Why Logic First?

Kent Slinker
Tucson Az, 2005

Some students may wonder why I chose a set of essays which are not included in the text book to begin our Introduction to Philosophy. Let me explain, and at the end of this brief introduction to Philosophy - *Why Logic First*, I will also explain what is going on with the online logic test many of you have taken (many of whom did not do well).
As I state in my syllabus, Philosophy is not the study of one's personal opinions on matters of concern to Philosophy (What is knowledge?, What is the universe really like?, What is truth?, Who am I?, Is there a god? What moral code should I follow? etc.) Rather this Introduction to Philosophy will examine several answers to these questions put forth by other Philosophers. What the student will quickly discover through careful reading is that many Philosophers simply disagree with each other. For example, on the existence of God, one Philosopher may take the existence of God to be so self evident that to deny it means either you do not understand the definition of God, or you are a fool. Another Philosopher will conclude that any rational person can see that there is no reason to believe in God, and the only possible way one can not see this is to be blinded by emotional (hopeful) wishes. Obviously both propositions, "That God exists", and that "God does not exit" cannot both be true (here we assume that the words maintain their meanings in both sentences). To take note of this impossibility it to take note of a logical point, often called the *Law of Contradiction*, which more generally stated tells us that both "something" and "*not* that same something" are two statements which cannot both be true. For example, George W. Bush either is or *is not* the son of the 41st President, either it will rain in Bisbee Arizona on September 22, 2007 or *it will not*. Whether or not we know which of these pairs of statements is true is irrelevant to the logician. But we do know that *both of them cannot be true*, and in the cases just presented, *one of the pair must be true*. Hence, Logic is mainly concerned with relationships between sentences (many times called "propositions" because of their ability to be either true or false).

One of the main goals of logic is to *distinguish between types of arguments.* Recall that an argument is a set of reasons (called *premises*) that bring the reader-listener to one or more *conclusions.* All arguments can be classified into two types - *valid or invalid* (sometimes called deductive and inductive, but inductive arguments are just a special case of invalid arguments). If an argument is valid, then certain things must be true about that argument:

- If the premises turn out to be true in a valid argument, the conclusion is guaranteed to be true.
- If the conclusion turns out to be false in a valid argument, then at least one premise must be false also.

On the other hand, if an argument is invalid, then it *is possible* to have all true premises and still have a *false conclusion*.

Here is an example of a valid argument:

If John gets a raise, he will buy a new house.	← Premise 1
John did not buy a new house	← Premise 2
Therefore John did not get a raise.	← Conclusion

Now assume that all of the premises are indeed true. Could it be possible that John actually *did* get a raise, which would make the conclusion false and violate what I said earlier about this being a valid argument?
Well if he did get a raise, then that would mean premise 1 is false or that premise number 2 is false or both (since it states that if John does get a raise, he will buy a new house, and that he indeed did *not* buy a new house).
Notice that by saying that this argument is valid only means that if indeed the premises are true, then the conclusion *must be true*. The important point about that last sentence is that it is a conditional, IF something, THEN something else. In saying that an argument is valid one does not say that the premises are actually true, but only what must be the case *if they do turn out to be true*. Valid arguments with premises which indeed turn out to be true are called *sound arguments*.
One last important point about valid arguments pointed out first by Aristotle. Valid arguments can be detected simply by their form, what they actually say makes no difference to their validity at all. The general form of the above argument is:

If P then Q
Not Q
Therefore not P

In the above case, P = "John gets a raise" and Q = "John will by a new house". Go ahead an substitute the specific P an Q in the above form, and see if you don't get the same argument as above.
What Logic tells us is that any substitution for P and Q (as long as what is substituted has the quality of being either true or false) in the above general form results in a valid argument. It makes no difference what the content of the P or Q is, when placed together to form an argument of the form:

If P then Q
Not Q
Therefore not P

The resulting argument is valid, hence if the premises turn out to be true, then the conclusion must be true.

Let's look at another valid form:

If P then Q
P
Therefore Q

Now for convenience let's use the same assignment as above for P and Q, we get:

If John gets a raise, he will buy a house	← Premise 1
John did get a raise	← Premise 2
Therefore John will buy a house	← Conclusion

Here as before, if the premises really are true, then the conclusion must also be true. I realize some students may protest at this point, and claim that John could change his mind after getting the raise and fail to buy a house. But notice that if John does change his mind, then premise 1 is no longer true! So as before, if it indeed is the case that all premises are true, then the conclusion of a valid argument must be true also.

Before I give a few examples of invalid arguments I want to point out that I have only given you two forms of valid arguments - incidentally those are the very forms you need to know to solve the online Logic quiz. There are an infinite many forms of valid arguments, but in most logic classes you start out with about nine basic ones, and learn that from those basic forms you can construct an infinite number of other valid arguments.

Now to turn quickly to *invalid arguments*. As previously stated, an invalid argument is any argument where it is possible for all of the premises to be true and yet still have a false conclusion. This does not mean that invalid arguments are useless, as a matter of fact they are quite common. Invalid arguments can be classified into different types. Some invalid arguments (called strong inductive arguments) actually nearly guarantee their conclusion, just coming short of 100% certainty, such that if the premises are true, it is near certain that the conclusion is true also. Other types of invalid arguments are called "Logical Fallacies", such that the conclusion does not follow from the truth or falsity of the premises at all.[1] Here are some examples:

I bought my car 2 years ago, and I have never had any problems with it starting up on cold mornings.	← Premise 1
Therefore it will start this cold morning.	← Conclusion

This is a simple argument with one premise and one conclusion. However, even if we assume the single premise is true, the truth of the conclusion is not guaranteed! The

[1] I realize that if there are advanced readers in logic reading this they may protest at this point. Circular reasoning (begging the question) is almost always included in the list of Logical Fallacies, and such arguments actually are valid - However, I maintain that my way of presenting logic with the split down the Valid-Invalid side is more consistent, since I do not have to introduce the intentions of the person making the argument as is done in many Logic texts when one makes the split between Deductive and Inductive reasoning!

conclusion may be considered more probable than not (in other words, it is more likely that my car will start than not start) but the conclusion is *in no way certain*. This particular example is a case of strong inductive reasoning, which - just like the name implies - leads to strong conclusions (conclusions that are likely to be true). Strong inductive arguments move from what is the case several times to what will be the case the next time(s). The more cases where X is true (in our example, the more cold mornings that my car starts without problem) the more probable is the conclusion inferred from those cases.
However, just like strong inductive arguments, there are weak inductive ones too. Suppose someone says that every internet class they have ever taken they received an A, so they will more than likely receive an A in their next internet class. Well, if it turns out that that person has only taken one internet class (a single case!) then the conclusion certainly does not follow at all from the premise, even though the premise is true! *From one single case, you cannot make a strong argument for the next case!* Some students may immediately see a connection between weak inductive arguments and stereotypes. Suppose one has had little experience with people from Kenya, and assumes that all people from Kenya are like those few they have experienced. The conclusion certainly does not follow from the few cases experienced, and from that reason alone, one could not make a rational decision about Kenyans in general! [2]

So now that I have examined strong-weak induction, let me give one last example of an invalid argument of the logical fallacy type.

I've seen Susan Carter get mad for no reason ← Premise 1
Therefore she would be a bad candidate for School Council member. ← Conclusion

Here is another simple argument which is an example of the logical fallacy usually known by its Latin name, "*Ad hominem*" - also known as "Attack against the person". What is important to note here is that the conclusion does not follow at all from the premise. Which means that it makes no difference to the conclusion whether the premise is true or false! In other words the reason (premise) given for stating that Susan Carter would be a bad candidate for School Council member has nothing to say about the conclusion it is supposed to support. This is the worst type of reasoning (logical fallacies are all instances of non-sequitors) - since the whole point of giving a reason for something is that the truth of that reason somehow leads to the truth of the conclusion that is inferred from the reason!

[2] Here I should note another common logical fallacy. In statistics and the sciences, the term, "the average x" occurs often. For example, the average male in the United States may have 2.3 cars, 2.7 children, and lives 72.7 years. Obviously one cannot have 2.7 children (and it would be difficult to imagine what 2.3 cars is like) - these statements make sense in Science - and they may allow one to state that more likely than not, if you are a male living in the U.S. (over a certain age determined by the results of the data used in the original calculation), then you have over 2 children. If one were to state that one must certainly have over 2 children if they are a male living in the U.S., then one has committed a fallacy that results from simply not understanding how averages are calculated!

One last note, rather technical. Notice that I did not give "forms" for invalid arguments like I did for valid ones. The reasons for this go well beyond the scope of this paper (I am lucky to be able to explain it to students in a course wholly devoted to Logic!) - However, there still remains one easy way to detect an invalid argument. If you can add an extra premise which would change the truth of the conclusion, then the argument must be invalid (this is sometimes called producing a counter-example).

Consider the following argument:

I have flown in jet airplanes across the country hundreds of times without ever experiencing any major airplane failure or crash. ← Premise 1
Therefore I will land in Chicago at the end of this airplane trip without any airplane failure or crash. ← Conclusion

Hopefully students can see that this is a type of strong-inductive reasoning, since if the single premise is true, the conclusion is not guaranteed, but it is more probable than not! Let's see if we can illustrate the invalid nature of the argument by adding a premise which will change the strength of the conclusion .
Try adding the following premise:

I just saw the right wing fall off the plane!

Certainly if this additional information is known, the probability of the conclusion changes greatly!
In other words, if one can add a premise which will change the conclusion, one knows one is dealing with an invalid argument, and it will require careful consideration to determine the strength (probability) or weakness (improbability) of the conclusion.
And here at last I add something I should have mentioned more forcefully earlier. When one is talking about valid arguments (rather than invalid ones), no additional premises can be added which would change the conclusion (remember, valid arguments only guarantee the truth of their conclusion if all of the premises are true!)

Why is all of this important when looking at the arguments of the Philosophers in our textbook? Well believe it or not, many Philosophers construct poor arguments (meaning they are invalid, or open to obvious counter-examples). Philosophers, after all, are human too, and are open to the same emotional thinking that more times than not takes one very far from reason and the proper conclusions that follow from a set of facts. I shall be challenging you to detect some of these errors in reasoning as the class progresses!

Now for the solution to the Logic test.

Note that the logic tests all give you conditional IF . . . THEN statements, and then ask you to chose an additional card (read PREMISE) whose truth will let you know for certain the answer to the proposed question. In other words, since one wants to know for certain about something, and the IF . . . THEN questions are assumed to be true, and also the answers on the cards are assumed to be true - one knows that one is dealing with the

possibility of finding out something by valid argumentation or through the process of deduction.

Let's examine an actual question taken from the test (test available at http://www.philosophersnet.com/games/logic_task.htm):

Question Instructions (italics mine)

You are the owner of a company that runs a pension scheme, *according to the rule that if a person receives a pension, then they have worked for your company for more than 12 years.* You become concerned that people who are not entitled to a pension are receiving payments.

The cards below have information about the employment record and pension situation of four of your previous employees. Each card represents one previous employee. One side of the card tells how long the person worked for your company. The other side of the card details whether they are receiving a pension.

Please indicate, by ticking the appropriate box(es), which card or cards you definitely need to turn over, and only that or those cards, in order to determine whether the rule is broken in the case of any of these four previous employees.

Card 1	Card 2	Card 3	Card 4
Receives a pension	Receives no pension	10 years with company	14 years with company

Which cards should one chose to know for certain if the rule is being violated?

Well we know the rule is a conditional statement, "if a person receives a pension, then they have worked for your company for more than 12 years"
Let P = "a person receives a pension"
Let Q = "they have worked for your company for more than 12 years"

Now remembering our two forms of Valid argumentation:

If P then Q
P
Therefore Q

If P then Q
Not Q
Therefore not P

How can we use this information to discover ,"which card or cards you definitely need to turn over, and only that or those cards, in order to determine whether the rule is broken in the case of any of these four previous employees"

Let's look at Card 1. One side states truthfully that that person receives a pension (and the other side will truthfully reveal whether or not they have worked for the company for more than 12 years) - Suppose I pick this card - then I have:

(Premise 1) If a person receives a pension, then they have worked for the company for more than 12 years
(Premise 2) This person receives a pension

From these two facts or premises (1 is simply the rule restated, 2 is what is truthfully revealed on one side of card one) I can know that they must have worked for the company for more than 12 years! So if the other side of the cards states that <u>they have not</u> worked for the company at least 12 years, then one knows they are in violation of the rule!

To restate, if you know:

1. If a person receives a pension, then they have worked for the company for more than 12 years
2. This person receives a pension
3. Therefore they have worked for the company for more than 12 years.

This is simply an instance of a valid form of reasoning:

If P then Q
P
Therefore Q

That tells us that any card which states P allows us to deduce that Q must be the case, so that if we turn the card over, <u>and Q is not the case</u> - that person has violated the rule!

Are there any other cards which state P (that the person has received a pension) ?
Upon examination there are not (remember that it must state that a person has received a pension, not that they have <u>not</u> received a pension, which would be represented as NOT P)

Can we use our other valid form of argumentation to help us out?
That form is slightly different and is:

If P then Q
Not Q
Therefore not P

What this tells us is that if we know "Not Q" (which is, the person has NOT worked for the company for more than 12 years), then we can conclude with certainty "Not P" (that the person does not receive a pension)
Hence, if I chose a card which states that the person had not worked for the company for more than 12 years, then *if the other side of the card does not state NOT P, then I know the rule has been broken.*

So which cards state Not Q? Card 3 does, since NOT Q = "the person has not worked for the company for more than 12 years" and card 3 states that that individual has worked for the company for only 10 years.

As it turns out, these are the only two valid argument forms needed to get every one of the logic questions right. So RETAKE THE TEST, using this rule:
Find out the rule (it is always stated in the form of IF P THEN Q)
Identify (write it down) what is the P and what is the Q
Then chose only those cards which state either P or NOT Q!
You will get 100% on the test!

So just to review. If the rule is, "If you are over 21, then you can drink", then
P= "you are over 21"
Q = "you can drink"

So you would chose cards which state either P, or NOT Q, or cards which state the equivalent of "you are over 21", or "you can not drink"

Try it, and let me know the results!

One final point.
I have not explained why choosing the other cards will not generate a certain answer. I will set that out in a challenge thought question which all will be thinking about soon!