Philosophy Logic 1 - Contents

I. Introduction: Arguments and Explanations

Logic is the use of intellect or cognition from memory and/or instincts to make good reasoning.

Reasoning is the analysis and evaluation of a situation to make proper judgments or decisions.

- It is not abstract.
- It clarifies our judgments.
- It contains *principles* that govern critical thinking.

Proper judgments can only be done with *evidences* and *reasons*.

Basic Principles of Logic:

- Law of non-contradiction: *Nothing can both be and not be at the same time and in the same respect.*
- Law of the excluded middle: *Something either is or is not.*
- Law of identity: *Something is what it is.*

Argument

Argument is the expression of reasoning. It contains the *claim* and the *premises*.

It is different from **explanation**, which means a statement, fact, or situation that tells you why something happened.

The starting point for structural approaches is the **thesis** that the premises of an argument are reasons offered in support of its **conclusion**.

A **proposition** is a statement or assertion that expresses a judgment or opinion.

A collection of propositions, P1, …, Pn, C, is an *argument* if and only if there is a reasoner R who puts forward the Pi as reasons in support of C.

A **claim** is a group of statements in which one statement follows the other statements.

Inference (implication or entailment) is the process of drawing information from the flow of the statements.

A **fallacy** is a failure in reasoning that renders an argument invalid.

Explanation

An **explanation** is not an argument.

Whereas an argument is a series of statements designed to support or establish the truth of an idea, an explanation is a series of statements designed to shed light on some event that is already accepted as a matter of fact.

Technically, an explanation is composed of two parts: the *explanandum* and the *explanans*.

The **explanandum** is the event or phenomenon or thing which is supposed to be explained.

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The **explanans** is the series of statements which is supposed to do the actual explaining.

II. Recognizing Arguments and Evidences

Sometimes an argument will not follow a specific order.

> For instance, the conclusions might be stated first, and the premises stated afterwards in support of the conclusion. This is perfectly valid, if sometimes a little confusing.

Arguments are harder to recognize than premises or conclusions. Many people shower their writing with assertions without ever producing anything which one might reasonably describe as an argument. Some statements look like arguments but are not.

> *"If the Bible is accurate, Jesus must either have been insane, an evil liar, or the Son of God."*

The above is not an argument, it is a conditional statement. It does not assert the premises which are necessary to support what appears to be its conclusion.

> *"God created you; therefore, do your duty to God."*

The phrase *"do your duty to God"* is neither true nor false. Therefore, it is not a proposition, and the sentence is not an argument.

Causality is important. Suppose we are trying to argue that there is something wrong with the engine of a car. Consider two statements of the form "A because B". The first statement:

Example 1:

"My car will not start because there is something wrong with the engine."

> The statement is not an argument for there being something wrong with the engine; it is an explanation of why the car will not start. We are explaining A, using B as the explanation. We cannot argue from A to B using a statement of the form "A because B".

"There must be something wrong with the engine of my car, because it will not start."

> Here we are arguing for A, offering B as evidence. The statement "A because B" is then an argument.

To make the difference clear, note that "A because B" is equivalent to "B therefore A". The two statements then become:

"There is something wrong with the engine, therefore my car will not start."

And:

"My car will not start, therefore there is something wrong with the engine."

If we remember that we are supposed to be arguing that there is something wrong with the engine, it is clear that only the second statement is a valid argument.

Example 2:

"Smoke appears because of fire: a combination of flammable material, oxygen, and sufficient heat."

>The phrase *"smoke appears" is* the explanandum and the phrase *"fire: a combination of flammable material, oxygen, and sufficient heat"* is the explanans. In fact, this explanans itself consists of an entire explanation *"fire"* plus the reason why fires happen.

>This is not an argument because no one disputes the idea that *"smoke appears"*. We already agree that smoke exists and are simply looking to find out **why**. Were someone to dispute the existence of smoke, we would have to create an argument to establish the truth of smoke.

"Smoke appears because of smoke-producing events."

>This is not a valid explanation because it provides us with no **new** information. We have not **learned** anything from it because the supposed *explanans* is simply a restatement of the *explanandum*: the appearance of smoke.

>A good explanation is something which provides new information in the explandum which does not appear in the explans. A good explanation is something from which we can **learn**.

In the first example above, we are provided with new information: fire, and what causes fire. Because of that, we learned something new which we did not know from simply examining the *explanandum*.

Unfortunately, too many *explanations* we see take a form more like #2 than like #1. It usually isn't quite so obvious as these examples here, but if you examine them closely you will find that the *explanans* is little more than a restatement of the *explanandum*, with no new information added.

III. Models of Arguments

Arguments can be separated into two categories: **deductive** and **inductive**.

Deductive Argument

A deductive argument is one in which it is impossible for the premises to be true but the conclusion false. Thus, the conclusion follows necessarily from the premises and inferences. In this way, it is supposed to be a definitive proof of the truth of the claim (conclusion).

> *All men are mortal. (premise)*
> *Socrates was a man. (premise)*
> *Socrates was mortal. (conclusion)*

As you can see, if the premises are true (and they are), then it simply isn't possible for the conclusion to be false.

If you have a deductive argument and you accept the truth of the premises, then you must also accept the truth of the conclusion; if you reject it, then you are rejecting logic itself.

Deductive arguments provide absolute necessity for "P guarantees the truth of Q".

Inductive Argument

An inductive argument is one in which the premises are supposed to support the conclusion in such a way that if the premises are true, it is improbable that the conclusion would be false.

Thus, the conclusion follows probably from the premises and inferences.

> *Socrates was Greek. (premise)*
> *Most Greeks eat fish. (premise)*
> *Socrates ate fish. (conclusion)*

In this example, even if both premises are true, it is still possible for the conclusion to be false (maybe Socrates was allergic to fish, for example).

Words which tend to mark an argument as inductive—and hence probabilistic rather than necessary—include probably, likely, possibly and reasonably.

Deductive vs Inductive Arguments

It may seem that inductive arguments are weaker than deductive arguments because there must always remain the possibility of their arriving at false conclusions, but that is not entirely true.

> With deductive arguments, our conclusions are already contained, even if implicitly, in our premises. This means that we don't arrive at new information - at best, we are shown information which was obscured or unrecognized previously.

> Thus, the sure truth-preserving nature of deductive arguments comes at a cost.

Inductive arguments, on the other hand, do provide us with new ideas and thus may expand our knowledge about the world in a way that is impossible for deductive arguments to achieve.

Thus, while deductive arguments may be used most often with mathematics, most other fields of research make extensive use of inductive arguments.

IV. Categorical syllogism

A **syllogism** is an argument with two premises and a conclusion.

A **categorical syllogism** is a syllogism whose premises and conclusion are all categorical statements, and which contains exactly three terms. Because each categorical statement contains exactly two (distinct) terms, it follows from this definition that each term in a categorical syllogism must occur exactly twice in the argument.

The major term in a categorical syllogism is the predicate term of the conclusion. The minor term is the subject term of the conclusion. The middle term is the term that occurs in each premise.

Example 1:

All good logicians are beer lovers.
No politicians are good logicians.
Some politicians are not beer lovers.

Major term: "beer lovers". Minor term: "politicians". Middle term: "good logicians".

The syllogism above is invalid.

A categorical syllogism is in standard form *if and only if*:

1. Its component statements are all in standard form (i.e., not stylistic variants)

2. Its first premise contains the major term

3. Its second premise contains the minor term

4. The conclusion is stated last.

Example 2:

No birds are mammals.
All dogs are mammals.
Therefore, no dogs are birds.

The major premise of a categorical syllogism (in standard form) is the premise containing the major term.

The minor premise of a categorical syllogism (in standard form) is the premise containing the minor term. It follows that, in a standard form categorical syllogism, the first premise is the major premise and the second premise is the minor premise.

V. Mood and Validity of Categorical Syllogism

Categorical syllogisms have 2 premises and 1 conclusion. It has 3 terms. The major (P) or the predicate of the conclusion, minor (S) or the subject of the conclusion, and the middle (M) as it appears in both premises.

The forms of categorical syllogism are:

- Universal Affirmation -> A

- Universal Negation -> E

- Particular Affirmation -> I

- Particular Negation -> O

The mood of a categorical syllogism in standard form is a string of three letters indicating, respectively, the forms of the major premise, minor premise, and conclusion of the syllogism. Thus, the mood of the syllogism in Example 2 above is EAE.

Note, however, that syllogisms can have the same mood but still differ in logical form. Consider the following example:

Example 3:

> *No mammals are birds.*
> *All mammals are animals.*
> *Therefore, no animals are birds.*

Example 3 also has the form EAE. But, unlike Example 2, it is invalid. What's the difference?

The syllogisms in Examples 2 and 3 have the following forms, respectively:

> No P are M. No M are P. All S are

> M. All M are S. No S are P. No S are P.

These two syllogisms differ in figure.

The figure of a categorical syllogism is determined by the position of the middle term. There are four possible figures:

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   M  P      P  M      M  P      P  M
 1  \      2  |     3 |        4  /
   S  M      S  M      M  S      M  S
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The syllogism in Example 2 exhibits second figure. The one in Example 3 exhibits third figure.

Now for the central fact about syllogistic validity: The form of a categorical syllogism is completely determined by its mood and figure.

Aristotle worked out exhaustively which combinations of mood and figures result in valid forms and which result in invalid forms. Thus, the form of Example 2 ("EAE-2") is valid; that of Example 3 ("EAE- 3") is invalid.

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There are 256 combinations of mood and figure (64 (4 × 4 × 4) moods × 4 figures). Only fifteen are valid.

The valid syllogistic forms

- First figure:
    1. AAA
    2. EAE
    3. AII
    4. EIO
- Second figure:
    5. EAE
    6. AEE
    7. EIO
    8. AOO
- Third figure:
    9. IAI
    10. AII
    11. OAO
    12. EIO
- Fourth figure:
    13. AEE
    14. IAI
    15. EIO

VI. Hypothetical Syllogism

Pure Hypothetical Syllogism is a valid argument form which is a syllogism having a conditional statement for one or both of its premises. Its structure is:

If p, then q.	If p, then not r.
If q, then r.	If not r, then not q.
(So) If p, then r.	(So) If p, then not q.

Example:

> If I do not wake up, then I cannot go to work.
> If I cannot go to work, then I will not get paid.
> Therefore, if I do not wake up, then I will not get paid.

Meanwhile, in **mixed hypothetical syllogisms** (or **Conditional Syllogism**), one of the premises is a conditional while the other serves to register agreement (affirmation) or disagreement (denial) with either the antecedent or consequent of that conditional.

> There are thus four possible forms of such syllogisms, two of which are valid, while two of which are invalid.

Affirming the Antecedent (or **Modus Ponens**)	Denying the Consequent (or **Modus Tollens**)
If p, then q.	If p, then q.
p.	Not q.
Q.	Not p.

Note that it is not valid to affirm the consequent and conclude the antecedent, or deny the antecedent and conclude the negation of the antecedent.

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Valid Examples:

Affirming the Antecedent (AA)
If Tweety is a bird, then Tweety flies.
Tweety is a bird.
Tweety flies

Denying the Consequent (DC)
If Tweety is a bird, then Tweety flies.
Tweety doesn't fly.
Tweety is not a bird.

Invalid Examples:

Affirming the Consequent (AC)
If Tweety is a bird, then Tweety flies.
Tweety flies.
Tweety is a bird

Denying the Antecedent (DA)
If Tweety is a bird, then Tweety flies.
Tweety is not a bird.
Tweety doesn't fly.

A **disjunctive syllogism** (or **modus tollendo ponens**) is a valid argument where the basic form of the disjunctive syllogism is:

Either A or B. (A exclusive-or B).

- If A, then not B.
- If B, then not A.

Example:

The cake has either chocolate or vanilla frosting.
The cake does not have vanilla frosting.
Therefore, the cake has chocolate frosting.

Either the Sun orbits the Earth, or the Earth orbits the Sun.
The Sun does not orbit the Earth.
Therefore, the Earth orbits the Sun.

A **Modus ponendo tollens** (from Latin meaning "mode that by affirming, denies") is usually described as having the form:

Not both A and B
A
Therefore, not B.

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VI. Toulmin's Model of Argument

Stephen Toulmin, an English philosopher and logician, identified elements of a persuasive argument. These give useful categories by which an argument may be analyzed.

Issue/problem

The issue states a question concerning the problem.

Example:

> Do you have a hard time hearing?

Claim

A claim is a statement that you are asking the other person to accept. This includes information you are asking them to accept as true or actions you want them to accept and enact.

Example:

> You should use a hearing aid.

Many people start with a claim, but then find that it is challenged. If you just ask me to do something, I will not simply agree with what you want. I will ask why I should agree with you. I will ask you to prove your claim. This is where grounds become important.

Grounds

The grounds (or data) is the basis of real persuasion and is made up of data and hard facts, plus the reasoning behind the claim.

> It is the 'truth' on which the claim is based.

> Grounds may also include proof of expertise and the basic premises on which the rest of the argument is built.

The actual truth of the data may be less than 100%, as much data are ultimately based on perception.

> We assume what we measure is true, but there may be problems in this measurement, ranging from a faulty measurement instrument to biased sampling.

> It is critical to the argument that the grounds are not challenged because, if they are, they may become a claim, which you will need to prove with even deeper information and further argument.

Example:

> Over 70% of all people over 65 years have a hearing difficulty.

Information is usually a very powerful element of persuasion, although it does affect people differently.

> Those who are dogmatic, logical or rational will more likely to be persuaded by factual data.

Those who argue emotionally and who are highly invested in their own position will challenge it or otherwise try to ignore it.

It is often a useful test to give something factual to the other person that disproves their argument and watch how they handle it.

Some will accept it without question. Some will dismiss it out of hand. Others will dig deeper, requiring more explanation.

This is where the warrant comes into its own.

Warrant

A warrant links data and other grounds to a claim, legitimizing the claim by showing the grounds to be relevant. The warrant may be explicit or unspoken and implicit. It answers the question 'Why does that data mean your claim is true?'

Example:

A hearing aid helps most people to hear better.

The warrant may be simple and it may also be a longer argument, with additional sub-elements including those described below.

Warrants may be based on logos, ethos or pathos, or values that are assumed to be shared with the listener.

In many arguments, warrants are often implicit and hence unstated. This gives space for the other person to question and expose the warrant, perhaps to show it is weak or unfounded.

Backing

The backing (or support) for an argument gives additional support to the warrant by answering different questions.

Example:

Hearing aids are available locally.

Qualifier

The qualifier (or modal qualifier) indicates the strength of the leap from the data to the warrant and may limit how universally the claim applies. They include words such as 'most', 'usually', 'always' or 'sometimes'. Arguments may hence range from strong assertions to generally quite floppy with vague and often rather uncertain kinds of statement.

Example:

Hearing aids help most people.

Another variant is the reservation, which may give the possibility of the claim being incorrect.

Unless there is evidence to the contrary, hearing aids do no harm to ears.

Qualifiers and reservations are much used by advertisers who are constrained not to lie. Thus they slip 'usually', 'virtually', 'unless' and so on into their claims.
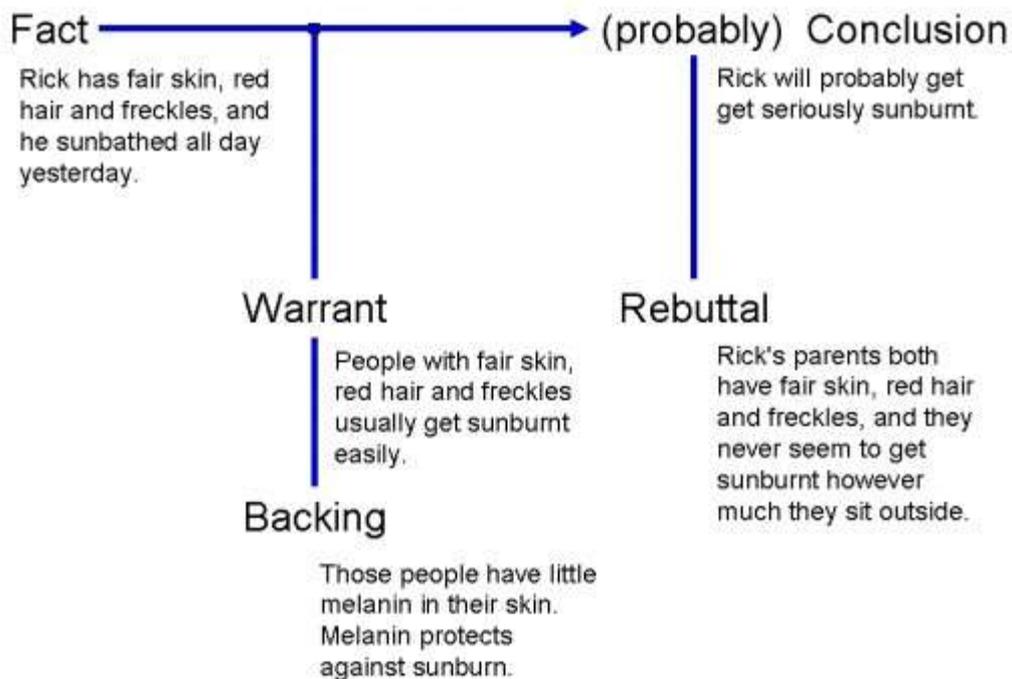
Rebuttal

Despite the careful construction of the argument, there may still be counterarguments that can be used. These may be rebutted either through a continued dialogue, or by pre-empting the counterargument by giving the rebuttal during the initial presentation of the argument.

Example:

> There is a support desk that deals with technical problems.

Any rebuttal is an argument in itself, and thus may include a claim, warrant, backing and so on. It also, of course can have a rebuttal. Thus, if you are presenting an argument, you can seek to understand both possible rebuttals and also rebuttals to the rebuttals.

Example

Fact → (probably) Conclusion

Fact: Rick has fair skin, red hair and freckles, and he sunbathed all day yesterday.

Conclusion: Rick will probably get get seriously sunburnt.

Warrant: People with fair skin, red hair and freckles usually get sunburnt easily.

Backing: Those people have little melanin in their skin. Melanin protects against sunburn.

Rebuttal: Rick's parents both have fair skin, red hair and freckles, and they never seem to get sunburnt however much they sit outside.

Source: https://owlcation.com/academia/How-to-Use-a-Toulmin-Argument-Model-for-Reading-and-Writing