that all members of the population have the property.

# Inductive Argument Types

Arguments of the following types are normally inductive:

**Argument from authority:** The fact that some authority has asserted X is taken to show that X is true.

**Argument based on signs:** The fact that there is a sign of a certain kind is taken to show that things are the way the sign says.

**Causal inference:** Inferring an effect from seeing its cause or vice versa.

In all these six kinds of argument, the conclusion does not follow necessarily from the premise and it probably is not being claimed to. Hence these are normally inductive arguments.

# Exercises

The following arguments are inductive. For each argument, say whether it is strong and whether it is cogent. False premises are in italics.

1. The grave marker at Arlington National Cemetery says that John F. Kennedy is buried there. It must be the case that Kennedy is really buried in that cemetery.

2. The ebb and flow of the tides has been occurring every day for millions of years. But nothing lasts forever. Therefore, probably the motion of the tides will die out within a few years.

3. *The vast majority of Rose Bowl games (in Pasadena, CA) have been played in freezing cold weather.* Therefore, probably the next Rose Bowl game will be played in freezing cold weather.

# Evaluating Arguments

- (1) Is the argument inductive or deductive?
- (2) Does the argument present good reason to accept its conclusion?

# Four steps

Step 1: Break down the argument into its premises and conclusion.

Step 2: See if the truth of the premises guarantees absolutely the truth of the conclusion. If yes, then it is most likely deductive, and deductively valid as well, in which case you should see if it is sound.

If the truth of the premises does not guarantee the truth of the conclusion, move on to step three.

# Four steps

Step 3: See if the truth of the premises makes the conclusion probable or likely. If they do, then treat the argument as inductive, and check to see if it is cogent.

If the truth of the premises does not make the conclusion probable or likely, move on to step four.

Step 4: At this point, you only have two options left: an invalid deductive argument, or a weak inductive argument. How to decide between the two? Look at *argument form* and look for *indicator words*.

# Indicator Words for Deductive Arguments

The following words and phrases are good indicators of the presence of a deductive argument:

“it necessarily follows that”

“absolutely”

“certainly”

# Indicator Words for Inductive Arguments

The following words and phrases are good indicators of the presence of an inductive argument:

“likely”

“probably”

“chances are”

“odds are”

“it is plausible that”

“reasonable”

# Exercises

Say whether the following arguments are inductive or deductive. If an argument is deductive, say whether it is valid; if it is inductive, say whether it is strong.

1. When a cook can't recall the ingredients in a recipe, it is appropriate that she refresh her memory by consulting the recipe book. Similarly, when a student can't recall the answers during a final exam, it is appropriate that she refresh her memory by consulting the textbook.
2. This figure is a Euclidean triangle. Therefore, the sum of its angles is equal to two right angles.
3. By accident Karen baked her brownies two hours longer than she should have. Therefore, they have probably been ruined.
4. Since Phyllis is the cousin of Denise, and Denise is the cousin of Harriet, it follows necessarily that Harriet is the cousin of Phyllis.

# Exercises

Say whether the following argument is inductive or deductive. If an argument is deductive, say whether it is valid; if it is inductive, say whether it is strong.

The Ethiopians say that their gods are flat-nosed and black while the Thracians say that theirs have blue eyes and auburn hair. Yet if cattle or horses or lions had hands and could draw, and could sculpt like men, then the horses would draw their gods like horses, and cattle like cattle; and each they would shape bodies of gods in the likeness, each kind, of their own.

- Xenophanes, *Fragments*