

Logic and Argument

Logic is the study of argument. In this sense, "argument" means not a quarrel but a piece of reasoning in which statements (**premises**) are offered in support of a conclusion. This kind of argument is called "syllogistic reasoning."

Here is a famous example of syllogistic reasoning (using a **syllogism**):

All men are mortal
Socrates is a man
Therefore, Socrates is mortal.



A syllogism based on **true premises** and **valid reasoning** is a **sound argument**, and the conclusion must follow by necessity.

Here is the same syllogism in "mathematical" form:

$A = B$	Another form: If $A = B$
$C = A$	and $B = C$
$C = B$	then $A = C$

Is the following syllogism a sound argument? Why or why not?

Most Scandinavians are blonde.
My cousin Christine is Scandinavian.
She must be blonde too.

Deductive arguments vs. Inductive arguments:

Deductive: All the pens in this box are broken. $A = B$
All the pens on the table are from that box. $C = A$
Therefore, all the pens on the table are broken. $C = B$
*(The conclusion follows of **necessity**.)*

Inductive: All the pens on the table are from that box. $A = B$
All the pens on the table are broken. $A = C$
Therefore, all the pens in the box are broken. $B = C$
*(The conclusion follows with **probability**.)*

Inductive: The sun has risen every morning since the beginning of time.
Therefore, the sun will rise tomorrow morning.

Evaluating Arguments: Truth, Validity, and Soundness

People are sometimes heard to say, "That may be logical, but it's not true," and they may be right. Together, *truth*, *validity*, and *soundness* provide a basis for evaluating any argument.

Validity: The correctness with which a conclusion has been inferred from its premises (logical)

Truth: The correctness of the premises (are the premises factual?)

Soundness: The result when the premises of an argument are true and its conclusion is validly (logically) reached.

It is possible in logic to start with true premises but reach a false conclusion because we reason badly from our premises. We can also reason correctly (validly) but not reach a true conclusion because our premises are false. **Soundness results when the premises of an argument are true and its conclusion is validly reasoned.** Otherwise, the argument is unsound.

Determine the soundness of each example below:

- A. All movie stars live in Hollywood.
Robert Redford is a movie star.
Therefore, Robert Redford lives in Hollywood.
Are the premises true? _____ Is the reasoning valid? _____ Is the argument sound? _____
- B. All cats are animals
All pigs are animals.
Therefore, all pigs are cats.
Are the premises true? _____ Is the reasoning valid? _____ Is the argument sound? _____
- C. A final exam determines a student's grade in Algebra 1.
All final examinations are easy.
Therefore, I will receive a high grade in Algebra 1.
Are the premises true? _____ Is the reasoning valid? _____ Is the argument sound? _____
- D. All human life requires water.
There is no water on the planet Venus.
Therefore, there is no human life on the planet Venus.
Are the premises true? _____ Is the reasoning valid? _____ Is the argument sound? _____

FOUR TYPES OF ARGUMENTS

	<i>Premises</i>	<i>Validity</i>	<i>Soundness</i>
1	T	V	S
2	T	I	U
3	F	V	U
4	F	I	U