Logic Review Notes: Definition

What is Logic?

* Logic: the study of methods and principles used to distinguish correct(valid) from incorrect(invalid) reasoning
* It is the study of arguments in regard to their form and quality
* Logic is NOT the study of thoughts or reasoning in general; it specifies in arguments.
* Logic is also prescriptive, in that it shows what and how something should be done. Logic is different from psychology in this manner as the latter is a descriptive science.

Central Concepts

* Inference/Inferential Process: The process in which one proposition(conclusion) is affirmed on the basis of other propositions(premises), which are recognized as starting points.
* The relation of “following from”
* Propositions: an assertion that something is or is not the case.
* Necessary condition: all propositions must have the value of either truth or falsity. Whether its truth value can be known or not does not matter.

(ex) There is life outside of our galaxy. – is also a proposition.

* A proposition is NOT a question / command / exclamation. None of these can be affirmed (true) or denied (false). In this context, a proposition is different from a mere sentence, as sentences would include all the things above.
* In analogy, a proposition is the algorithm and the sentences expressing the proposition are like programs. A single proposition is more abstract than sentences in that it can be expressed by multiple sentences.

(ex) John loves Mary = Mary is loved by John

It is raining = 지금 비 온다

* Statement ≠ Proposition. I don’t know why exactly. But perhaps it is related to above; statements only *express* propositions.
* Anyway, in the textbook they are used interchangeably.

Arguments

* Definition = a group of propositions which are structured so the conclusion “follows from”(is inferred from) the premises.
* Necessary: only propositions + premise-conclusion structure
* Relativity: Propositions can both be premises and conclusions depending on the context
* Recognizing arguments: one way is to use indicators
* Conclusion Indicators: Therefore, hence, so, as a result, thus, for these reasons etc
* Premise Indicators: since, because, for, as etc
* BUT, to be used carefully. Not all indicators are used in a correct sense, and sometimes the premise or the conclusion is not made explicit and left to be inferred.
* The task of a logician: to recognize the argument, make it explicit, and check for its validity
* What an argument is NOT:

1. Conditional(hypothetical) Proposition

ex. “If God exists, reality would be fundamentally good”.

* In this compound proposition, neither of the component propositions is being asserted. It is neither that “God exists” or that “reality is fundamentally good”; only the “if-then” structure is asserted. Two simple propositions may form it, but it is still a proposition and not an argument.
* In this sense, a conditional proposition can be used for a conditional argument.

Ex. If God exists, reality would be fundamentally good.

God exists.

Therefore, reality is fundamentally good.

* A conditional proposition is not an argument for there is nothing being concluded on the basis of something else. The former merely *implies* the latter.
* On the contrary, a “because” instead of “if-then” would have created a cause-effect relation, thus making the example an argument.

Ex. Because God exists, reality is fundamentally good.

Both “God exists” and that “reality is fundamentally good” is being asserted, and the latter is concluded from the former.

1. Command

Ex. “Synonyms are good servants but bad masters. Therefore, select them with care”.

* A command is not a proposition. An argument is only consisted of propositions.
* Also note that the indicator ‘therefore’ did not properly indicate a conclusion in this example.

1. Explanation

Ex. “No system in physics can exist as half-matter and half anti-matter because the forms of matter annihilate each other”. = argument

“The roman empire crumbled because it lacked the spirit of free enterprise”. = explanation

* The main difference between explanation and argument: the status of the conclusion
* Explanation = cause + accepted conclusion
* Argument = evidence(premise) + uncertain/debated conclusion
* If something is already widely accepted as true, there is nothing being argued.
* Singularities in arguments
* The premise and conclusion may be stated in the same sentence
* The conclusion may precede the premise
* Deductive and Inductive Arguments (= the two classes of argument)
* Deductive Argument: An argument in which the premises provide conclusive grounds for the conclusion.
* When an argument is deductively valid, the conclusion follows with necessity. So, if the premises are true in a valid argument, the conclusion MUST be true.
* A deductive argument is either valid or invalid.

\*invalid argument = (typical) even when the premises are true, the conclusion is false

valid argument = if the premises are true, the conclusion cannot be false

* Inductive Argument: An argument in which the conclusion follows from the premises with probability.
* An inductive argument is not valid or invalid; it is better, worse, weaker, or stronger
* The degree of probability of an inductive argument can be altered by additional information. But deductive arguments are unalterable; their validity is not dependent on anything else.

Ex. X is a chess champion and a great mathematician.

Y is also a chess champion and a great mathematician.

Z is also a chess champion and a great mathematician.

Therefore, all/most chess champions are great mathematicians.

BUT, additional information could easily undermine the example above.

W, V, U are chess champions but not great mathematicians.

Terminology

* True & False
* applies to propositions
* Valid & Invalid
* applies to deductive arguments (more specifically, its inferential relations)
* An argument’s validity is irrelevant to the truth of its propositions. Only the relation matters.
* Weak & Strong
* Applies to inductive arguments
* Sound & unsound
* Applies to deductive arguments, with the consideration of the truth/falsity of its propositions
* If an argument is valid, and all its premises are true- said argument is sound.
* If an argument is invalid and/or not all of its premises are true – said argument is unsound.
* Only sound arguments establish the truth of its conclusion.
* Correct & Incorrect is not used.

Truth & Validity

* Invalid arguments (\*need more info on what constitutes an invalid argument)

: all combinations of true & false premises & conclusions are possible.

* True premises + false conclusion

Ex. If Bill Gates owned all the gold in Fort Knox, he would be rich.

Bill Gates does not own all the gold in Fort Knox.

Therefore, Bill Gates is not rich.

* True premises + true conclusion (🡪 Question)

Ex. If I owned all the gold in Fort Knox, I would be rich.

I do not own all the gold in Fort Knox.

Therefore, I am not rich.

* False premises + false conclusion (relate to above question)

Ex. All mammals have wings.

All whales have wings.

Therefore, all mammals are whales

* False premises + true conclusion

Ex. All mammals have wings.

All whales have wings.

Therefore, all mammals are whales.

* Valid arguments

Even if the premises are true, the conclusion is not necessarily true.

: almost all combinations are possible,

BUT when the premises are true, the conclusion cannot be false.

= If the premises are true in a valid argument, the conclusion MUST be true

= If the conclusion is false in a valid argument, not all of its premises can be true (at least one must be false)

= CANNOT be true premises + false conclusion

* True premises + true conclusion

Ex. All mammals have lungs.

All whales are mammals.

Therefore, all whales have lungs.

* False premises + true conclusion: \*I think this is possible because while the inference is correct, the medium of the false premises does not show up in the conclusion.

Ex. All fishes are mammals.

All whales are fishes.

Therefore, all whales are mammals.

* False premises + false conclusion

Ex. All four-legged creatures have wings.

All spiders have four legs.

Therefore, all spiders have wings.

Informal Fallacies

* Fallacy = a type of argument that seems correct, but is in fact incorrect
* Informal fallacy = an argument which is incorrect, but for reasons unrelated to its logic or form

= the type of mistake in reasoning due to the mishandling of the *content* of the propositions

* errors in reasoning occur because of carelessness, inattention, or deliberate misleading
* it is not the case that they DON’T work. Sometimes they are more persuasive than non-fallacious arguments.
* Subcategories: (1) fallacies of relevance, (2) fallacies of defective induction, (3) fallacies of presumption, (4) fallacies of ambiguity

1. Fallacies of Relevance

: premises are logically irrelevant to the conclusion. The claims made are irrelevant to the TRUTH of the conclusion. What is said may be true, even persuasive, but still may not be the reason why a conclusion is true or false.

1. The appeal to emotion = *ad populum*

: an argument relies on emotion rather reason

Ex. probably all advertisements – “smoke Malboro, be a man”

1. The appeal to pity = *ad misericordiam*

: (subcategory of appeal to emotion) an argument which relies on generosity, altruism, mercy, rather than reason

1. The appeal to force = *ad baculum*

: Making threats, not only in terms of physical violence, to force one to accept the conclusion

Ex. Lobbyists may say, “If you don’t follow our suggestions, we will stop funding your campaing”

1. The argument against the person = *ad hominem (or, genetic fallacy)*

: to base the conclusion on the person or his/her character rather than the truth of the argument itself (= personalized attack)

* This can be used both negatively & positively (says the professor)

Ex. “I cannot be homophobic because I have gay friends”

* There are two kinds of ad hominem.

-abusive: attacking his/her character or position. In many cases, it is name-calling.

Ex. “People who deny affirmative action program are racists” – attack on character

“Socrates’ loyalty to Athens is suspect because he has been long associated with traitors of Athens” – guilt by association

-circumstantial: treating personal circumstances as the premise of an opposing argument

A sort of “look who’s talking” vibe.

Ex. certain views are obliged to be accepted because of consistency to one’s position (inconsistency between belief and practice/claims) - “you cannot support gay marriage because you are Catholic” (?)

Attack it on grounds that it is resented by a member of that group and therefor self-serving – “of course you would support a protective tariff; you are a manufacturer who would benefit from that”

Poisoning the well (of discourse) – “you catholics cannot be trusted in your words because your first loyalty is not to the truth” – cuts off rational discourse

* In trials: attack the integrity of the witness – works, but still fallacious

1. Irrelevant conclusion = *ignoratio elenchi*

: the premises support a different conclusion than the one that is proposed

* The argument “misses the point”

ex. non sequitor

red herring

straw man

1. Fallacies of Defective Induction
2. The argument from ignorance = *ad ignorantiam*

: reasoning from ignorance

Ex. “God exists because no one can prove that he doesn’t”

1. The appeal to inappropriate authority = *ad verecundiam*

:

* An appeal to authority is almost always fallacious. Even when it is appropriate, is not sufficient to guarantee the truth of the argument

1. False cause = non causa pro causa. 오비이락

: making a mere coincidence a cause and effect (temporal succession)

Thinking just because p comes before q, p is the cause of q “rooster and the sun”

/ also correlation – just because p is related to q, does not mean p is cause of q (?)

1. Hasty generalization

: given x, y and z will follow (but can’t say that it will evidently)

\*difference between hasty generalization and composition

-> composition is some to all, generalization links individual cases to be in inevitable cause and effect

1. Fallacies of Presumption
2. Accident

:

1. Complex question

:

1. Begging the question =  *petitio principii*

: premises are irrelevant to the conclusion because the conclusion is nothing but a paraphrasing of the premise

= same proposition in different words

Ex. “Atheists are wrong because God does exist”

Ex. typical form: A because of B, B because of C, C because of A

1. Fallacies of Ambiguity
2. Equivocation

: use different meanings of the same word in premise and conclusion

1. Amphiboly

: ambiguity due to grammatical construction – the interpretation varies in premise and conclusion

Ex. “Women prefer Democrats to men” / “He donated 10 dollars, along with his wife, to the charity”

1. Accent

: the emphasis is put in different places and creates different meanings

Ex. “We should not *speak* ill of our friends” ≠ “We should not speak *ill* of our friends”

1. Composition

: single charactieristic of a part is ascribed to the whole

1. Division

: when the characteristic of the whole is attributed to its composing part.

Logical Languages

* Syllogism
* Predicate Logic (Modern symbolic version of syllogism)

-categorial proposition

-distribution

-inductive argument