LOGIC

Logic is the system of methods and principles that may be used as criteria for evaluating arguments. It is the study of the methods and principles used to distinguish good reasoning (correct) from bad (incorrect) reasoning. Logic involves the use of arguments.

1. Argument

2. A Broader (everyday) sense: By and large, the notion of argument is used here to refer to a fight, a quarrel, a conflict, a disagreement or generally anytime two or more people are screaming abuses at each other
3. A Narrow (logic) sense: Here, an argument specifically refers to a process of trying to convince someone of something. That is, it refers expressly to the dispassionate marshalling of support for some position, point of view, a course of action, decision or conclusion. This sense of 'argument' has its own vocabulary; arguments here are not something one gets into but rather something that one constructs, offers to someone, brings to bear on an issue or evaluates. Thus to offer an argument is, typically, to provide reason to believe the conclusion is correct.

Therefore, in logic, an argument refers to a group of statements, one or more of which (called the premise(s)) is/are claimed to provide support for, or reasons to believe, one of the others (normally called the conclusion). In other words, an argument is a sequence of statements of which one is intended as a *conclusion* and the other(s), the premise(s), are intended to prove or at least provide evidence for it (i.e. the conclusion). The statements that make up an argument are divided into premises and a conclusion. The premises are the statements that set forth the reasons, evidence or basis and the conclusion is the statement that is claimed to follow from the premises i.e. it is the statement that the evidence is claimed to imply

Examples of arguments in logic

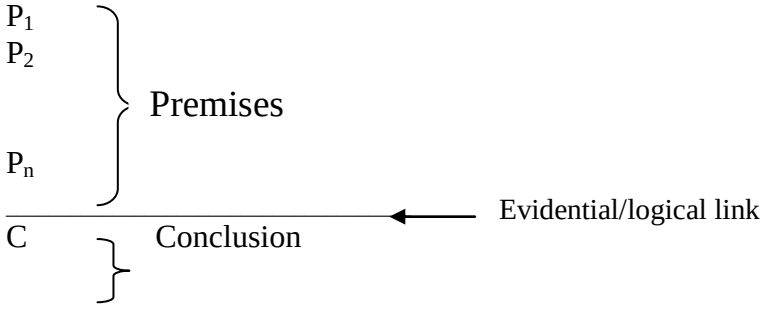
1. Peter is not a boy scout, since he does not know how to tie a square knot and all boy scouts know how to tie square knots.

2. Current economic indicators are so bad that the wise investor will stay out of the stock market until there is a substantial change in the forecast

3. Inflation has dropped considerably, while interest rates have remained high. Therefore in real terms borrowing has become more expensive, since under these conditions borrowed money cannot (as it could when inflation was higher) be paid back in highly inflated dollars.

The Standard Structure of an Argument

We can ideally identify two parts of an argument; a top (the reasons or support claims or premises) and a bottom (conclusion), offered as having a certain relationship to one another (the logical link): This can be illustrated as follows:



2. Identifying and Analyzing Arguments

1. Is it an argument?

It is not the case that everything that is presented to one is an argument. And since logic deals with arguments it is important to be able to distinguish cases that contain arguments from those that do not. Generally a case contains an argument if it purports to prove something, otherwise it does not. That is, for something to pass as an argument two conditions must be fulfilled: a) there must be a factual claim. That is, at least one of the statements must claim to present evidence or reasons and b) there must be an inferential claim. That is, there must be a claim that the alleged evidence supports or implies something or implies that something follows from the alleged evidence.

2. What is it an argument for (What is the conclusion)?

One of the most important tasks in the analysis of arguments is being able to distinguish premises from conclusion. We need to note that in our ordinary discussions, arguments are never presented to one in a neat tidy way as illustrated above. It is upon one to clearly identify the reasons being offered and the conclusion that is supposed to follow from them. To assist in doing this there are flag terms that one can use. For conclusions, conclusion indicators are important since they signal that the sentence that contains them or to which they are prefixed is a conclusion from previously stated premises.

Typical examples include: Therefore, accordingly, consequently, we may conclude, so, we may infer, thus, hence, it follows that the moral is, which proves/means among others.

3. What support does it provide (what are the premises)?

This question requires one to identify the basis or foundation of an argument. In other words, one is expected to clearly articulate the reasons, evidence, grounds data, or information (generally called the premises) of an argument. At this point I need to indicate that though formal logic is not interested in the content of an argument and thus the actual truth of the premises, one need to appreciate that the nature (truth) of the premises can determine whether the argument is good or bad. Thus, a supplementary question that one ought to ask is: *Are the premises credible and acceptable?*

For the main question premise indicators are always of assistance. They include flag terms such as; since, because, owing to, given that, for the reason that, as indicated by etc.

Example:

> Expectant mothers should never use recreational drugs, ***since*** the use of these drugs can jeopardize the development of the fetus.

4. How strong is this support (How good is the argument)?

These are the pragmatics of evaluation and include the practical consideration in the assessment of an argument. This process involves the examination of the evidential link and whether it is good enough to warrant acceptance or rejection of an argument. I need to clarify here that at this point one is not trying to prove the truth of the conclusion but whether it follows from the premises i.e. examining the inferential claim. To anticipate a discussion that will be coming a little later on, depending on the nature of the argument, one ought to assess the deductive validity if it is a deductive argument or inductive strength if it is an inductive argument.

4. Deductive reasoning

Deductive arguments try to prove their conclusions with rigorous, inescapable logic. Thus, an argument is considered to be deductive when the premises present absolute and irrefutable evidence for the conclusion. When this happens such a deductive argument is said to be a valid one; but if the premises do not guarantee the truth of the conclusion it is termed invalid.

An argument is deductively valid if and only if its underlying structure or form guarantees that if its premises are all true, then its conclusion must also be true. Otherwise it will be invalid.

This means that in deductively valid argument, when its premises are true then, it is ***impossible*** that its conclusion can be false. This is because if this happens then we involve ourselves in a contradiction. But an argument is deductively invalid if and only if its underlying structure does not guarantee that if its premises are all true, then so is its conclusion.

The reason why it is impossible for the conclusion of a deductively valid argument to be false if the premises are true is that the conclusion makes no factual claim that is not implicitly made by the premises. What the conclusion does is merely to lay bare (or make explicit) what was initially hidden (or implicit) in the premises. So, the conclusion actually does not venture to say

anything more than what the premises contain. Such arguments are normally referred to as truth-transmitting since they merely transfer the truth contained in the premise(s) to the conclusion and the conclusion cannot claim anything that is not already implied by the premises.

It is noticeable therefore that deductive logic regards argument correctness as all or nothing, i.e. either it is valid or it is invalid. This is simply because these kinds of arguments provide logically conclusive grounds for their conclusions such that it is logically inconsistent to assert the premises and deny the conclusion given that the conclusion follows necessarily (or with necessity) from the premises.

Notice that the above definitions of deductive validity or invalidity are not about the truth of the premises but rather the structure of the arguments. It is precisely the structure of the argument that guarantees that provided its premises are all true its conclusion will not be false.

Let us take an example to illustrate our point: *All Nigerians are Africans; President Kibaki is a Nigerian. Therefore, President Kibaki is an African*

We observe that the second premise in the argument above is false because President Kibaki is not a Nigerian. Nevertheless, we are claiming that if these premises were all true, then the conclusion would also be true. Therefore, the above argument is a deductively valid argument. We need to appreciate however that because of the falsity of one of the premises it is obvious that the argument cannot be convincing. This means that validity is only the first of the evaluative criteria for acceptability or rejection of deductive reasoning. The second standard is what logicians' term soundness. Whenever an argument has all true premises and is deductive validity, we say that it is a sound argument. Otherwise it is unsound.

NOTE: *An argument is SOUND if and only if it is both deductively valid and has all true premises.*

5. Inductive Reasoning

Inductive logic on the other hand, is concerned with connections from premises to concussions that allow for gradations. We can hence have a more or less strong inductive argument. In other words inductive arguments try to show that their conclusions are plausible or likely given the premises(s). Unlike deductive arguments which claim to guarantee their conclusions, inductive arguments simply claim that their conclusions are likely or probable given the premises offered.

NOTE: *An argument is inductively strong (or weak) in direct proportion to the likelihood of its conclusion being true on the assumption that its premises are true.*

This means that if the premises of an inductive argument are true then it is ***probable*** that its conclusion can be true. The degree of inductive strength depends entirely on how improbable it is that the conclusion is false given that the premises are true. Therefore, inductive arguments

can be of varying degrees of strength ranging from very strong inductive arguments to weak inductive arguments.

The main reason as to why an inductive argument can be strong or weak is that its conclusion asserts more than what is contained in the premises. That is an inductive argument is *truth-increasing*. It therefore makes factual claims, which lie beyond what the premises claim. A denial of the conclusion of an inductive argument does not necessarily lead us to a contradiction since we can describe situations in which the premises remain true and yet the conclusion is false.

Typical examples of such inductive arguments are weather forecasts of the meteorological department or opinion polling. On the basis of the data and information gathered during the day or throughout the week, meteorologists forecast what the weather is likely to be the following day. The forecast certainly ventures beyond what the premises contain because it refers to a day, which has not yet arrived. This same reasoning applies to opinion polls as well.

So in evaluating inductive arguments we should try to determine the probability or likelihood of the conclusion being true if the premises are all true. If the conclusion is likely to be true if the premises are true then we consider the argument to be inductively strong. But if the conclusion is only slightly supported by the premises, then we consider the argument to be inductively weak.

NOTE: *Other than strength, when assessing inductive arguments one ought to determine its cogency. A cogent argument is an inductive argument that is strong and has all true premises; if either of condition is missing, the argument is uncogent. A cogent argument is the inductive analogue of a sound deductive argument.*

6. Distinguishing Deductive from Inductive Reasoning

1. If the conclusion follows necessarily from the premises, the argument should always be treated as deductive

2. If the conclusion does not follow necessarily from the premises, the argument should be treated as inductive unless (a) the language or context of the argument makes clear that the argument is deductive or (b) the argument has a pattern of reasoning that is characteristically deductive.

3. If there is significant doubt about whether an argument is deductive or inductive, always interpret it in the way most favorable to the arguer.