Logic: Day 1

Critical Thinking is:

Thinking clearly and following rules of logic and rationality

- It's not being argumentative just for the sake of arguing
- Academics disagree about which departments do critical thinking in their courses. Philosophers like to think that they are the main ones doing it!

Meta-thinking

- Thinking about thinking and good principles of reasoning
- Also called “metacognition”
- How do we think well, how do we learn well?

Critical thinking helps you to

- make balanced arguments
- express yourself clearly
- read for important information

Consider the audience when writing and arguing:

- When writing in a critical thinking style, it is often to assume that your audience may not have the same background knowledge you do.

Arguments

- Always made up of Statements
- Statements are sentences that have clear truth value, that can be determined to be true or false
- “The sun is shining.”
- “My phone number has the number 9 in it twice.”
- “You must earn 120 credit hours to graduate.”

Indicator Words

Premise Indicator Words:

Since, as indicated by, because, following that, it may be inferred from

Conclusion Indicator Words:

therefore, thus, so, it follows that, it may be inferred that (and others listed on page 2)

Finding reasoning in passages

- Be able to read a passage and find the premises and conclusion, even if there are no indicator words used.

- “Faculty members should not be able to reduce their course load from 4-4 to 3-3. To do this would merely distract state leadership from declining enrollment numbers by offering fewer sections of courses.”

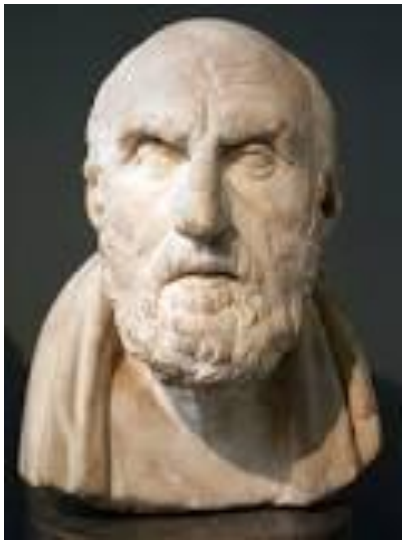
History of Logic Notes

- Aristotle and Syllogistic Logic
- All Aristotle's logic revolves around one notion: the deduction (sullogismos). A thorough explanation of what a deduction is, and what they are composed of, will necessarily lead us through the whole of his theory.
- A deduction is speech (logos) in which, certain things having been supposed, something different from those supposed results of necessity because of their being so. (Prior Analytics I.2, 24b18-20)
- Each of the “things supposed” is a premise (protasis) of the argument, and what “results of necessity” is the conclusion (sumperasma).

Examples of Aristotelian Syllogisms

- All horses are animals that have hooves. Some horses have brown manes. Some animals that have hooves have brown manes.
- No foxes are birds. All parrots are birds. No parrots are foxes.
- Socrates is a man. All men are mortal. Socrates is mortal.

Chrysippus and Propositional Logic



- Chrysippus of Soli was a Greek Stoic philosopher. He was a native of Soli, Cilicia, but moved to Athens as a young man, where he became a pupil of Cleanthes in the Stoic school.
- Born: 280 BC, Soli, Cilicia
- Died: 207 BC, Athens, Greece
- Looking at the truth value of whole propositions/statements sets the stage for the kind of logic we do in our course (the importance of statements, truth, and premises leading to conclusions)

Some key definitions:

Logic: the science that evaluates arguments.

Argument: a group of statements one or more of which (the premises) are claimed to provide support for, or reasons to believe, one of the others (the conclusion).

Statement: a sentence that is either true or false.

Premise: a statement in an argument that sets forth evidence or reasons.

Conclusion: the statement in an argument that the premises are claimed to support or imply.

Conclusion indicators: words that provide a clue in identifying the conclusion (therefore, so...)

Premise indicators: words that provide a clue in identifying the premises (since, because...)

Inference: the reasoning process used to produce an argument.

Proposition: the information content of a statement.

Truth value: the attribute by which a statement is either true or false.

More samples to do together:

1. Only a fool or a daredevil smokes cigarettes, since cigarette smoking is a leading cause of cancer.

2. The French are the most intelligent people in the world. For it takes years and years for adult Americans to learn to speak the French language well. But in France even little children speak it well.

Typical kinds of nonarguments

Special emphasis on **conditional statements and explanations**. Even though conditional statements are not by themselves arguments, they may serve as premises or conclusions of arguments.

Conditional statements always have the form "If….then…."

But, only one conditional statement by itself cannot be counted as a full argument.

Here is an **argument** containing a **conditional statement as a premise**:
If the air pressure lowers, then the barometer falls.
Note the form: "If (antecedent), then (consequent)."
The air pressure just lowered.
Therefore the barometer just fell.

and this is an **argument** with a **conditional statement as a conclusion**:

The higher the altitude, the lower the air pressure.
At higher altitudes the barometer falls.
We may conclude that if the air pressure lowers, then the barometer falls.

Explanations

- Explains why something happened, usually something that everyone would agree happened, not something up for debate.

- “The barometer exploded because we placed it into high temperature and pressure.”
- “The litmus paper changed color because we exposed it to an acid.”

Are these arguments, or not?

- 1. The reason the beaker exploded is that it contained nitroglycerine and was shaken violently.
- 2. Several nations now posses the technology to manufacture nuclear weapons, even though they may not actually build such weapons. Thus, the world is in much greater danger of a nuclear confrontation than one might think.

Distinguishing Arguments from non-arguments:

1. Are the indicator words used with statements meant as evidence for other statements, or as inferences from other statements?

2. Is the inferential relationship between the statements one in which the inferred statement is evidenced by the others and vice versa?

- Non-inferential passages and statements:
- Warning, Advice, Belief/Opinion, Loosely Associated Statements, Exposition, Illustration/Example, Conditional Statement, Explanation.
- In our class, Explanations and Conditional Statements are the most important.

Conditional Statements:

* Every conditional statement is comprised of two component statements. The statement immediately following the “if” is called the antecedent, and the statement immediately following the “then” is the consequent.

* A **sufficient condition** is one which obtains when a thing or event is all that is needed for the existence or occurrence of another thing or event. (Being a tiger is a sufficient condition for being an animal.)

* A **necessary condition** is a more strict condition, and it is one which obtains whenever a thing or event cannot occur without the occurrence of another thing or event. (Being an animal is a necessary condition for being a tiger.)

Necessary vs. Sufficient Conditions

Definition: A **necessary condition** for some state of affairs S is a condition that must be satisfied in order for S to obtain.

For example, a necessary condition for getting an A in PHIL 3100 is that a student hand in a term paper. This means that if a student does not hand in a term paper, then a student will not get an A, or, equivalently, if a student gets an A, then a student hands in a term paper.

Definition: A **sufficient condition** for some state of affairs S is a condition that, if satisfied, guarantees that S obtains.

For example, a sufficient condition for getting an A in PHIL 3100 is getting an A on every piece of graded work in the course. This means that if a student gets an A on every piece of graded work in the course, then the student gets an A.

Handing in a term paper is not a sufficient condition for getting an A in the course. It is possible to hand in a term paper and not to get an A in the course.

Examples:

1. Being a mammal is a necessary condition for being human. Being a mammal does not guarantee that one is a human. There are mammals that are not human.

2. Being human is a sufficient condition for being a mammal. Being a human guarantees that one is a mammal. As soon as we find out that something is not a mammal, we know that it cannot be a human.

3. Being alive is a necessary condition for having a right to life. Nothing that is not alive can have a right to life.

4. Being alive is a necessary condition for having a right to life. There are lots of things that are alive that do not have a right to life. What about, for example, grass? This answer could be questioned by those who think that it is seriously wrong to kill anything that is alive.

5. If it is true that if P then Q, then P is a sufficient condition for Q. The truth of P is sufficient for, guarantees the truth of Q.

6. If it is true that if P then Q, then Q is a necessary condition for P. If Q is not true, then P is not true. The falsity of Q rules out the truth of P. It is necessary for Q to be true in order for P to be true.

7. If it is true that if P is not the case, then Q is not the case, then P is a necessary condition for Q. The truth of P is necessary in order for Q to be true. When P is not true, Q is not true.

8. Something is a brother if and only if it is a male sibling. This means that being a male sibling is both necessary and sufficient for something to be a brother. In general if it is the case that P is true if and only if Q is true, then Q is necessary and sufficient for P and P is necessary and sufficient for Q. If anything fails to be male or fails to be a sibling, then it is not a brother. So being a male sibling is a necessary condition for being a brother. Furthermore, it is impossible for anything to be a male sibling and not to be a brother. So being a male sibling is a sufficient condition for being a brother.