LOGIC OF CRITICAL THINKING

BY

MADUABUCHI DUKOR

Logic is an instrument or organ for appraising the correctness of reasoning. The principles of logic or the notions relevant to it are called philosophical logic. The ability to think out the correctness of proposition, the truth of propositions and validity of argument is called critical thinking or informal logic while the use of instrument for appraising the validity of reasoning is called formal logic. Symbolic logic is nothing less than expression in signs and syllogisms evaluating certain types of preposition and syllogism. Logic helps one to distinguish between correct and incorrect arguments. There are three ways it could achieve this. Firstly, it approaches this object as an art as well as a science. Secondly, the study will help to increase proficiency in reasoning. Finally, the study of logic will give student the techniques for testing the validity of arguments. It is interested in whether the conclusion follows form the premises used or assumed on an argument. If the premises provide adequate ground for accepting the conclusion, the reasoning is correct.

In formal logic we have propositional calculus which deal with proposition joined by word like and symbolized as . (dot), ‘or’ symbolized as ‘V’, if then symbolized as (horse or shoes). But predicate calculus distinguishes between different kind propositions like, ‘All cat are black and some cat are black which they are different but with some similarities. Formal logic also studies natural deduction and formal parts of modal and deontic logic. Deontic logic studies logical relations between proposition containing terms like ‘obliged’, ‘commanded’, permitted ‘forbidden’. Modal logic which studies logical relation between proportions containing term like necessary, possible, ‘must’, ‘may’, and so on.

Philosophical logic studies valid reasoning in general and dwells on issue like deductive and inductive reasoning, validity, premises, conclusions, relation, implication, inference statements, sentences and propositions contains terms like ‘necessary’, ‘possible’, ‘must’, ‘may’, and so on.

Inferring is process by which one proposition is affirmed on the basis of one or more proportions that are accepted as the starting point of the process. Proposition means a message or an assertion embedded in a language. It is either true or false. In logic, ‘proposition’ and statement are used in much the same sense but they are not synonyms. Also a statement is either true or false. Every structure of argument contains the premise and conclusion. The conclusion of an argument is the proposition or statement which is affirmed on the basis of the positions of the argument which are called the premises.
**For example:**

<table>
<thead>
<tr>
<th>All humans mortal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Socrates is human</td>
</tr>
<tr>
<td>Therefore, Socrates is mortal</td>
</tr>
</tbody>
</table>

According to Copi, a deductive argument is called when its premises and conclusion are so related that it is absolutely impossible for the premises to be true unless the conclusion is true also.

Inductive reasoning is an argument whose premises provide some grounds for their conclusion.

The term ‘valid’ and ‘invalid’ are not usually applied to inductive argument. Inductive reasoning is the method of science.

Logic studies meaning in general. It studies work like ‘all’ and ‘etc.’ as well as sentence. It is the study of language in general and how it corresponds to the worlds of facts and ideas.

**Truth and Validity**

Truth, falsehood, valid and invalid are logical terms which every student of logic must be acquainted with. While truth and falsehood are properties of propositions and statements, valid and invalid are properties of arguments. However, there is connection between the validity and invalidity of an and the truth of falsehood of its premises and conclusion.

Some valid argument contain true proportion, e.g.

<table>
<thead>
<tr>
<th>All rabbit are mammals</th>
</tr>
</thead>
<tbody>
<tr>
<td>All mammals have lungs</td>
</tr>
<tr>
<td>Therefore, all rabbits have lungs</td>
</tr>
</tbody>
</table>

An argument may contain false proportions only and still be valid e.g.

<table>
<thead>
<tr>
<th>All mammals have lungs</th>
</tr>
</thead>
<tbody>
<tr>
<td>All mammals have hand</td>
</tr>
<tr>
<td>Therefore, all flowers have hands</td>
</tr>
</tbody>
</table>

The argument is valid because if its premises were true, conclusion would have to be true also even though the propositions are false. This shows that some valid arguments do have true conclusion while others do not have. Therefore, the validity of an argument does not guarantee the truth of its conclusion.

Again both the premises and conclusion of argument can be true, still it is invalid e.g.

If I am a vice-chancellor, than I am a scholar

I am not a vice-chancellor
Therefore, I am not a scholar

But consider a situation where the argument goes like this

If Wole Soyinka is a vice-chancellor, then
Wole Soyinka is a scholar
Wole Soyinka is not a vice-chancellor
Therefore, whole Soyinka is not a scholar

Here the argument is valid because its premises are true in the sense that a vice-chancellor is a scholar, but Wole Soyinka is scholar whether he is a Vice-chancellor or not. Therefore, its conclusion that he is not a scholar is false. For the conclusion of an argument to be true, the argument must be valid and its premises must be true. Such argument is said to be sound. The argument must be valid and its premises are must be true. Such argument is said to be sound. The truth or invalidity is that of deductive logic.

The law of Thought
1. The law of identity: A is a e.g. Black is Black
2. The law of non-contradiction: Nothing can be both A and A e.g. nothing can be both black and not black
3. The law of excluded middle: Everything is either A or not A e.g. everything is either black or not black.

Tautology
A tautology is a proposition where the subject and the predicate are saying the same thing. It is any analytic or logical truth that is any statement that is truth in virtue of its forms. E.g. A triangle is three angled, white is white, snow is white, etc.

Contradiction
The principle of contradiction says that nothing can at the same times have and lack the same property, or that a proportion and its negative cannot both be true.

Contingency
A Proposition is contingent, if it is neither necessary nor impossible.

**Fallacies**

Fallacies are errors of reasoning in ordinary languages e.g. Ambiguity, Begging the question (petition principle). Two wrong make a right and so on. For details see Maduabuchi Dukor, *Symbolic and philosophical Logic*, 2004, pp. 4-11

**Rules of inference and Replacement**

These are formulas for affirming a proposition on the basis of one or more proposition that are accepted as the starting point of an argument.

e.g. Modus Ponens (M.P) \( p \rightarrow q, \ p/\vdash q \) or (if you study hard you will pass, if you studied hard therefore you passed).

Modus Tollens (M.T): \( P \rightarrow q, \ -q/\vdash -p \) (if you study hard you hard you will pass, you did not pass therefore, you did not study hard).

- **Hypothetical Syllogism (H.S).** \( p \rightarrow q \)
  \( q \rightarrow r \)
  \( p \rightarrow r \)
  - **Obi loves John**
  - **Joe loves tom, therefore**
  - **obi loves tom**

- **Disjunctive syllogism (D.S)** \( p \lor q \)
  \( -q \)
  \( \vdash p \)
  - **either bread or Rice**
  - **not rice**
  - **Therefore bread**

For details see the 19 Rules of Inference and Replacement in Maduabuchi Dukor, *symbolic philosophical logic*, 2004, pp. 61-63

**Truth Function**

Sometimes the truth or falsity of a sentence depends only on truth or falsity of the sentence within it. We therefore say that a compound sentences is a truth function of the atomic sentences.

**Examples**

1. It is not true that Kwame was a drug addict.
   This is a truth- functional sentence. If the sentence Kwame was a drug addict” is true, the samples sentence is false otherwise, the sample sentences is true.
Since Segun refused to stop going to night clubs, his father continued to be ill.

This is not a truth – functional sentence. We may know that Segun refused to stop going to night clubs and that his father continued to be ill but not that his father has been ill because Segun continued to go to club.

Categorical proportions

A categorical proportion is the proportion which says something is the case without reference to conditions or alternative. Traditional syllogistic logic deals with four types of categorical proportions.

1. Universal affirmative - All S are P (A proposition)
2. Universal negative - No S and P (E proposition)
3. Particular affirmative - Some S are P (I proposition)
4. Particular negative - Some S are no P (O Proposition)

The term in the S position is the subject term, while the term in the P position is the predicate term. These are the same as subject-predicate in a sentence. Categorical proposition differ in quality (being either affirmative or negative) and in quality (behind either universal or particular) (see Warner Morse, logic and philosophy, 1971)

ARGUMENTS PRETEST

1. In a recent survey, the majority of respondents answered “no” to the question “should free hypodermic needles be provided by the government to drug addict on welfare?”

The survey results can best be criticized because the question structure.

a) Presented more than one issue to respondents
b) Presented a choice that suggested a negative reply
c) Presented respondent with an impossible value judgment
* d) Presented an issue to largely unaffected respondents
e) Presented a controversial issue out context

*With number d the question structure commits the fallacy of argumentum ignorantum

2. When it rains, the crop grows, but it hasn’t rained recently, so the crops must not be growing.

Which of the following argument is logically most similar to the one above?
a) When people are old, they complain about their health: but our town has no health problems. So it must have no old people.

b) When a town has health problems it must also have many old people.

c) When people are old, they complain about their health; but no people can complain about their health and yet not to be old.

d) When people complain about their health, they get old but no people are complaining about their health, so we must have no people getting old.

e) When a town has people complaining about their health, it must also have old people, our town has many people complaining about their health, so it must have many old people

*‘d” is correct because it demonstrates the structure of the argument thus: \( p \rightarrow q, \neg p \rightarrow \neg q \), which is a fallacy of denying the antecedent.

3 Company X recently bought company Y. since the two companies had previously been the only companies manufacturing cardboard container, company X now has a monopoly in this particular branch of industry and therefore will probably raise the price of its cardboard containers.

a. An increase in the price of cardboard containers would not necessary increases the retail price of items packed in these containers.

b. The cost of lumber is a major determinant of the cost of cardboard containers

c. There has been a recent increase in demand for cardboard containers.

d. Manufacturers of cardboard containers face increasingly stiff competition from manufactures of plastic containers

e. Before company X bought Y, Company X had consistently set the prices of its cardboard containers below the price set by company Y.

* e. is the contingent truth.

He has produced over five (5) PhDs, examined five (5) PhDs in other Universities and assessed scholar’s professorial chairs. He is a Review Editor of many local and international scientific/academic journals including open journal of philosophy (member of editorial board). Of the Research and Scientific publications, Irvine, USA, tribes and Tribal of Kre publication, India, philosophical, Israeli philosophical Quarterly, Tel-Aviv, Israel of Springer, Netherlands and journal of Black Studies (Sage Publications, USA). Professor Dukor has published over one hundred academic and scientific papers in local and foreign Journals with over thirty percent index in philosopher’s index blowing Green state University, USA. These include nine (9) books some which are: symbolic and philosophical logic and the four great works in African Philosophy published by Lambert Academic publishing, AG and CO., Germany namely: African Freedom, the Freedom of Philosophy, Theistic publishing, scientific paradigm in African philosophy in Global Village. He has edited many books and journals, and contributed over 188 development articles in Nigerian nation newspapers. He is the president/Editor in chief of Essence library (cultural and scientific Development Centre) and publisher of Essence Journals.