Dr. Sita Kumari, Assistant Professor, YBN university, Ranchi

Philosophy

Dr. Sita Kumari, Assistant Professor, YBN university, Ranchi

Nature of Logic

CHARLES SANDERS PEIRCE DO YOU KNOW THAT ..... Logic is a branch of philosophy. Logic developed independently in India. Ability to reason is the unique characteristic of man. Logic will train you to reason correctly. You need not have formal training in logic to use the rules of logic & reason correctly.

ORIGIN AND DEVELOPMENT OF LOGIC

Logic is traditionally classified as a branch of philosophy. Philosophy is fundamental to all spheres of human enquiry, and logic is the basis that strengthens philosophical thinking. In philosophy one needs to think clearly to deal with the most fundamental questions related to our life and this universe. Use of principles of logic in thinking, reasoning and arguments is central to the practice of philosophy. In ancient times Logic originated and developed in India, Greece and China. The beginning of modern logic as a systematic study can be traced back to the Greek philosopher Aristotle (384-322 B.C.). Aristotle is regarded as the father of logic. The development of logic throughout the world is mainly influenced by the Aristotelian logic, except in India and China where it developed independently. Logic originated in ancient India and continued to develop till early modern times. The Indian logic is represented by the Nyaya School of philosophy. The Nyaya Sutras of Akshapada Gautama (2nd century) constitute the core texts of the Nyaya School. In Mahabharata and Arthashastra of Koutilya (Chanakya) we find reference of the Anviksiki and Tarka schools of logic in India. For his formulation of Sanskrit grammar, Panini (5th century BC) developed a form of logic which is similar to the modern Boolean logic. The Buddhist and Jaina logic also comes under the Indian logic. Jain logic developed and flourished from 6th century BCE to 17th century CE. Buddhist logic flourished from about 500 CE up to 1300 CE. The main philosophers responsible for the development of Buddhist logic are Nagarjuna (c. 150-250 CE), Vasubandhu (400-800 CE), Dignaga (480- 540 CE) and Dharmakirti (600-660 CE). The tradition of Buddhist logic is still alive in the Tibetan Buddhist tradition, where logic is an important part of the education of monks. Mozi, “Master Mo”, a contemporary of Confucius who founded the Mohist School, was mainly responsible for the development of logic in China. Unfortunately, due to the harsh rule of Legalism in the Qin Dynasty, this line of study in logic disappeared in China until Indian Logic was introduced by Buddhists. Aristotelian logic is also known as traditional logic. Aristotle’s logic reached its peak point in the mid-fourteenth century. The period between

the fourteenth century and the beginning of the nineteenth century was largely one of decline and neglect. Logic was revived in the mid-nineteenth century

At the beginning of a revolutionary period logic developed into a formal discipline. Logic is therefore classified as a formal science. The development of modern "symbolic" and "mathematical" logic during this period is the most significant development in the history of logic. As a formal science logic is closely related.

DEFINITION OF LOGIC

We all can solve puzzles, give proofs and deduce consequences as illustrated above. This is possible because we are blessed with the ability to reason. This is the unique ability which differentiates man from other animals. This ability of ours is revealed when we infer, argue, debate or try to give proofs. We are born rational and may not require any formal training to reason. However our reasoning is not always good / correct / valid. Sometimes our reasoning is good and sometimes it is bad. It is necessary that we always reason correctly and this is where the role of logic is important because logic trains us to reason correctly. Reason has applications in all spheres of human affairs. The study of logic, therefore, has applications in many important fields like Mathematics, Philosophy, Science, Law, Computer science, Education and also in our day to day life. Training in logic thus can help one in all the endeavors of life. The word logic is derived from the Greek word 'Logos'. The word 'logos' means 'thought'. So etymologically logic is often defined as, 'The science of the laws of thought.' There are three types of sciences, 1) Natural sciences like physics, chemistry etc. 2) Social sciences like history, geography, sociology etc. and 3) Formal science like mathematics. Logic is a formal science. The etymological definition of logic, however, is not accurate, firstly because it is too wide and may lead to misunderstanding that logicians study the process of thinking, which is not correct. Thinking process is studied in psychology. Secondly the word 'thought' refers to many activities like remembering, imagining, day dreaming, reasoning etc. and logic is concerned with only one type of thinking i.e. reasoning. Another very common and easy to understand definition of logic is – 'Logic is the science of reasoning.' But this definition also is too wide. This definition restricts the study of logic only to reasoning but logicians are not interested in studying the process of reasoning as is implied by this definition too. Logicians in fact are concerned with the correctness of the completed process of reasoning. The aim of logic is to train people to reason correctly and therefore the main task of

logic is to distinguish between good reasoning and bad reasoning. This practical aspect of logic is accurately stated in I.M. Copi's definition of logic. He defines logic as – 'The study of the methods and principles used to distinguish good (correct) from bad (incorrect) reasoning.' This definition is widely accepted by logicians. Reasoning is a kind of thinking in which inference takes place i.e. a thinker passes from the evidence to the conclusion. The term 'inference' refers to the mental process by which one proposition is established on the basis of one or more propositions accepted as the starting point of the process. An argument is a verbal representation of this process of inference and logic is mainly concerned with arguments. (In this text we shall use the words reasoning, inference and argument as synonyms).

SOME BASIC CONCEPTS OF LOGIC

To get precise understanding of the nature of logic it is further necessary to understand certain technical terms used in logic viz. 1) Argument 2) Valid argument 3) Form of argument. 4) True / False and Valid / Invalid. 1) Argument / Inference : An argument consists of proposition / statements. Every argument attempts to establish a proposition by giving another proposition / propositions in its support. An argument may be defined as, 'A group of propositions in which one proposition is established on the evidence of remaining propositions.' The proposition which is established is called the conclusion and the propositions which are stated in support of the conclusion are called premises. For instance in the given argument All artists are creative. Sunita is an artist. Therefore, Sunita is creative. The propositions, 'All artists are creative' and 'Sunita is an artist' are premises and the proposition 'Therefore, Sunita is creative' is the conclusion which is established on the basis of evidence in the premises. Thus premise (premises) and conclusion are the two basic constituent elements of an argument. In every argument the conclusion is derived from the premises and an attempt is made to show that the conclusion is a logical consequence of the premises. 2) Valid argument : Every argument claims to provide evidence for its conclusion. However, every argument is not valid. The validity of an argument depends on the nature of relationship between its premises and conclusion. If the premises provide 'good' evidence for the conclusion, the argument is valid otherwise it is invalid. What is regarded as 'good' evidence, however, depends upon the type of argument. 3) Form of argument : The two important aspects of any argument are – form and content. Every argument is about something and that is the subject matter or the content of the argument. In the same way every argument has some form. Form

means pattern or structure of the argument. For instance, pots may be of various shapes or patterns. These different shapes are the forms of pots. These pots may be made up of any material like clay, iron, bronze or silver. The material out of which it is made is the content of the pot. Now we may have pots of the same shape but made up of different material, we may have pots of the same material but of different forms or the pots differing in both form and matter. In the same way the arguments may differ in the content and have the same form, they may have the same content but different forms or they may differ both in the content and the form. For example – (1) All men are wise. Rakesh is a man. Therefore, Rakesh is wise.

All doctors are rich. Sunil is a doctor. Therefore, Sunil is rich. The content or the subject matter of the above given arguments is different. The first argument is about men, wise and Rakesh. The second is about doctors, rich and Sunil. However, the form of both the arguments is same. The first premise of both the arguments states that a narrower class (men and doctors) is included in a wider class (wise and rich). The second premise of both the arguments states that an individual (Rakesh and Sunil) is a member of the narrower class. In the conclusion of both the argument it is inferred that the individual is, therefore, a member of the wider class. The following diagram clearly reveals how the form of both the arguments is same. Argument – 1 Wise Men Men Rakesh Wise Rakesh Argument – 2 Rich Doctors Doctors Sunil Rich Sunil Can you give examples of ..... 1. Two arguments having different forms and same content? 2. Two arguments having different forms and different content? Can you state the form of the following arguments? 1. All scientist are intelligent. 2. All men are rational. All intelligent are creative. Some rational beings are good. Therefore, all scientists are creative. Therefore, some men are good. The form of the above arguments can also be expressed as follows -- True / False and Valid / Invalid True / False and Valid / Invalid are important terms in logic. The terms valid / invalid are used for arguments in logic. An argument is either valid or invalid and never true or false. Validity of an argument depends upon the evidence in the premises for the conclusion. If the conclusion of an argument necessarily follows from the evidence in the premises then the argument is valid otherwise it is invalid. An arguemnt consists of propositions / statements. Proposition is either true or false. The terms valid / invalid are not used for propositions in logic. A proposition is considered to be true if whatever is stated in the proposition agrees with actual facts, if not it is false. For example, ‘Washington is an American city’ is a true proposition. And ‘London is an Indian city’ is a false proposition.

Dr. Sita Kumari, Assistant Professor, YBN university, Ranchi

DEDUCTIVE AND INDUCTIVE ARGUMENTS / INFERENCES

Arguments are classified into two types 1) Deductive arguments 2) Inductive arguments. This classification of argumments into deductive and inductive is based on the nature of relationship between premises and conclusion. Premises of deductive arguments claim to provide sufficient evidence for the conclusion, whereas premises of inductive arguments provide some evidence for the conclusion. Deductive Argument / Inference – Every argument attempts to prove the conclusion. The evidence needed to establish the conclusion is given in the premises. The evidence given in the premises is not always sufficient. A deductive argument claims to provide conclusive grounds i.e. sufficient evidence for its conclusion. If the claim that premises provide sufficient evidence is justified, the deductive argument is valid, if not it is invalid. In a valid deductive argument where the evidence is sufficient the relation between the premises and the conclusion is of implication. Premises imply the conclusion means, if premises are true the conclusion is also true, it is impossible for the conclusion to be false. Thus the conclusion of a valid deductive argument is always certain. Another important feature of a deductive argument is that, its conclusion is implicit in the premises i.e. the conclusion does not go beyond the evidence in the premises. This means we don't arrive at any new information. By deductive argument we can know what is implied by the premises. Deductive arguments do not give us any new information. For this inductive arguments are useful. Thus, the certainty of deductive arguments comes at a cost. In an invalid deductive argument, however, the claim that premises provide sufficient evidence is not justified, therefore, the relation of implication does not hold between its premise and conclusion. Even when the premises are true the conclusion may be false. For example, let us consider the following arguments. (1) If Amit passes S.S.C. with good marks, he will get admission in college. Amit passed S.S.C. with good marks. Therefore, he well get admission in college. (2) Meena will either go to college or study at home. Meena did not go to college. Therefore, Meena is studying at home.

If Anita gets the prize then she will become famous. Anita did not get the prize. Therefore, Anita will not become famous. (4) If it rains heavyly, the college will declare holiday. College has declared a holiday. Therefore, it is raining heavily. All these arguments are deductive arguments as the conclusions of all the arguments don't go beyond the evidence in the premises. The first two arguments are valid as premises provide sufficient evidence. The premises imply the conclusion.

If premise are true, conclusion cannot be false. The last two arguments, though deductive, are not valid because the claim that premises provide sufficient evidence is not justified. Even when premises are true, the conclusion may be false. So there is no relation of implication, the conclusion does not necessarily follow from the premises. The deductive arguments are formally valid. A formally valid argument is one whose validity is completely determined by its form. In case of deductive arguments the content of its premises and conclusion does not affect its validity. There is no need to judge the content of the premises and conclusion, also there is no need to find out whether they are true or false to determine the validity. One only needs to check the form of the argument. If the form is valid the argument is also valid. For example – (1) All men are animals. All animals are mortals. Therefore, all men are mortals. (2) All crows are birds. All birds have wings. Therefore, all crows have wings. (3) All singers are actors. All actors are leaders. Therefore, all singers are leaders. (4) All cats are rats. All rats are lazy. Therefore, all cats are lazy. The form of all the above given deductive arguments is as follows : All X is Y. All Y is Z. Therefore, All X is Z. It is obvious that the form is valid and therefore all the arguments being its substitution instances are also valid. It is easy to accept that the first two arguments are valid because the premises and conclusions of these arguments are all true and conclusion necessarily follows from the premises. But one may find it difficult to accept that, the third and fourth argument is valid as premises and conclusion of both the arguments are false. However they are also valid. Validity of deductive argument is conditional. In case of a valid deductive argument if premises are true the conclusion must be true. So if premises of the last two arguments are assumed as true then the conclusions of both the arguments necessarily follow from the premises and therefore both the arguments are valid. If conclusion necessarily follows from the premises then the deductive argument is valid. Premises and conclusion of valid deductive argument may or may not be true. When the deductive argument is valid and its premises and conclusion are true, such an argument is called sound argument. As deductive arguments are formally valid, the validity of deductive arguments can be determined or proved by using the rules and methods developed by logicians. Inductive Argument / inference --- Inductive argument is an argument which provides some evidence for the conclusion. The conclusion of an inductive argument goes beyond the evidence in the premises. There is a guess, prediction or something new is asserted in the conclusion for which the evidence given in the premises is not sufficient. As the evidence in the premises is not sufficient, the premises of an inductive argument don’t imply the conclusion. This means even

when the premises are true the conclusion may be false. The conclusion of an inductive argument is always probable. Whether 7 the argument is good (valid) or bad (invalid), the possibility of its conclusion being false always remains. Technically the terms 'valid' and 'invalid' cannot be used for inductive arguments. Only deductive arguments are either valid or invalid. Inductive arguments can be judged as better or worse. More the possibility of the conclusion being true, better the argument. The addition of new premises may alter the strength of an inductive argument, but a deductive argument, if valid, cannot be made more valid or invalid by the addition of any premises. We shall use the terms 'good' or 'bad' for inductive arguments. For example, consider the following arguments. (1) Whenever cat crossed my way in the past, something bad happened on that day. Today morning a cat crossed my way. Therefore, I am sure that something bad is going to happen today. (2) Every morning I have seen the sun rising in the east. It is early morning now. So, I am sure I will find sun rising in the east. (3) The doctor told me that, Suresh is suffering from cancer and he will not survive for more than three months. After two months I got the news that Suresh is no more. So, Suresh must have died due to cancer. All the above given arguments are inductive arguments as conclusions of all the arguments go beyond the evidence in the premises. The premises don't imply the conclusion. Even if premises are true the conclusions of all the arguments are probable. The conclusion is probable does not mean that the argument is bad. In the above given arguments the first one is bad where as the other two are good. Like deductive arguments the validity of inductive arguments i.e. whether the inductive argument is good or bad, is not determined by the form of the argument, but is decided by its content. Inductive arguments are materially valid. A materially valid inference is one whose validity is completely determined by its content. To decide whether the given inductive argument is good or bad, one has to consider the content / the subject matter of the argument. The form of the first and second argument is the same but the first one is bad whereas the second one is good. The amount of evidence in the premises determines whether the argument is good. If the evidence in the premises makes it reasonable to accept the conclusion, then, the argument is good otherwise it is bad. From the above given arguments, the first arguments is a bad one because the conclusion is based on the superstition, there is no connection between a cat crossing the way and good or bad events happening in our life. In the other two arguments, though, the conclusions may turn out to be false, the evidence on the basis of which the conclusions are derived is scientific. Hence the last two arguments are good. Though the content decides whether an inductive argument is good, this does

not mean that the premises and conclusion of good inductive arguments are true and of bad inductive arguments are false. In case of the first argument, even if premises are true and the conclusion turns out to be true, still the argument is bad. Similarly in case of the last argument even if conclusion turns out to be false when the premises are true, the argument is good because the inference is based on the doctor's verdict. Like deductive arguments, whether the given inductive argument is good or bad cannot be determined by the methods and rules of logic. In case of common man's inductive arguments, as given above, one can easily decide whether they are good or bad. However, in case of the inductive arguments, in various sciences, by judging the evidence in the premises only the expertsin thefield can decidewhetheritis good or bad. Unlike deductive arguments, the Inductive arguments, provide us with new information and 8 thus may expand our knowledge about the world. So, while deductive arguments are used mostly in mathematics, most other fields of research make extensive use of inductive arguments. Truth and Validity of arguments – The relation between validity or invalidity of the argument and truth or falsity of its premises and conclusion is not simple. As discussed earlier, an argument may be valid when one or more or even all its premises and conclusion are false and an argument may be invalid with all its premises and conclusion true. The truth or falsity of an argument's conclusion does not by itself determine the validity or invalidity of that argument. And the fact that an argument is valid does not guarantee the truth of its conclusion.

DEDUCTIVE ARGUMENT INDUCTIVE ARGUMENT Premises claim to provide sufficient 1. Premises provide some evidence for the evidence for the conclusion. Conclusion. 2. in valid deductive argument premises 2. Premises do not imply the conclusion. Imply the conclusion. 3. In valid deductive argument if premises 3. Even when premises are true conclusion are true, conclusion must be true. May be false. 4. Conclusion of valid deductive argument 4. Conclusion is always probable. Is always certain. 5. Conclusion does not go beyond the 5. Conclusion goes beyond the evidence in evidence in the premises. The premises. 6. Arguments are formally valid. 6. Arguments are materially valid. 7. Validity can be determined by rules 7. Correctness of arguments can be decided and methods of logic. By an appeal to experience and not by rules and methods of logic. 8. Deductive arguments cannot expand 8. With inductive arguments we can discover our knowledge of the world, by deduction something new and expand our knowledge we can only know what is implied by the of the world.

Dr. Sita Kumari, Assistant Professor, YBN university, Ranchi