Chapter I

Introduction

1.1 What is Logic?

1.1.1 A Branch of Philosophy

What is Philosophy?

The word "philosophy" is derived from the Greek words and word-fragments:

Philia/ phile /philo—love of, affinity for, liking of

Sophia/ sophos / sophist *wisdom*

And this means love of wisdom.

Philosophy is the systematic inquiry into the principles and presuppositions of any field of study.

Branches of Philosophy

The main branches of philosophy are divided as to the nature of the questions asked in each area. The integrity of these divisions cannot be rigidly maintained, for one area overlaps into the others.

1. **Metaphysics** or **Ontology**: the study of what is *really* real. Metaphysics deals with the so-called first principles of the natural order and "the ultimate generalizations available to the human intellect." Specifically, ontology seeks to indentify and establish the relationships between the categories, if any, of the types of existent things.

What kinds of things exist? Do only particular things exist or do general things also exist? How is existence possible? Questions as to identity and change of objects—are you the same person you were as a baby? as of yesterday? as of a moment ago?

How do ideas exist if they have no size, shape, or color? (My idea of the Empire State Building is quite as "small" or as "large" as my idea of a book. *I.e.*, an idea is not extended in space.) What is space? What is time?

E.g., Consider the truths of mathematics: in what manner do geometric figures exist? Are points, lines, or planes real or not? Of what are they made?

What is spirit? or soul? or matter? space? Are they made up of the same sort of "stuff"? When, if ever,

are events necessary? Under what conditions are they possible?

2. **Epistemology**: the study of knowledge. In particular, epistemology is the study of the nature, scope, and limits of human knowledge.

Epistemology investigates the origin, structure, methods, and integrity of knowledge.

1. Consider the degree of truth of the statement, "The earth is round." Does its truth depend upon the context in which the statement is uttered?

3. Axiology or **Value theory**: the study of value; the investigation of its nature, criteria, and metaphysical status.

Some significant questions in axiology include the following:

Nature of value: is value a fulfillment of desire, a pleasure, a preference, a behavioral disposition, or simply a human interest of some kind?

Criteria of value: do objective or universal standards apply?

Status of value: how are values related to (scientific) facts? What ultimate worth, if any, do human values have?

Axiology is usually divided into two main parts.

3.1 **Ethics**: the study of values in human behavior or the study of moral problems: *e.g.*, (1) the rightness and wrongness of actions, (2) the kinds of things which are good or desirable, and (3) whether actions are blameworthy or praiseworthy.

3.2 Aesthetics: the study of value in the arts or the inquiry into feelings, judgments, or standards of beauty and related concepts. Philosophy of art is concerned with judgments of sense, taste, and emotion.

E.g., Is art an intellectual or representational activity? What would the realistic representations in pop art represent? Does art

represent sensible objects or ideal objects?

Is artistic value objective? Is it merely coincidental that many forms in architecture and painting seem to illustrate mathematical principles? Are there standards of taste?

Is there a clear distinction between art and reality?

4. Logic is a branch of philosophy that deals with arguments.

Logic is also the science that evaluates arguments.

This means that logic aims at criticizing the arguments of others and constructing arguments of our own.

1.1.3 Brief on History of Logic

Aristotle (384-322 B.C) is the ***father of logic***. His logic is called ***syllogistic logic***. He also catalogued a number of informal fallacies.

The major logician of the middle age was Peter Abelard (1079-1142). He refined Aristotle's logic and originated a theory of ***universals***

The Oxford philosopher William Occam (C.1285-1349) also contributed to the concept of ***Modal logic*** (involves possibilities such as possibility, necessity, belief and doubt) and ***metalanguage.***

G. W Leibniz (1646-1716) introduced ***symbolic logic*** , which later developed by A. DeMorgan, George Boole, W.S.Jevons and J. Venn

The British Philosopher J. S. Mill (1806-1873) initiated the revival of ***inductive logic***.

Gottlob Frege (1848-1925) founded modern Mathematical logic

Most recently logic has made a major contribution to technology by providing a conceptual foundation for the electronic circuitry of digital computers.

1.2 The Nature of Arguments

1.2.1 What is an Argument?

An **argument**, in logic, is 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**).

Example:

Man is mortal.

Professor Kitaw is man.

Professor Kitaw is mortal.

Based on the logical relation between the premises and the conclusion arguments may be said good or **bad.**

1.2.2. Components of Argument

A **statement** is a sentence that has a **truth value** (which is either true or false).

A **proposition** is the meaning or information content of a statement. (we can interchangeably used it with a statement)

Example: Cairo is in Ethiopia.

Statements in an argument contain one or more **premises** and one and only one **conclusion.**

The premises are statements that set forth the *reasons* or *evidence* for the conclusion.

The conclusion is the statement that the evidence is *claimed to support* or *imply*. In other words, it is what follows from the evidence or premises.

Premises and conclusions may be identified in arguments from their indicators.

Example:

Some **conclusion Indicators**: therefore, whence, accordingly, we may conclude, as a result, so, thus, hence, entails that, consequently, it follows that, we may infer, implies that etc.

Some **premise indicators**:

Since, as indicated by, because, for, in that, may be inferred from, as, given that, seeing that, for the reason that, in as much as, owing to etc.

Inference is a **reasoning process** expressed by an argument.

In the loose sense inference is used interchangeably with argument.

An argument with one premise is also called an immediate inference.

Example:

All Japan Cell phones are original apparatuses.

Therefore, it is false that no Japan Cell phones are original apparatuses.

1.3 Recognizing Arguments

A passage may contain arguments if it purports to **prove** something, and not otherwise.

A passage which purport to prove something is only the one that fulfills the following two claims:

1.3.1 Factual & Inferential Claim

1. **Factual Claim:** at least one of the statements must claim to present evidence or reasons. (This mainly refers premises)
2. **Inferential Claim:** there must be a claim that something follows from the alleged evidence. (This mainly refers the logical relationship between premises and the conclusion)

The inferential claim may be **explicit** or **implicit.**

Explicit inferential claims are asserted by the premise or conclusion **indicator** words.

Implicit inferential claims exist if there is an inferential relationship between the statements in a passage but there are no indicator words.

Example:

The price reduction [seen with electronic calculator] is the result of a technological revolution. The calculator of 1960s used integrated electronic circuit that contained bout a dozed transistors or similar components on a single chip. Today, mass production chips, only a few millimeters square contain several thousand such components. (Boikess and Edelson, in Hurley)

To decide whether a passage contains an argument, we should look for three things:

1. Indicator words

2. The presence of inferential relationship between the statements

1.3.2 Typical kinds of Non-arguments

A. Passages lacking an inferential claim such as: warnings, statements of beliefs or opinions, loosely associated statements, report, expository passage, illustration,

B. Conditional statements

The reason is the **antecedent** and the **consequent** show a **causal** connection; not inferential relationship.

Example:

If Alemu studies hard, (antecedent) he will pass the exam. (consequence)

Note that:

A **single** conditional statement is **not** an argument.

A conditional statement may serve as **either** the **premise** or the **conclusion** (or both) of an argument.

Example:

If Alemu studies hard, he will pass the exam.

Alemu really studies hard.

Therefore, Alemu will pass the exam.

The inferential content of a conditional statement may be **re-expressed** to form an argument.

C. Explanations

The reason is statements in explanations intend to **shed light** on some accepted facts; but not they use accepted facts as a **claim to prove** a conclusion.

Just as arguments have premises and conclusions, so do explanations have **explanans** and **explanandum.**

Explanandum: is the statment that is to be explaind.

Explanans: is the statement or group of statements that purports to do the explaining.

As both express the outcome of a reasoning process, explanations and arguments have certain similarities, however, explanations do not claim to prove anything.

Many [particularly, scientific] explanations can be reexpressed to form arguments.

Example: (Hurley: 22-23)

The sky appears blue from the earth's surface because light rays from the sun are scattered by particles in the atmosphere. (**Explanation**)

Light rays from the sun are scattered by particles in the atmosphere.

Therefore, the sky appears blue from the earth's surface. (**Argument**)

Some passages may be interpreted as either explanations or Arguments or both.

Example: (Hurley: 23)

Women become intoxicated by drinking a smaller amount of alcohol than men, because men metabolize part of the alcohol before it reaches the bloodstream, whereas women do not.

Some indicators have a twofold meaning.

1.4 Types of Arguments

Based on the *strengths of an arguments inferential claim* arguments are divided in to **deductive** and **inductive**.

1.4.1. Deductive Argument

In deductive arguments the conclusion is claimed to follow **necessarily or absolutely** from the premises.

A deductive argument is an argument in which if the premises are assumed to be true, it is **impossible** for the conclusion to be false.

Example:

All Ethiopians love unity.

ILS students are Ethiopians.

Therefore, ILS students love unity.

1.4.2. Inductive Argument

In these arguments the conclusion is claimed to follow **only probably** from the premises.

It is an argument in which if the premises are assumed to be true, then based on that assumption it is **improbable** that the conclusion is false.

Example:

The vast majority if AU students are from Tigray region.

Engineering students are AU students.

Therefore, Engineering students are from Tigray region.

1.4.3. Three Factors to decide arguments as deductive or inductive

1. Special i**ndicator** words

Deductive indicators:

necessarily, certainly absolutely, definitely

Inductive indicators

Probably, improbable, plausible, likely, unlikely and reasonably to conclude

2. The actual strength of **inferential claim**

3. Form of Arguments

Typically Deductive Arguments:

Arguments based on Mathematics

Argument from definition

Categorical Syllogism (Contains words All, No, some)

Hypothetical syllogism (if-then)

Disjunctive syllogism (either-or)

Typically Inductive Arguments

Prediction

Argument from Analogy

(Vs. Arguments in geometry)

Inductive Generalization

Argument from Authority

Argument based on signs

A causal inference

N.B. Argument from science can be either inductive or deductive, depending on the circumstances.

N.B. Traditional conception of Deductive and inductive arguments that involves proceedings from particular to general and vice versa is not acceptable for modern logicians.

1.5 Evaluating Arguments

Based on the **factual** and **inferential claims** of the arguments.

In other words to evaluate an argument one has to answer the following two questions:

1. Do premises support the conclusion? (Inferential claim)

2. Are all the premises true? (Factual claim)

1.4.1 Evaluating Deductive Arguments

Deductive arguments will be evaluated for:

1. **Validity**
2. **Truthfulness**
3. **Soundness**

1. Validity Vs Invalidity

Validity is about whether premises support the conclusion.

There is no middle ground between valid and invalid arguments.

A. Valid Deductive Argument

It is the one in which the conclusion follows from the premises with **necessity or certainty**.

It is an argument in such that if the premises are **assumed true**, it is **impossible** for the conclusion to be **false**.

An argument can be valid regardless of the fact that the [content of the] premises are false (because truth or falsity is irrelevant for validity).

B. Invalid Deductive Argument

It is an argument such that if the premises are **assumed true**, it is **possible** for the conclusion to be **false**.

In these arguments the conclusion does **not** follow with **strict necessity** from the premises, even though it is claimed to.

It is an argument having **true premises** and a **false conclusion**

Example:

All cats are animals. **True**

Dogs are animals. **True**

Therefore, dogs are cats. **False**

Thus, the argument is **Invalid.**

2. Truth and Falsity

The truth and falsity of premises and conclusion is **irrelevant** to the question of validity except in one case: (Have true premises and a false conclusion), which is **invalid**. The reason is an argument with false premise and false conclusion could be valid. Similarly, an argument with true premise and true conclusion could be invalid

Example:

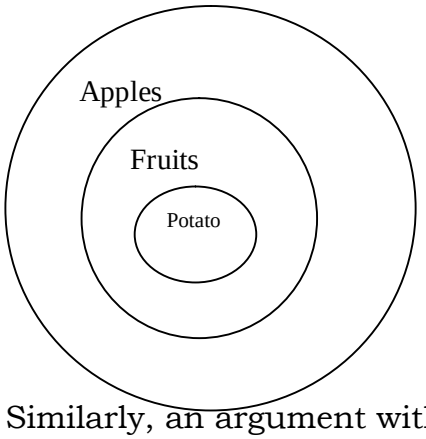
All fruits are apples. **False**

Potato is a fruit. **False**

Therefore, potato is an apple. **False**

(But it is Valid)

Look the pictorial representation



Similarly, an argument with true premise and true conclusion could be **invalid.**

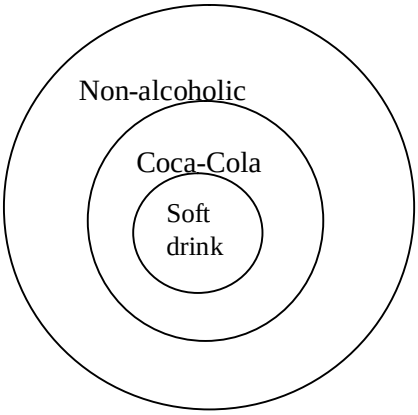
Example:

All Soft drinks are non-alcoholics. **T**

Coca-Cola is non-alcoholic. **T**

Therefore, Coca-Cola is Soft drink. **T**

Look at the following pictorial representation of the above argument.



3. Sound and Unsound Arguments

Truth and Falsity is **relevant** to evaluate arguments as **Sound** and **Unsound**.

Sound Deductive Arguments

A **sound deductive** argument is an argument that is **valid** and has **all true** premises.

The **only case** of a Sound Deductive argument is **true premises** and **true conclusions.**

Unsound Deductive Arguments

Regardless of their truth truth or falsity all **invalid** deductive arguments are **Unsound.**

Summary

The relationship among **Truthfulness, validity** and **soundness** is summarized as follows.

Pre.	Con.	Validity	Soundness
T	T	?	?
T	**F**	Invalid	Unsound
F	T	?	Unsound
F	F	?	Unsound

N.B The question mark (?) in the table indicates that based on the factual and/or the inferential claim the argument could be valid, invalid, sound or unsound.

N.B The case: True Premise & False Conclusion is impossible; if it happened, the argument is necessarily **invalid.**

1.4.2 Evaluating Inductive Arguments

To evaluate an inductive argument one has to answer the following two questions:

1. Do premises support the conclusion?
2. Are all the premises true?

Inductive arguments will be evaluated for

1. Strength
2. Truthfulness
3. Cogency

1.Strong and weak arguments:

Strength is the feature of inductive arguments

Strength of an inductive argument is determined by the degree of probability for the conclusion to come out from the premises.

The probability may be determined by various factors.

Example: The selection of a larger or smaller sample, the trustworthiness of the authorities or witnesses etc.

A. Strong Inductive Argument

It is an argument such that if the **premises** are **assumed true**, then, based on that assumption, it is **probable** that the **conclusion** is **true**.

Example:

Famine had been occurring in every decade for the last several consecutive decades in Ethiopia. **T**

Therefore, probably there will be famine in Ethiopia in the next decade. (**Probably True**)

If we assume the premises are true, it is probable for the above conclusion to be true. Indeed, the above premise is **actually true**. Therefore, it is a **Strong Inductive Argument.**

B. Weak Inductive Argument

It is an argument such that if the **premises** are **assumed true**, then, based on that assumption, it is **not probable** that the **conclusion** is **true**.

Example:

The dreams that Weyzero Debre repeatedly dreams sometimes occur directly. (**True**)

Weyzero Debre dreamt that there will be a government change in Ethiopia. (**True**)

Therefore, probably there will be a government change in Ethiopia. (**Probably False**)

If we assume the premises are true, it is **NOT** probable for the above conclusion to be true for it has the least probability (for her dreams occur directly only **occasionally**). Therefore, it is a **Weak Inductive Argument.**

2. Truth and Falsity

Truth and falsity are **irrelevant** in evaluating arguments as strong or weak.

The reason is inductive argument having **false premise** and a **probably false conclusion** could be **strong**.

Example:

All previous Soccer world cups were won by the Ethiopian team. (**False)**

Therefore, probably the next world cup will be won by the Ethiopian team. (**Probably False)**

If we assume the premises are true, it is probable for the above conclusion to be true. Therefore, this is a **Strong Inductive Argument.**

Similarly an inductive argument having **true premise** and a **probably true conclusion** could be **weak**.

Example:

A few Ethiopian leaders were warriors. (**True**)

Therefore, probably the next Ethiopian leader will be a man. (**Probably True**)

In fact both the premises and the conclusion is true, however the above argument is **weak** for the conclusion do not probably come from the premise.

3. Cogent and Uncogent Arguments

A **cogent argument** is is an inductive argument that is **strong** and has **all true premises**, if either

condition is missing, the argument is **uncogent**.

Summary

The relationship among **Truthfulness, strength** and **cogency** is summarized as follows.

Pre.	**Con.**	**Strength**	**Cogency**
T	probably T	?	?
T	probably **F**	Weak	Uncogent
F	probably T	?	Uncogent
F	probably F	?	Uncogent