STUDY SESSION 7

INFERENCE AND ARGUMENT TYPES IN LOGIC

7.1 Introduction

The principal aim of this study session is to expose you to the formal structure of logic. It may interest you to know that this formal structure is grounded on the internal form of the theories of induction and deduction. In logic, induction and deduction are primarily considered as forms of argument. And since argument itself is a process of inference, it follows that inference and argument are central to logic.

7.1.1 Learning Outcomes for Study Session 7

At the end of this session you should be able to:

1. Describe how inference relates to argument;
2. Analyse the nature of argument as the subject matter of logic;
3. Distinguish between deduction and induction as methods of inference and argument;
4. State the Rules of Inference and Replacement;
5. Illustrate how arguments are validated and invalidated with the aid of the rules of inference and replacement; and
6. Analyze the soundness and logical form in logic, and the inter-relationship between induction and deduction.

7.2 Inference in Logic

Human knowledge is essentially inferential. “By the in-built laws of our minds, we think in terms of association, causation, succession; which explains the reason why we always see a link or affinity between ideas, and events of the world” (Kant, 1964, xxiii).

Thinking is fundamentally a process of judgment. Judgment as a process of inference is an act of combinations or synthesis. Hence, inferential thinking or reasoning can be defined as a process of abstraction or extraction by which we combine or synthesize occurrences in the world to arrive at a judgment. Inference is not possible without linking one occurrence (event) to another. This act is purely mental and is not possible without judgment. For instance, it is not possible for a mechanic to find out the problem with a car and also find solution to such problem without inferring. In the same way, it is not possible for a detective to gather clues, and also link together the clues gathered such that based on the evidence before him, he reaches a conclusion about the case under investigation; ditto the lawyer and judge. So on daily basis we make inferences. These inferences we make may be related to issues that border on commerce, religion, economics, politics, education, culture and so on. Sometimes we infer correctly. At other times we infer wrongly. Thus, whether our judgment about a situation is true or false, valid or invalid, correct or incorrect is dependent upon our act of inference.

But how is inference related to logic? Inference in logic is “the ability to discern and describe the connections between terms and statements whose association may not be immediately apparent” (Uduigwomen, 1998: 31). In essence, inference in logic is the reasoning process by which we transit from premises to conclusion. As stated earlier, the premises that comprise an argument are the antecedent conditions for the conclusion which is the same as the judgment made in that argument. This means that by the aid of inference, we are able to rationalize

about how we can derive conclusions from premises. This reasoning or inferential process of moving from premises to conclusion involves deriving a new set of information (i.e. the conclusion) from available sets of information (i.e. the premises). This makes allowance for a transition from the known to the unknown. Hence, *because inference enables the transition from the premises to the conclusion of an argument, it (inference) becomes a process that allows us to make propositions about the unknown using the known as a foundation* (Uduma, 1997: 197). Granted that inference necessarily forms an important category of logic, we must however, note that the interest of the logician is never in the process of inference itself; rather, the logician is primarily concerned with the outcome of the process of inference. As Copi and Cohen (2005) noted:

> It is not the thought processes called reasoning (i.e. inference) that are the logician's concern, but the outcomes of those processes, the *arguments* that are the products of reasoning, and that can be formulated in writing, examined, and analyzed. Each argument confronted raises these questions for the logician: Does the conclusion reached *follow* from the premises used or assumed? Do the premises *provide good reasons* for accepting the conclusion drawn? If the premises do provide adequate grounds for accepting the conclusion – that is, if asserting the premises to be true does warrant asserting the conclusion also to be true – the reasoning is correct. Otherwise it is incorrect (p. 3).

Much later, we shall briefly but vividly explain what is meant by correct reasoning, but for now our interest is to explain how inference is connected to argument. The act of inference involves the arrangement of certain information (i.e. propositions) into premises from which

a conclusion is drawn. This act of methodically and structurally arranging propositions into premises and conclusion constitutes what in logic is called *argument* or *argumentation*. In the first place, to argue or to make argumentation is to provide grounds or reasons for justifying how we reached certain conclusions or judgments. The grounds or reasons provided act as backgrounders (i.e. assumptions or antecedent conditions) to certain submissions (i.e. conclusions or judgments) made. This is so because inferential reasoning in logic *is essentially the combination or synthesis of available information such that when combined they are found to warrant new information which could not have been derived from any of the information separately* (Uduma, 1997: 193). The point we should note however, is that it is not the duty of argument or logic to tell us what to infer or how to infer, rather, what argument helps us to achieve is to establish the procedure by which we can logically determine whether our inference is valid or invalid, correct or incorrect.

To this point, you should have understood the meaning of inference, the place of inference in logic and how inference is connected to argument. This, taken, our next task is to examine the meaning of argument and the importance of argument in logic.

7.2.1  In-Text Questions (ITQs)

- What is inferential thinking?
- What is argumentation?

7.2.2  In-Text Answers (ITAs)

- Inferential thinking is a process of abstraction or extraction by which we combine or synthesize occurrences in the world to arrive at a judgment.
- Argumentation is the act of methodically and structurally arranging propositions into premises and conclusion.

7.3 Argument in Logic

Have you ever attempted to substantiate your claims consciously through arguments? Or, have you ever consciously attempted to identify fault in someone's method of inferring a claim from another? Your understanding of the nature of argument will enlighten you on this matter. Argument is the theme or subject matter of logic. In a sense, logic is defined *as the criteria for the evaluation of argument* (*Ibid.*). What this means is that logic as it relates to argument seeks to establish those rules or principles for ensuring the goodness or soundness of an inference. By implication, argument is not possible without inference. This is another way of saying that argument is the formal substantiation of the process of inference in structural form. As noted by Copi and Cohen, logicians use the word argument to mean any "group of propositions of which one is claimed to follow from the others, which are regarded as providing support or grounds for the truth of that one" (2005: 6). The writers also define inference as the process by which one proposition is arrived at and affirmed on the basis of one or more other propositions accepted as the starting point of the process (*Ibid.*).

The definitions of argument and inference provided by Copi and Cohen show that (a) in logic, argument and inference are inter-connected, and (b) whereas inference determines the process of argument, argument is in itself the very structure of the inferential process, and by this virtue, the structure of thought. The question that follows concerns how argument constitutes the structure of thinking or reasoning?

We should note that when we speak of argument in logic, we do not in any way imply debate or controversy. This may be the conventional or denotative definition of argument in ordinary language, but not in logic. Argument in logic is not about propositions (i.e. points given in support) and oppositions (i.e. points given against), but about the reasoning or inferential procedure which results in the soundness or goodness of a completed reasoning process. When we speak of form in argument, we mean the same thing as the structure of reasoning or thinking. Again, when we say that argument provides the form or structure for reasoning, we mean that argument comprises sets of propositions some of which are grouped as premises, thereby providing the basis for the conclusion. It means that argument consists of (a) propositions, (b) premises, and (c) conclusion. Briefly, we shall define proposition, premises and conclusion.

According to Copi and Cohen, in logic the term proposition is used *to refer to what declarative sentences are typically used to assert* (*Ibid.* 5). This simply means that a proposition is a declarative statement or sentence. A declarative statement is a formal sentence that either asserts or denies something in our everyday world. Usually, a sentence or statement consists of subject and object (i.e. the predicate), and also establishes the connection between the subject and predicate, either by way of affirmation or denial. There are other types of statements or sentences that do not possess the foregoing characteristics and for this reason, cannot be said to be declarative, on the ground that they cannot be affirmed or denied. These include exclamatory, interrogative and imperative statements or sentences. Logic does not deal with any of the aforementioned sentences or statements. It deals only with statements that can be confirmed, affirmed or denied. It is in this very sense that Copi and Cohen defined a proposition as *something that may be asserted or denied* (p. 4).

Having established the nature of propositions, our next task is to explain how propositions constitute the structure of argument. According to Copi and Cohen, *propositions are the building blocks of every argument, they are the building blocks with which arguments are made* (pp. 4 & 6). The question that follows concerns how propositions constitute the building blocks of arguments? The simple answer to this question is that within an argument, propositions are further divided into premises and conclusion. What then is a premise or what are premises? What is a conclusion? And what roles do they play in logic?

Usually, the definition(s) of premise / premises and conclusion determine their functions in logic. C. S. Momoh defines premise / premises as follows:

> A premise is the *building block* of a conclusion, it is the prop, the leg on which a conclusion stands. Wherever an argument is present there must be a premise or a set of premises which provide the logical, inferential or implicational leg or legs for the conclusion to stand. By the recognition of premise indicators, we are able to separate the premises of an argument from its conclusion (2009: 280).

Premise indicators are usually prefixed to the premises that constitute an argument. As the name implies, they indicate the premises of an argument. They include words and expressions such as "since, because, for, as, follows from, as shown by, as indicated by, the reason is that, for the reason that, may be inferred from, may be deduced from, in view of the fact that" (p. 281).

We now know that premises are the inference or reasoning process by which we arrive at a conclusion. Put differently, premises are the very process of inference in an argument and in logic in general. What then is a conclusion and what is its role in argument and in logic? Copi and Cohen are of the view that "the conclusion of an argument is the proposition that is

affirmed on the basis of other propositions of the argument" (*ibid.* 6 – 7). These other propositions are of course the premises. Momoh on his own part defined conclusion as:

> The peak or the apex of the premises of an argument. The conclusion of an argument is the point where the premises hang things together; it is the logical confluence of the premises. Where the implicational knot is tied and finds its bearing, where the premises are explicitly stated, the conclusion has no choice but to be what it has to be (Ibid. 281).

Going by Momoh's definition, a conclusion in logic is simply the submission or final judgment made in an argument which is the direct result of inferential reasoning. There are also conclusion indicators which are usually used before a conclusion is made. They include "therefore, hence, thus, so, accordingly, *consequently*, in consequence, *given that*, proven that, as a result, it follows that, we may infer, I conclude that, which shows that, which means that, which entails that, which points to the conclusion that" (*Ibid.* 283; the italicized are my own additions).

Provided above is the very structure that constitutes argument or the components of argument. Now argument as a reasoning or inferential process basically occurs in two ways or methods namely *Deduction* and *Induction*. Deduction is the general rule of logic, while induction is the particular rule of logic.

7.3.1  In-Text Questions (ITQs)

- What is an argument?
- Identify the constituent elements of an argument

7.3.2 In-Text Answers (ITAs)

- An argument is any group of propositions of which one is claimed to follow from the others, which are regarded as providing support or grounds for the truth of that one.
- The constituent elements of an argument are propositions, premises and conclusion.

7.4 The Theory of Deduction

By the expression "the theory of deduction" we simply mean the method of deduction or deductive inference. Recall we said that argument is not possible without inference, meaning that deductive argument is the same as deductive inference. Now, the real fact about a deductive argument is the logical coherence of its propositions. By logical coherence we mean the *formal structure* of a deductive argument which determines its validity. But for a deductive argument to be valid it must be complete both by *form* and by *content*. The point to note here is that for a deductive argument to be said to be valid, the premises must provide adequate and sufficient grounds for the truth of the conclusion. It is such that if the premises are true, the denial of the conclusion will render the argument inconsistent and self-contradictory or simply invalid. So for a deductive argument to be valid, the truth of its premises must necessarily render the conclusion to be true. Hence we say that "a deductive argument is one whose premises are claimed to provide conclusive grounds for the truth of its conclusion" (Copi and Cohen, 2005: 181). Put differently, "a deductive argument is valid when, if its premises are true, its conclusion must be true" (*Ibid.* 43). In essence, what Copi and Cohen are saying is that contrary to the rule of induction, deductive inference by its

method leads to certainty. This explains why the truth of its premises must absolutely and necessarily lead to the truth of its conclusion. This point is buttressed by Copi and Cohen thus:

> A deductive argument is one whose conclusion is claimed to follow from its premises with absolute necessity, this necessity not being a matter of degree and not depending in any way on whatever else may be the case (p. 45).

As a theory of logic, the importance of deduction is to "explain the relationship between premises and conclusion of a valid argument and to provide techniques for the appraisal arguments either as valid or invalid" (p. 81). What this implies is that the basic characteristic of deductive inference is to discriminate between valid and invalid argument. Therefore, every deductive argument is either valid or invalid: valid if it is impossible for its premises to be true without its conclusion being true also, invalid otherwise.

From a conventional point of view, deductive argument is described as a method of inference in which we "move from assertions about a whole class of things to assertions about some of them" (Uduigwomen, 1998, 14). This involves a movement from general or complex to particular or simple, or from what is true of the whole to what is true of its parts. The above definition of deductive inference is incomplete and misleading because there are deductive arguments that go from general to general. There are also deductive arguments that go from particular to particular. Next, we shall take examples of deductive arguments. These include deductive arguments with true and false premises and the various types of deductive arguments as already outlined. The deductive argument of invalid kind shall not be discussed because it does not form part of the focus of our discourse.

Examples of deductive arguments with true premises and true conclusion:

a. All men are mortal 1st Premise

b. Amadi is a man 2nd Premise

c. Therefore, Amadi is mortal Conclusion

Or

a. All planets revolve round the sun 1st Premise

b. Jupiter is a planet 2nd Premise

c. Therefore Jupiter revolves round the sun Conclusion

Examples of deductive arguments with false premises and false conclusion:

a. Spiders have wings 1st Premise

b. Creatures with wings are insects 2nd Premise

c. Therefore, spiders are insects Conclusion

Or

a. Soldiers are gays 1st Premise

b. Joke, a woman and a soldier 2nd Premise

c. Therefore, Joke is a gay Conclusion

Note that the above examples also represent the conventional definition of deductive argument as that which the truth of the whole entails the truth of its parts. In addition, it can be seen that the premises and conclusion of arguments under example two are false, but the

arguments remain valid because by form, they are coherent. However, logicians pay little attention to this type of argument because logic essentially deals with the truth or falsity of the premises of arguments.

Example of deductive argument that goes from general to general:

a. All hardworking students are bright 1st Premise

b. All bright students have good grades 2nd Premise

c. Therefore, all hardworking students have good grades. Conclusion

Example of deductive argument that goes from particular to particular:

a. Amadi is stronger than Amaka 1st Premise

b. Amaka is stronger than Chika 2nd Premise

c. Therefore, Amadi is stronger than Chika. Conclusion

From the above examples, we can see that the essential characteristic of deductive arguments is such that the information contained in the premises provides conclusive grounds for the truth of the conclusion. When such smooth relationship exists between the premises and conclusion of a deductive argument, we say it is valid.

7.4.1 In-Text Questions (ITQs)

What is a deductive argument?

7.4.2 In-Text Answers (ITAs)

A deductive argument is one whose premises are claimed to provide conclusive grounds for the truth of its conclusion

7.5 Test of Validity

Validity is akin to deductive argument. We have already explained what validity means. The task before us now is to explain the meaning of "test of validity". Recall we said that argument is the subject matter of logic. It may interest you to know that logic does not deal with argument as a subject matter. Logic principally deals with the *form* and *quality* of arguments. As it relates to deduction, its form and quality is determined by its validity. In fact, it is the issue of validity that makes deduction a theory or a method. Hence, to talk about the test of validity is to deal with the form and quality of deductive inference. Most books on logic outline four standard ways of testing the validity of deductive logic namely *Syllogisms and Venn Diagrams*, *Truth Tables*, *The Rules of Inference* and *The Rules of Replacement*. Copi and Cohen, however, explain that – Syllogisms/Venn Diagrams and Truth Tables belong under classical logic and are rooted in the analytical works of Aristotle, while The Rules of Inference and The Rules of Replacement are techniques of modern symbolic logic (*Ibid.* 43).

7.5.1 In-Text Questions (ITQs)

Identify four standard methods of testing the validity of an argument.

7.5.2 In-Text Answers (ITAs)

Four standard methods of testing the validity of an argument are Venn Diagrams, Truth Tables, the Rules of Inference and the Rules of Replacement.

7.6 The Theory of Induction

Very soon, you will come to realize that the features of the induction theory or inductive inference in logic are quite different from those of the deduction. Inductive arguments do not obey the rules of validity or invalidity. Rather, we say that inductive arguments are either "correct or incorrect, reasonable or unreasonable, sound or unsound" (Uduigwomen, 1998: 14). Inductive arguments are also either "better or worse, weaker or stronger" (Copi and Cohen, 2005: 44). Hence, the gist about an inductive argument is that the premises do not necessarily provide conclusive ground for the truth of its conclusion. In contrast to deductive argument, we say that an inductive argument is one whose "conclusion is claimed to follow its premises only with probability, this probability being a matter of degree and dependent upon what else may be the case" (*Ibid.* 45).

In the most ordinary sense, we say that inductive argument is the particular rule of logic. By this statement we meant that rudimentarily, an inductive argument is one that involves making argument from particular instances to a general or universal instance. Sometimes it is said that inductive argument involves making a transition from simple instances to a complex instance. But this definition of induction is only conventional. In the real sense of things, the basic characteristic of induction is that it involves making inference from past instances through the present to the future. Now transition from past to the future does not in any way involve certainty, it rather involves a high level of probability. Again, making argument from particular instances of the past involves making argument from experience. This point is well

articulated by David Hume as follows: “In reality, all arguments from experience are founded on the similarity which we discover among natural objects, and by which we are induced to expect effects similar to those which we have found to follow from such objects” (cited by Copi and Cohen, 422).

By way of enumeration, we can outline the characteristics of inductive arguments thus:

a) Because the truth of the premises of inductive arguments does not entail the truth of their conclusions, we say that inductive arguments are at *best probabilistic* or that “they can be appraised to the degree of *probability* which the premises provide for the conclusion” (Uduigwomen, 14).

b) Because the premises of inductive arguments only render their conclusions *probable,* by implication, we say that inductive arguments are also *analogous. To draw an analogy between two or more entities is to indicate one or more respects in which they are similar;* hence we say: *Every analogical inference proceeds from the similarity of two or more things in one or more respects to the similarity of those things in some further respect* (Copi and Cohen, 425 & 426). Therefore, analogical arguments can neither be valid nor invalid, they are simply probabilistic.

c) The justification of inductive arguments is problematic. No amount or degree of instant confirmation of an occurrence (i.e. particular instantiations) constitutes sufficient grounds for the conclusion of inductive arguments. For this reason we say that inductive arguments are *non-demonstrative.* This latter feature merely confirms the probable nature of inductive arguments.

d) Based on the analogous nature of inductive arguments, we say that inductive arguments are *ampliative.* This means that the conclusions of inductive arguments expand beyond

the content of the premises or that the conclusions of inductive arguments implicitly contain new information not present in their premises.

Consequently, the conventional understanding of inductive inference as reasoning from particular *assertions about things to a general assertion about them* or as argument from particular to general can be misleading. Just as with deductive inference, in inductive inference, we can move from general to general or from universal to universal and from particular to particular. We shall now illustrate with examples:

Examples of inductive inferences (arguments) with particular premises but general or universal conclusions (i.e. the conventional case):

Akpan a labour leader is a democrat

Amadi a labour leader is a democrat

Gani a labour leader is a democrat

Therefore (probably), all labour leaders are democrats.

Amadi an Igbo trader is a liar

Bode a Yoruba trader is a liar

Abubakar an Edo trader is a liar

Therefore (probably), all traders are liars.

Instance of an inductive inference (argument) with general or universal premises and conclusion:

All academics are intelligent and successful

Therefore (probably), intending Academics will be intelligent and successful.

Instance of an inductive inference with particular premises and conclusion:

Idi Amin a military leader was a tyrant

Abacha a military leader was a tyrant

Therefore (probably), Abubakar a military leader would be a tyrant.

From the illustrations above, it is obvious that the consistent thing about an inductive argument (no matter the type) is that the conclusion is always probable to the premises.

7.6.1 In-Text Questions (ITQs)

What is inductive argument?

7.6.2 In-Text Answers (ITAs)

Inductive argument is that argument that the premises do not necessarily provide conclusive ground for the truth of its conclusion.

7.7 Link between Induction and Deduction

There are areas of agreement and disagreement between induction and deduction. In the first place, both are forms of argument and methods of inference, but their *modus operandi* differ. As forms of inference, deductive and inductive arguments are composed of propositions (as premises and conclusions), which can either be true or false. Propositions are declarative sentences that are capable of being verified such that their truth or falsity can be established. Thus, an argument is composed of propositions which are classified into premises and conclusion; the truth or falsity of the premises usually determines what the conclusion will

be. If the propositions of inductive or deductive argument follow coherently, we say that the former is correct, and the latter valid. If otherwise, we say an inductive argument is incorrect and a deductive argument invalid. Where both arguments are either valid or correct, we say that they are sound.

Second, as methods of inference, induction and deduction are conjectural, analogous and probabilistic. Recall that early in this module, we stated that human knowledge is fundamentally inferential. We cannot think without judging and judgment is by analogy, association, abstraction and inference. We believe that events and things of the world are interlinked or somehow interconnected. Hence, inferences are speculations or systematic conjectures about the future. Over the millennia, *experience and observation have taught us that uniformity, regularity, constancy or invariability are indispensable features of our universe ... Inference thus becomes our residue for dealing with the universe; all because, our daily experiences strengthen our faith in the reliability of our inferences* (Uduigwomen, 1998: 22).

By the method of analogy we compare or infer a relationship between two dissimilar things or events. This makes our knowledge about things all the more probabilistic. Analogy by deduction is holistic, just as analogy by induction is atomistic. This is so because; complexes and simples form part of the totality of our world. This habit of linking complexes with simples and vice versa is not out of order. In the first place, only a being with intelligence or reason can attempt or see the symbiosis in nature. Thus - by the rule of general logic (i.e. reason) we see relationship between complex things, and by the rule of particular logic (i.e. the senses) we see relationship between simple things (Kant, 1964: 63-64).

If inferential knowledge is conjectural and analogous, then it is probabilistic. But exactly how do induction and deduction apply to the probability theory? The inductive inference leads to

over generalization or a high degree of probability and this is not to our advantage because, such an attitude is counter-productive. On the other hand, the deductive inference helps to tame the attitude of overgeneralization. Instead of seeking for high degree of probability, we seek for a high degree of confirmation or corroboration among things or events. Hence, the deductive inference could be said to be a more dynamic system of probability.

7.7.1  In-Text Questions (ITQs)

- Define the method of analogy
- Distinguish between analogy by deduction and analogy by induction.

7.7.2  In-Text Answers (ITAs)

- The method of analogy is the act of comparing or inferring a relationship between two dissimilar things or events.
- Analogy by deduction is holistic while analogy by induction is atomistic.

7.8 Truth, Validity, Correctness, Soundness and Logical Form in Logic

Sometimes logic is defined as “the study of methods and principles used to distinguish correct reasoning from incorrect reasoning” (Copi and Cohen, 3). What this simply means is that the aim of logic is to discover and make available those criteria for demarcating sound from unsound arguments. Recall that argument as a method of inference is in two forms: deduction and induction. This means that the expressions “correct reasoning” and “incorrect reasoning” apply to both deductive and inductive arguments. In essence, the rules of correctness and incorrectness apply to both “deductive and inductive arguments. A deductive

argument is correct when valid and valid if the premises cannot be true and the conclusion false, on the other hand an inductive argument is correct when the premises if true justify the inductive claim" (Ucheaga, 2006: 59). What this means is that a deductive argument that is valid is also correct, while an invalid deductive argument is incorrect. Inversely, an inductive is correct when it is better or stronger and incorrect when it is worse or weaker. However, for specific reasons, validity and invalidity are used to qualify deductive argument, while correct and incorrect are used to qualify inductive arguments.

From the explanation made above, it can be seen clearly that logical correctness forms the basis for the soundness or unsoundness of an argument. What we mean to say here is that if by the rule of validity a deductive argument is said to be *logically correct*, otherwise it is *logically incorrect*. In the same vein, by the rule of probability an inductive argument is said to be *logically correct* if it is better or stronger, otherwise it is *logically incorrect*. And once an argument is *logically correct*, such argument is said to be sound. Thus, about soundness; "an argument is said to be sound if (a) it is valid, (b) all its premises are true, and (c) its conclusion is true" (Uduma,1997: 204). Put differently, "when an argument is valid, and all of its premises are true, we call it *sound*" (Copi and Cohen, 49).This is to say, logical correctness, soundness and validity are all interconnected. Which is why we say that "a valid argument with all true premises and a true conclusion is called a *sound argument*" (Uduma, 2008: 18). Hence:

> Logic as the principle of correct reasoning means that the subject is actually concerned with the criteria for the evaluation of arguments; in this connection, it has as its fundamental task the provision of standards or criteria to judge whether an argument is valid or invalid; that is logically correct or not (*Ibid.* 37).

Consequently, correct reasoning or soundness deals with the completed reasoning process. Not with inference as inference or about how to infer. Note, however, that "induction is concerned with the correctness or incorrectness of inference but certainly not with validity and invalidity" (Uduma, 1997: 204). However, whether for deductive or inductive argument, logical correctness or soundness is largely determined by both *form* and *content*. By *form* we mean rational coherence, while by content we mean empirical correspondence. Hence an argument cannot be said to be complete or sound if reason and fact do not cohere, which is another way of saying that the logical form of an argument must correspond with its content.

Next, we look at truth in logic and how truth connects to validity, probability and logical form. Truth and falsity are attributes of proposition in logic. When we talk of truth in logic we refer to the evaluation of declarative propositions. Recall that declarative propositions are those statements or sentences which can either be affirmed to the true or negated to be false. On the other hand, validity and invalidity, correctness or incorrectness, and soundness and unsoundness refer to arguments alone. Now since propositions are the building blocks of arguments, and truth determines the inner structure of propositions, it means that truth in logic is the rudimentary or elementary basis of validity, correctness and soundness; just as falsity is the primary basis of invalidity, incorrectness and unsoundness. In other words, just as validity, correctness or soundness constitute the formal structure of argument, so does truth constitute the formal structure of proposition. This is why we stated that an argument is valid, correct or sound when both its premises and conclusion are all true.

One other point you have to note is that the concern of logic is not about the truth or falsehood of propositions. The concern of logic and the logician is with logical relations between propositions which make the ground for the soundness of arguments. The test of

propositions, either as premises or as conclusion is a task for science and scientists. *By logical relations between propositions we mean those relations that determine the correctness or incorrectness of the arguments in which they occur. The task of determining the correctness or incorrectness of arguments falls squarely within the province of logic. The logician is interested in the correctness even of arguments whose premises may be false* (Copi and Cohen, 49 – 50).

If you get the gist above, it means that you now understand what is meant by *logical form* or *formal structure*. Logical form or formal structure means that by form (i.e. coherence) and by content (i.e. correspondence), the propositions that make up an argument are true, making the argument in itself to be correct or sound. For inductive inference, the conclusion may be probable, but its premises along with its conclusion, must be true. If so far you have understood the lecture, it means that you now know all the properties of inference and argument types in logic.

7.8.1  In-Text Questions (ITQs)

- When can we say that a deductive argument is valid?
- When can we say that an inductive argument is correct?
- What is a sound argument?

7.8.2  In-Text Answers (ITAs)

- A deductive argument is valid if its premises offer conclusive evidence for the truthfulness of its conclusion.
- An inductive argument is correct when the premises if true justify the inductive claim.

- A sound argument is a deductive argument that is valid and also contains true propositions.

7.9 Summary of Study Session 7

Recall that in the study session, we discussed about inference and argument types in logic. You have thus learnt how inference is related to logic. We said that argument is the subject matter of logic. As the subject matter of logic, argument describes and provides the internal form or structure of logic. However, argument in logic is not possible without inference. This means that the two types or arguments that we have which are induction and deduction are in actual fact two types or methods of inference. We then proceeded to describe the formal structure of deduction. We also discussed the method of induction and showed how induction is connected to probability. Having done that, you were shown how deduction and induction are inter-connected. Finally we discussed what is meant by logical correctness and logical form in logic. If you are sure that you have so far understood the trend in this lecture, you can now proceed to test your knowledge by attempting at the revision questions.

7.9.2 References / Suggestions for Further Reading

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