UNIT 8 SQUARE OF OPPOSITION AND EXISTENTIAL IMPORT*

Structure

8.0 OBJECTIVES

The present unit aims to understand,

- the relations of opposition between the four standard form categorical propositions by the medium of traditional square of opposition as given by Aristotle. From the perspective of Aristotelian logic we have immediate inferences based on the relations in square of opposition. These are of four varieties, namely; Contradictories, Contraries,

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Subcontraries and Subalternation. Given the truth-value of a particular standard form categorical proposition we shall learn the derivation of truth-value of all the other three categorical propositions.

- the difference in interpretations arising in the relation between the propositions in the light of the interventions made by modern logician George Boole to resolve the existing inconsistencies. This analysis shall be undertaken along with an in depth analysis of existential import and various assumptions implied by it.

8.1 INTRODUCTION

In the preceding units we have defined categorical propositions and their kinds. In the present unit we will see that there are relations of opposition between these four standard form categorical propositions. Traditionally, the technical term used to denote this kind of differing is "opposition." It is important to note that the central task of formal logic is to deal with analysis and evaluation of an argument. Validity/ Invalidity of an argument can be tested through inference. These inferences can be of two types; mediate inference and immediate inference. In the present unit we aim to understand how certain preliminary elementary forms of argument can be validated by immediate inference on the basis of relations in Traditional Square of Opposition. In case we are given the truth or falsehood of any one of the four standard form categorical propositions we can immediately infer the truth or falsehood of some or all the other three standard form propositions on the basis of the kind of relation of opposition between them. In the next unit we shall also study further immediate inferences.

8.2 THE TRADITIONAL SQUARE OF OPPOSITION

We have already observed in previous units that Aristotelian logic argued that the standard form categorical propositions, having same subject and predicate terms, might differ either in quality or quantity or both of them. The technical term with which these differences are designated is **opposition**. These different kinds of differences of truth relations that may hold between a pair of categorical statements are represented with the help of an important diagram called **Traditional Square of Opposition.** More specifically defined "opposition" is the logical relation that exists between two contradictories, contraries or other such relations displayed on

Traditional Square of Opposition. This term "opposition" need not denote any apparent disagreement between the propositions. The oppositions are correlated with some very important true relations. There are four possible ways in which the standard form categorical propositions are "opposed" with one another i.e. contradictories, contraries, subcontraries and subalterns and superalterns.

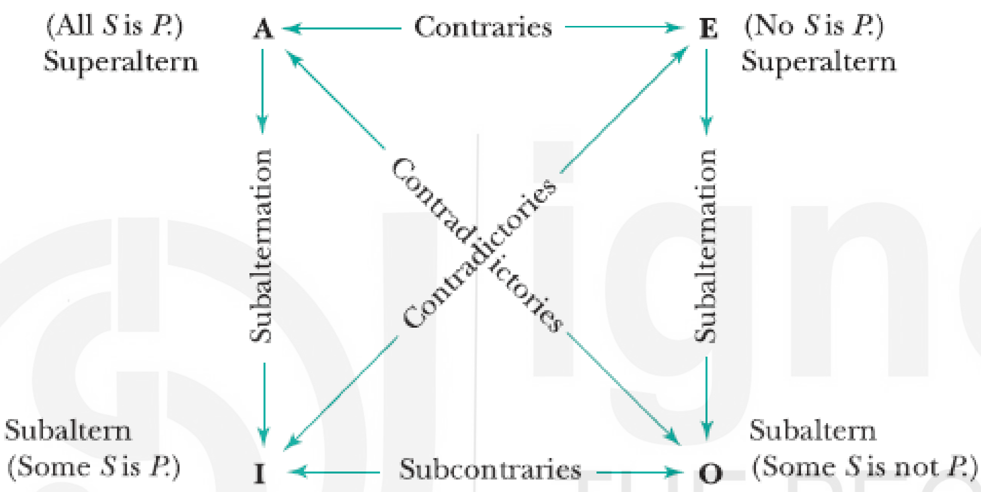

Diagram 1: Traditional Square of Opposition (Source: Copi et al., 2016, p. 114)

8.3 RELATIONS IN TRADITIONAL SQUARE OF OPPOSITION

8.3.1 Contradictories

Two propositions are contradictories when one is the denial or negation of the other proposition. Contradictories cannot both be true and cannot both be false. Two standard form categorical propositions that have the same subject and same predicate terms but differ from each other in both quality and quantity are contradictories. An A proposition, "All lawyers are accountants" and O proposition, "Some lawyers are not accountants" are contradictories. The reason is that they are opposed in both quantity (A refers to 'all' and O refers to 'some') and quality (one affirms, the other denies).We gather that out of the two exactly one is true and another is false. Similarly, the E proposition, "No lawyers are accountants" and I proposition, "Some lawyers are accountants" are contradictories as they are opposed to each other in both quantity and quality. Out of the two "A and I" and "E and O" one is true and the other is false. They can both be neither true nor false together.

"All S is P" is contradicted by "Some S is not P."

"No S is P" is contradicted by "Some S is P."

8.3.2 Contraries

Two propositions are said to be contraries if they cannot both be true together. In contrary propositions the truth of one entails the falsity of the other. However, both the propositions can be false. Let us take example of a one-day cricket match to be held between India and Australia. In the context of a match between two teams, the two propositions "India will win the upcoming game with Australia" and "Australia will win the upcoming game with India" are contraries. This implies that if one of the two statements is true then the other statement has to be false. However, if the result of the cricket match turned out to be a draw then both of these statements would be false. Therefore, these two propositions cannot both be true together however they can both be false. Unlike contradictories contraries can both be false.

Furthermore, let us figure out contraries among the four standard form categorical propositions. The traditional account of categorical propositions argues that the universal propositions (A and E) which have the same subject and same predicate terms but differ only in quality (one affirms and another denies) are contraries. Universal affirmative proposition, A "All poets are artists" and its corresponding E proposition "No poets are artists" cannot both be true but both of them can be false and therefore they are regarded as contraries. However, the modern logicians have identified a problem with this traditional Aristotelian interpretation, which shall be discussed in the second half of the chapter under the discussion on Existential Import.

Also, we shall qualify here that the A and E propositions are not taken as necessary propositions but assumed to be contingent i.e. they are neither necessarily true nor necessarily false. This assumption is important to our discussion because in case either A or E proposition is necessarily true i.e. in case either of them is a logical or mathematical truth, like, "All tautologies are true" or "No circles are rectangles" the claim that A propositions and E propositions are contraries cannot be correct. A necessarily true proposition cannot be false by definition and therefore it cannot have a contrary. We have already seen that by definition two propositions can only be contraries if they can both be false. We shall assume that according to the present interpretation the propositions are contingent so that we may correctly hold the claim that A and E propositions, which have the same subject and predicate terms are contraries (Copi et al., 2016, p.113).

8.3.3 Subcontraries

Two propositions are subcontraries when they cannot both be false, although they may both be true. The traditional account suggests that particular propositions (I and O), which have the same subject and predicate term but which differ from each other in quality (one affirms and another denies) are subcontraries. Particular affirmative proposition, 'Some dogs are pets' and particular negative proposition 'Some dogs are not pets' could both be true but they could not both be false and therefore are subcontraries.

Also, on the lines of the assumption made for contraries we shall qualify here that I and O propositions are assumed to be contingent i.e. they are neither necessarily true nor necessarily false. This assumption is important to our discussion because in case I or O proposition is necessarily false; like, "Some squares are triangles" or "Some triangles are not three-sided structures" the claim that I propositions and Opropositions are subcontraries cannot be correct. A necessarily false proposition cannot be true by definition and therefore it cannot have a subcontrary. We have already seen that by definition two propositions can only be subcontraries if they can both be true. We shall assume that according to the present interpretation the propositions are contingent so that we may correctly hold the claim that I and O propositions, which have the same subject and predicate terms, are subcontraries.

8.3.4 Subalteration

The relation of subalteration exists between two propositions when two categorical propositions, which have the same subject and predicate terms, agree in quality but differ in quantity. Since they agree in quality they are also called corresponding propositions i.e. A proposition "All dogs are mammals" has a corresponding proposition "Some dogs are mammals." Similarly, "No whales are reptiles" has a corresponding proposition, "Some whales are not reptiles". This relation holds between a universal statement and its corresponding particular statement. Subalteration is the relation of opposition between a universal proposition and its corresponding particular proposition. In these pair of corresponding propositions the universal propositions (A and E) are called superaltern and the particular propositions (I and O) are called subaltern respectively. Hence logically, the superaltern proposition implies the truth of subaltern proposition but not vice-versa.

For instance, from the universal affirmative proposition, “All spiders are eight-legged creatures” the particular affirmative subaltern proposition, “Some spiders are eight-legged creatures” follows. If A is true the corresponding E proposition is true. Similarly, from the universal negative proposition, “No spiders are eight-legged creatures” the particular negative proposition, “Some spiders are not eight-legged creatures” follows. If E is true the corresponding O proposition is true. However, the reverse does not hold i.e. if the particular proposition is true then the respective universal proposition is undetermined.

Moreover, in case I proposition is given as false then corresponding A proposition is also false and if O proposition is given as false then its corresponding E proposition is also false. However, the reverse does not hold i.e. if the universal proposition is false then the respective particular proposition is undetermined. We shall learn about the immediate inferences, which follow from the relations in the traditional square of opposition in the upcoming section.

Check your Progress I

Note: a) Use the space provided for your answer.

b) Check your answers with those provided at the end of the unit.

A. State the contradictory of the following propositions:

1. All politicians are liars.
2. Some grapes are not sour.
3. All elephants are vegetarian.
4. Some soldiers are not officers.

B. State the contrary of the following propositions:

1. All women are authors.
2. No whales are fishes.
3. All surgeons are physicians.
4. No trees are machines.

C. State the subcontrary of the following propositions:

1. Some knives are sharp.
2. Some animals are not cats.
3. Some spiders are not eight-legged creatures.
4. Some books are thick.

D. State the superaltern of the following propositions:

1. Some games are inventions.
2. Some pilots are trained professionals.
3. Some books are thick.
4. Some boxes are heavy.

E. State the subaltern of the following propositions:

1. All masks are protection devices.
2. All bananas are fruits.
3. All phones are communication devices.
4. All bottles are containers.

8.4 IMMEDIATE INFERENCES: FROM TRADITIONAL SQUARE OF OPPOSITION

On the basis of relations of oppositions presented in the traditional square of opposition we can draw several immediate inferences. To the present purpose we should start by differentiating between immediate and immediate inferences. In case of mediate inference we draw a conclusion from one or more premises. For example in categorical syllogisms wherein two premises imply conclusion, in such cases the conclusion is drawn from first premise through the mediation of the second. This inference shall be explored in the upcoming block. On the other hand when a conclusion is drawn from only one premise there is no need for mediation of the second premise and such inferences are called immediate inferences. We can draw many immediate inferences on the basis of Traditional Square of Opposition. If we are given the truth value of any of the four standard form categorical statements we can make immediate inference about the truth value of the other propositions. However, it is important to observe that in some cases the immediate inference will yield a definite conclusion and in some other cases it may yield to inconclusive answers.

In the previous unit we have understood the relations of opposition in Traditional Square of Opposition individually. Let us now see how these relations can be used to determine the truth-values of corresponding propositions. To find out truth-value of more than one proposition based on a given proposition, as a rule of thumb we can first use the relation of contradiction. Suppose the value of “All policemen are honest beings” is given as true. First, by contradiction relation we decide “Some policemen are not honest beings” is false. The truth-value of the rest of the statements can be determined by evoking other relations successively. Second, rule of thumb is that when one statement has logically undetermined truth-valuethen its contradictory statement also has logically undetermined truth-value. (Hurley and Watson, 2019, p. 241-242)

The truth-values can be determined through various routes. One such way is suggested below. However, we can seek help of other relations to reach the same results. Let us consider the following:

1. In case A is given as true: By relation of contradiction O must be false.

   By relation of subalteration I must be true.

   By relation of contrary E must be false.

2. In case E is given as true: By relation of contradiction I must be false.

   By relation of subalteration O must be true.

   By relation of contrary A must be false.

3. In case I is given as true: By relation of contradiction E must be false.

   By the relation of subalteration from the truth of the particular proposition I nothing would follow about the truth-value of the universal proposition therefore A is undetermined; it may be true or it may be false.

   By the relation of subcontrary both I and O can be true together and the truth of I does not stop O from being false, therefore the O is undetermined; nothing conclusive can be said it may be true or it may be false.

4. In case O is given as true: By relation of contradiction A must be false.

   By the relation of subalteration from the truth of the particular proposition O nothing would follow about the truth value of the universal proposition therefore E is undetermined; it may be true or it may be false.

   By the relation of subcontrary both I and O can be true together and the truth of O does not stop I from being false, therefore the I is undetermined; nothing conclusive can be said it may be true or it may be false.

5. In case A is given as false: By relation of contradiction O must be true.

   By the relation of contrary both A and E can be false together. From the falsity of A it does not follow that E must be true nor it follows that E must be false. Therefore, E is undetermined.

   By the relation of subaltern, the falsity of A neither implies that I must be false nor that it must be true. Therefore, I is undetermined.

6. In case E is given as false: By the relation of contradiction I must be true.

   By the relation of contrary both A and E can be false together. From the falsity of E it neither follow that A must be true nor it follows that A must be false. Therefore A is undetermined.

By the relation of subaltern, the falsity of E neither implies that O must be false nor that it must be true. Therefore, O is undetermined.

7. In case I is given as false: By the relation of contradiction E must be true.

   By the relation of subalternationA must be false.

   By the relation of subcontrary O must be true.

8. In case O is given as false: By the relation of contradiction A must be true.

   By the relation of subalternation E must be false.

   By the relation of subcontrary I must be true.

Check your Progress II

Note: a) Use the space provided for your answer.

b) Check your answers with those provided at the end of the unit.

A. If A proposition "All policemen are honest" is true what can be inferred about the truth or falsity of the following propositions:

1. No policemen are honest.

2. Some policemen are honest.

3. Some policemen are not honest.

B. If E proposition "No policemen are honest" is true what can be inferred about the truth or falsity of the following propositions:

1. All policemen are honest.

2. Some policemen are honest.

3. Some policemen are not honest.

C. If I proposition “Some policemen are honest” is true what can be inferred about the truth or falsity of the following propositions:

1. All policemen are honest.

2. No policemen are honest.

3. Some policemen are not honest.

D. If O proposition “Some policemen are not honest” is true what can be inferred about the truth or falsity of the following propositions:

1. All policemen are honest.

2. No policemen are honest.

3. Some policemen are honest.

E. If A proposition “All policemen are honest” is false what can be inferred about the truth or falsity of the following propositions:

1. No policemen are honest.

2. Some policemen are honest.

3. Some policemen are not honest.

F. If E proposition “No policemen are honest” is false what can be inferred about the truth or falsity of the following propositions:

1. All policemen are honest.

2. Some policemen are honest.

3. Some policemen are not honest.

G. If I proposition "Some policemen are honest" is false what can be inferred about the truth or falsity of the following propositions:

1. All policemen are honest.

2. No policemen are honest.

3. Some policemen are not honest.

H. If O proposition "Some policemen are not honest" is false what can be inferred about the truth or falsity of the following propositions:

1. All policemen are honest.

2. No policemen are honest.

3. Some policemen are honest.

I. For each of the following questions, given the truth-value of one of the four types of categorical propositions, determine the truth-values of the other three categorical propositions. Use your understanding from Traditional Square of Opposition to determine the correct answer.

1. If A proposition is T then what can you conclude about E proposition.
2. If A proposition is T then what can you conclude about I proposition.
3. If A proposition is F then what can you conclude about O proposition.
4. If A proposition is F then what can you conclude about I proposition.
5. If E proposition is F then what can you conclude about I proposition.
6. If E proposition is F then what can you conclude about O proposition.

7. If E proposition is T then what can you conclude about A proposition.
8. If E proposition is T then what can you conclude about O proposition.
9. If O proposition is T then what can you conclude about E proposition.
10. If O proposition is T then what can you conclude about A proposition.
11. If O proposition is F then what can you conclude about I proposition.
12. If O proposition is F then what can you conclude about E proposition.
13. If I proposition is T then what can you conclude about A proposition.
14. If I proposition is T then what can you conclude about O proposition.
15. If I proposition is F then what can you conclude about E proposition.
16. If I proposition is F then what can you conclude about A proposition.

8.5 EXISTENTIAL IMPORT

Existential import is that attribute of a categorical proposition, which asserts the existence of objects. A proposition having existential import asserts the existence of objects i.e. the class designated by the subject term of the categorical proposition is assumed to have at least one member. In other words the categorical propositions have existential import when the class designated by the subject term is non-empty. The classical logicians of Aristotelian tradition argue that all four categorical propositions A, E, I, and O have existential import. However, the modern logicians agree that I and O have existential import but they disagree with Classical logicians and do not attribute existential import to A and E propositions. Along with other references mentioned in the chapter I have mainly referred to *Introduction to Logic* (Copi et al., 2016) for the present and following sections.

The issue at hand is to be decided with utmost care. A student of logic is concerned with the correctness/incorrectness of reasoning. It is assumed that evaluation of validity/invalidity of an argument and correctness of reasoning in many arguments depends on the fact that whether the propositions, which constitute that argument, have existential import or not i.e. they have members or not. We have already seen that categorical propositions are preliminary units or building blocks of arguments. Along with translating ordinary language propositions in standard form and symbolizing the A, E, I and O propositions, we shall also guard ourselves against any incorrect inferences by establishing what is asserted or denied by the proposition about class membership. It is important to understand the resolution of the controversy of existential import in order to explore how we can develop a coherent analysis of a categorical syllogism.

Modern logicians argue that particular propositions I and O always have existential import. Let us understand the reasons they give for this claim by the help of examples:

Some animals are reptiles.

Some dogs are not pets.

The first proposition, “Some animals are reptiles” asserts that there exists at least one animal which is a reptile. Also the second proposition, “Some dogs are not pets” asserts the existence of some dogs or at least one dog and additionally asserts that those dogs or that one dog is not a pet. In both I and O propositions the classes designated by the subject terms are not empty. If these propositions are true then both the class of “animals” as well as the class of “dogs” each has at least one member. We shall see the interpretation of particular propositions in more detailed manner in the coming section.

However, in the history of logic, whether the universal propositions, A and E, have existential import or not is a matter on which there is no consensus. To understand the matter at hand we should begin by asking the primary question, when can we reasonably conclude that something exists? The modern logicians would answer that until we have definite evidence it is not logically justified to assume existential import. Let us understand why the traditional logicians believe that universal propositions have existential import while modern logicians deny it. For example:

A: All unicorns are horned creatures.

E: No inhabitants of moon are honest beings.

According to traditional logicians these two statements A and E have existential import i.e. the subject terms “unicorns” and “inhabitants of moon” refer to non-empty classes. But we know that there are no “unicorns” or “inhabitants of moon.”“Unicorn” is a fictional character and “inhabitant of moon” might be a possibility in distant future but it definitely is an empty class at present. Now the problem arises when we consider the consequences of the assumption of traditional logicians that A and E propositions mentioned above have existential import i.e. do have members. According to Traditional Square of Opposition two propositions are contradictories when only one of the propositions in the pair can be false at a time. But if we consider that the contradictory propositions, “All inhabitants of moon are honest beings” and “Some inhabitants of moon are not honest beings” have existential import i.e. there are “inhabitants of moon” then both these propositions would be false if it is the case that moon has no inhabitants. We know through our factual knowledge that the subject class i.e. the class of “inhabitants of moon” is empty therefore both the propositions are false. The problem arises that if we assume that universal propositions (in this case proposition A) have existential import then the relation of contradiction does not seem to hold in the Traditional Square of Opposition. If we assume existential import in the cases discussed above then both the propositions cannot be contradictories because in the contradiction relation only one of them can be false at a time.

We wonder how to explain the incompatible relations. The issue here is that we have a choice between preserving the relation of contradiction in Traditional Square of Opposition and preserving the traditional assumption of existential import and only one of them can hold in the existing situation. Another issue is that Traditional Square of Opposition claims that I follows validly from A through relation of subalteration. Similarly, O follows validly from E through the relation of subalteration. But for I and O to follow validly from A and E propositions A and E should have existential import. Otherwise how can a proposition without existential import validly imply a proposition, which has existential import from proposition, which does not have existential import. As from a claim to non-existence it would be inconsistent to move towards a claim to existence.

In order to rescue the relations in traditional square of opposition the concept of existential presupposition is introduced. We begin with a presupposition that all categorical propositions A, E, I and O refer to classes which have members and they are not empty. We make a blanket presupposition that all classes designated by our terms do have members i.e. we presuppose that the classes to which categorical propositions refer have members and they do not refer to empty classes. In this way all the relationships in Traditional Square Opposition are rescued.

- A and E remain contraries.
- I and O remain subcontraries.
- Subaltern I follows from superaltern A.
- Subaltern O follows from superaltern E.
- A and O remain contradictories.
- E and I remain contradictories.

The existential import is a presupposition, which is sufficient as well as necessary to rescue Aristotelian logic as well as traditional square of opposition. Even the ordinary use of modern languages, like, English makes this presupposition. For example, on being told, “All the masks on the table are made of cotton” we assume that the subject class is non-empty. We assume the existence of masks. However, if on observation we were to find out that there are no masks on the table then we would assume that the speaker has made a mistake i.e. in this case the existential presupposition about existence of masks was false. We would not argue that the claim is false or true. This shows that in general usage of language we do understand and accept the existential presupposition of propositions (Copi et al., 2016, p. 128-129).

Although we preserve the traditional relations in the square of opposition but this blanket assumption has other limitations. The blanket presupposition imposes heavy intellectual penalties. If we presuppose that the class designated by all categorical propositions has members then the question confronts us- Will we ever be able to formulate the proposition that denies the existence or denies that the class has members? It also curtails our power of expressing categorical propositions, which express empty classes. Furthermore, there are times when we utter propositions with the intention of using the term to designate empty classes. For example, when the Traffic Department makes a rule, “All those who break the traffic rules their driving license would be cancelled” they do not presuppose that “the class of those who break the traffic rules” should have members. Instead the intention of traffic department would be that the class would become and remain empty. Also, this statement would be taken as true even if no one were ever prosecuted. The word “all” in this statement might be assumed to refer to an empty class. Mostly, we make rules and laws intending the subject class to be empty.

Also, another limitation is that we would never be able to make statements about empty classes like, “All yellow zebras are creatures that have giraffe necks” and many others, which are statements made about hypothetical classes with possible characterizations in fictional works.

At times, we reason about theoretical entities without making any commitment about their existence, especially in case of scientific principles. Most of the times in science we refer to concepts like, points, lines, bodies at rest, bodies not acted upon, plane, frictionless, ideal gases, planets and several other conjectural entities. However, the scientists or mathematicians assume them hypothetically and do not necessarily want to commit that these entities actually physically exist.

4.6 BOOLEAN INTERPRETATION AND THE SQUARE OF OPPOSITION

For the above mentioned and other such reasons, George Boole and other modern logicians suggested that it is better to restrict existential import only to I and O propositions.* According to Boolean interpretation we make following claims:

- A and E do not have existential import.
- Only I and O statements have existential import.

On Boolean interpretation we commit an existential fallacy if we assume existence (a class has members) where we do not have clear evidence to claim existence. If an argument relies on this mistake it commits the fallacy of existential assumption or existential fallacy. Therefore, we cannot assume the existence of individuals in the subject term of universal propositions.

*Patrick J. Hurley clarifies that it was not George Boole but John Venn who eliminated existential import from universal propositions. In the book *Symbolic Logic* John Venn insisted that universal propositions should be interpreted as having no existential import. This modification by Venn is what is accepted as official Boolean position known to us. For more details on this please refer (Hurley, 2019, p. 226-227).

The modern interpretation argues that a conditional statement, which makes no assertion concerning the existence of members in a class, designates universal propositions. On Boolean interpretation there is no assumption that in the propositions mentioned below the class of either "men" or "unicorn" or "mangoes" or "dogs" is a non-empty class. According to Boolean interpretation the universal statement A is written as the conditional of the following type:

For any x, if x is S then x is P.

Let us take examples of universal proposition A and E with their modern interpretation:

"All men are mammals" would mean "for any x, if x is a man then x is a mammal"

"All unicorns are mammals" would mean "for any x, if x is a unicorn then x is a mammal"

"No mangoes are yellow objects" would mean "for any x, if x is a mango then x is not yellow object"

"No dogs are cats" would mean "for any x, if x is a dog then x is not a cat"

We see that none of these conditional statements make any assertion concerning the existence of members of a class. However, according to Boolean interpretation unlike "all" in universal propositions, the word "some" in an I proposition makes the claim that there is a membership in the subject class. "Some" is interpreted to mean "at least one." Therefore if particular propositions are true then subject class is not empty because particular propositions are analyzed as conjunction with an existential claim. For example,

"Some roses are beautiful" would mean "There is at least one x such that x is a rose and x is beautiful"

However, we should note that in the Boolean interpretation there is no claim to membership in subject class of universal propositions. If "unicorn" is the subject and there are no members in the subject class (subject being empty) then both the propositions "No S is P" as well as "All S is P" can be true. Also, If there are no unicorns, then I proposition, "Some unicorns are horned creatures" and O proposition, "Some unicorns are not horned creatures" are both false.

What we witness is that the Boolean interpretation results in an important shift in the relations of opposition in Traditional Square of Opposition.

1. Since A and E do not have existential import and I and O do have existential import therefore the relation of subalternation does not hold in modern interpretation. It will be an existential fallacy to infer a statement, which has existential import from premises, which do not have existential import. From the truth of universal propositions we cannot follow the truth of particular propositions.
2. The relation of contraries does not hold for corresponding A and E propositions. If there are no "inhabitants of moon" then both the propositions "All inhabitants of moon are honest beings" and "No inhabitants of moon are honest beings" can be true. We have seen above that both A and E would be written as conditional propositions "if thereis an inhabitant of moon then it is an honest being" and "if there is an inhabitant of moon then it is not an honest being" and conditional can both be true together if there is no member in the subject class.
3. Similarly the relation of subcontraries does not hold for corresponding I and O propositions. In case the subject class turns out to be empty then both the corresponding I and O propositions can be false together. Since corresponding I and O propositions have existential import in case there are no "inhabitants of moon" it would be false to assert both "Some inhabitants of moon are honest beings" as well as "Some inhabitants of moon are not honest beings."By traditional definition subcontraries cannot be false together although they may be true. Since by the above analysis we gather that they can be false together therefore the relation of subcontraries does not hold.
4. However, like the traditional square even in modern interpretation universal propositions A and E are the contradictories of the particular propositions O and I. We just noted that if we begin with a presupposition of existence in the case of contradictory propositions A and O and then the subject class turns out to be empty then both the propositions would become false. Thus relation of contradiction would not hold. However, if we accept the modern interpretation then the relation of contradiction holds between A and O as well as E and I(Copi et al., 2016, p.130-131).

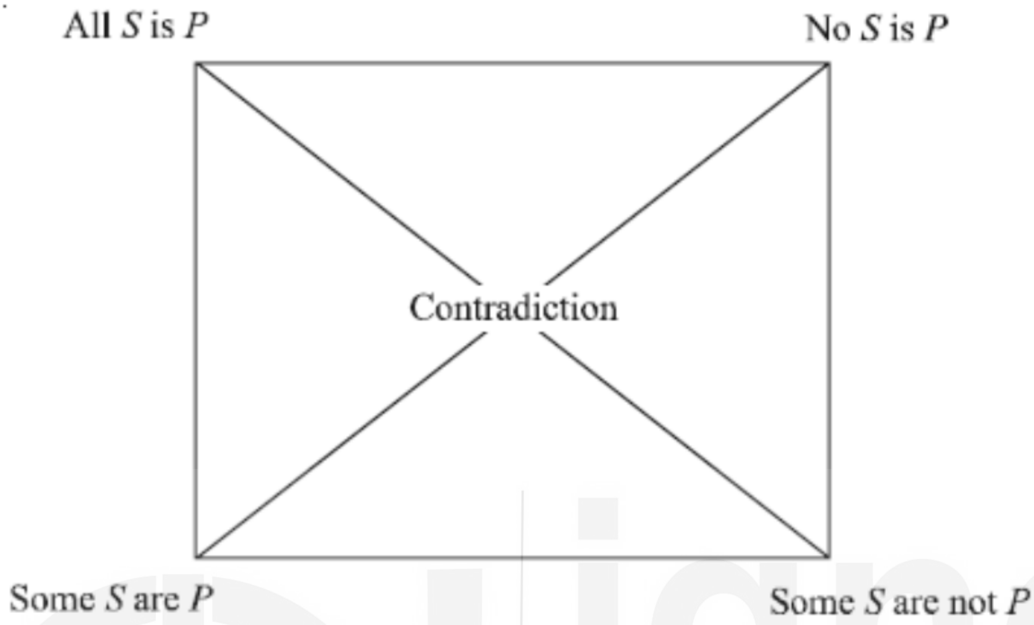

Diagram 2: The Square of Opposition after Boolean Interpretation (Source: Chakraborty, 2006, p. 255)

Since the blanket modern logicians the traditional square of opposition is only left with the relation of contradiction reject existential presupposition. According to Boolean interpretation the relations along the side of the square are undone and only the diagonal relation i.e. contradictory remains. Also, the Boolean interpretation has an impact on further immediate inferences performed by limitation. Since the subalternation relation is not a valid relation in this interpretation therefore conversion by limitation for A proposition is invalid. Also, for the same reason contraposition by limitation for E proposition is invalid. We shall elaborate on this matter in the next unit.

Although Boolean interpretation is not making an assumption of existence in case of universal propositions yet there is a scope to use universal proposition whenever we intend to assert existence. In order to do this we require asserting two propositions i.e. universal as well as particular. The universal proposition, “All human beings on earth are mortal” has no existential import and it makes a limited claim, “if there is a human being on earth then he/she is mortal.” In case we claim this proposition and wish to refer to existing human beings then it would have to be asserted as a conjunction of the two. This implies that we would have to assert another particular proposition alongside which intends to assert existence of human beings on earth. Thus we assert, “Ojas is a human being on earth.” Therefore the resultant proposition is a conjunction, “All human beings on earth are mortal” and “Ojas is a human being on earth.” It would take the form, “For any x, if x is a human being then x is mortal, and there is at least an x and x is a human being.”This proposition adds the existential force and refers to actual human beings. Therefore in a universal statement whenever we intend to assert the existence of members of the subject term we will have to add an existential statement separately. According to modern logicians, the impact of Boolean interpretation would hold that only relation of contradiction is valid in square of opposition.

Furthermore, unlike the case of universal propositions, the particular propositions I and O are always assumed to have existential import under both modern as well as traditional interpretations. The issue of existential import pertains only to universal propositions. On the traditional interpretation of universal propositions we need to determine whether or not the subject class denotes things, which actually exist in the world. The question regarding existence is dependent on truth-value. Therefore under traditional interpretation truth-value of a proposition or propositions in an argument play a role in determining validity/invalidity of an argument. However, according to modern interpretation validity/invalidity of an argument is a purely logical concept. (Baronett, 2013, p. 193)

8.7 LET US SUM UP

Immediate inferences based on Traditional Square of Opposition:

A is given as true: E is false; I is true; O is false.

E is given as true: A is false; I is false; O is true.

I is given as true: E is false; A and O are undetermined.

O is given as true: A is false; E and I are undetermined.

A is given as false: O is true; E and I are undetermined.

E is given as false: I is true; A and O are undetermined.

I is given as false: A is false; E is true; O is true.

O is given as false: A is true; E is false; I is true.

8.8 KEY WORDS

Contradictories: When two propositions are related in such a manner that one is the denial or negation of another. A and E are the contradictories of I and O respectively.

Contraries: When two propositions are related in such a manner that although they both may be false but they cannot both be true.

Existential Fallacy: Any mistake in reasoning that arises from assuming illegitimately that some class has members.

Existential Import: An attribute of those propositions that normally assert the existence of objects of some specified kind. Particular propositionsI and O always have existential import. However, Aristotelian and Boolean interpretations of propositions differ on whether universal propositions have existential import or not.

Opposition: The logical relations, displayed on the square of opposition, which exist between any two propositions that differ in quality, quantity or other respects. They are relations between two contradictories, contraries, subcontraries and others.

Square of Opposition: A square shaped diagram, which exhibits logical relations between four types of categorical propositions (A, E, I and O) situated in the four corners.

Subalternation: The relation on square of opposition between auniversal proposition and its corresponding I or O proposition where the particular proposition is called “subaltern” and the universal proposition is called “superaltern.

Subcontraries: When two propositions are related in such a manner that although they may both be true but they cannot both be false.

8.9 FURTHER READINGS AND REFERENCES

- Baronett, Stan. (2013). *Logic*, 3rd Edition, NewYork: Oxford University Press.
- Chhanda, Chakraborti. (2006). *Logic: Informal, Symbolic and Inductive*, 2nd Edition, Delhi: Prentice-Hall of India Private Limited.
- Cohen, Morris R. & Nagel, Ernest. (1968). *An Introduction to Logic and Scientific Method,* Delhi: Allied Publishers.
- Copi, Irvin M., Cohen, Carl.,& McMahon, Kenneth. (2016). *Introduction to Logic*, 14th edition Pearson India Education Services Pvt. Ltd.
- Hurley, Patrick J., & Watson, Lori. (2019). *A ConciseIntroduction to Logic*, Cengage Learning India Private Limited.
- Jain, Krishna. (2014). *A Text Book of Logic*, Delhi: D.K. Printworld (P) Ltd.
- Priest, Graham. (2000). *Logic: A Very Short Introduction,* New York: Oxford University Press.
- Sen, Madhucchanda. (2008). *Logic*, Delhi: Pearson.

8.10 ANSWERS TO CHECK YOUR PROGRESS

Check Your Progress I

A. Contradictory:

1. Some politicians are not liars. Since the given proposition is A its contradictory is an O proposition.
2. All grapes are sour. Since the given proposition is O its contradictory is an A proposition.
3. Some elephants are not vegetarian. Since the given proposition is an A proposition its contradictory is an A proposition.
4. All soldiers are officers. Since the given proposition is an O proposition its contradictory is an A proposition.

B. Contrary:

1. No women are authors. Since the given proposition is an A proposition, its contrary is an E proposition.

2. All whales are fishes. Since the given proposition is an E proposition its contrary is an A proposition.
3. No surgeons are physicians. Since the given proposition is an A proposition its contrary is an E proposition.
4. All trees are machines. Since the given proposition is an E proposition its contrary is an A proposition.

C. Subcontrary:
1. Some knives are not sharp. Since the given proposition is an I proposition its subcontrary is an O proposition.
2. Some animals are cats. Since the given proposition is an O proposition its subcontrary is an I proposition.
3. Some spiders are eight-legged creatures. Since the given proposition is an O proposition its subcontrary is an I proposition.
4. Some books are not thick. Since the given proposition is an I proposition its subcontrary is an O proposition.

D. Superaltern:
1. All games are inventions. Since the given proposition is an I proposition its superaltern is an A proposition.
2. All pilots are trained professionals. Since the given proposition is an I proposition its superaltern is an A proposition.
3. All books are thick. Since the given proposition is an I proposition its superaltern is an A proposition.
4. All boxes are heavy. Since the given proposition is an I proposition its superaltern is an A proposition.

E. Subaltern:

1. Some masks are protection devices. Since the given proposition is an A proposition its subaltern is an I proposition.
2. Some bananas are fruits. Since the given proposition is an A proposition its subaltern is an I proposition.
3. Some phones are communication devices. Since the given proposition is an A proposition its subaltern is an I proposition.
4. Some bottles are containers. Since the given proposition is an A proposition its subaltern is an I proposition.

Check Your Progress II

A.

1. E is false (by contrary)
2. I is true (by subalternation)
3. O is false (by contradiction)

B.

1. A is false (by contrary)
2. I is false (by contradiction)
3. O is true (by subalternation)

C.

1. A is undetermined
2. E is false (by contradiction)
3. O is undetermined

D.

1. A is false (by contradiction)
2. E is undetermined
3. I is undetermined

E.

1. E is undetermined
2. I is undetermined
3. O is true (by contradiction)

F.

1. A is undetermined
2. I is true (by contradiction)
3. O is undetermined

G.

1. A is false (by subalternation)
2. E is true (by contradiction)
3. O is true (by subcontrary)

H.

1. A is true (by contradiction)
2. E is false (by subalternation)
3. I is true (by subcontrary)

I.

1. False
2. True
3. True
4. Undetermined
5. True
6. Undetermined
7. False
8. True
9. Undetermined

10. False
11. True
12. False
13. Undetermined
14. Undetermined
15. True
16. False