Basic Principles of Deductive Logic

Part One:

In this section you will learn three basic aspects of logic. When you are done, you will understand the following:

Mental Act	**Verbal Expression**
Simple Apprehension	Term
Judgment	Proposition
Deductive Inference	Syllogism

A. What is Simple Apprehension?

1. Three things generally occur during simple apprehension: we perceive it with out senses, we have a mental image of it and we conceive the meaning of it.

   a. Sense perception is the act of seeing or hearing or smelling or tasting or touching.

   b. A mental image is the image of an object formed in the mind as a result of a sense perception of that object.

   c. When you develop a basic understanding of what something is, like a chair, then you have a concept.

Simple apprehension is an act by which the mind grasps the concept or general meaning of an object without affirming or denying anything about it. We can essentially treat the term "simple apprehension" as a the same as the term "concept."

Abstraction: The process by which a simple apprehension is derived from a sense perception and mental image is called *abstraction.* Through abstraction, an object such as a chair is lifted from the level of the senses to the level of the intellect.

Exercises:

1. What are the three things associated with simple apprehension?

2. Why is the sense perception of a chair different from the chair itself?

3. What is another term used for simple apprehension?

4. T F A sense perception of something we see disappears when we are no longer looking at it.

5. T F The terms **concept** and **simple apprehension** mean the same thing.

B. What is a Term?

1. A term is a word or group of words that verbally expresses a concept that is applicable to real things. The term *man*, for example, is a word that stands for a concept, that refers to real men in the world.

C. What is Judgment?

You learned that *simple apprehension,* is a mental act, and *term* is the verbal expression of simple apprehension.

Just as simple apprehension, as a mental act, has a corresponding verbal expression, so does *judgment. Judgment* is a mental act whose verbal expression is called a *proposition.*

1. Judgment can be defined as the act by which the intellect unites by affirming, or separates by denying.

a. When we say, for example, "Man is an animal," we are joining two concepts: the concept *mand and* the concept *animal.* When we say "Man is *not* God," we are separating the concept *man* from the concept *God.*

2. The two concepts that a judgment unites or separates are called the **subject** and the **predicate.** The subject is that about which we are saying something; it is the concept about which we are affirming or denying something. The predicate is what we are saying about the subject; it is what we are affirming or denying about it.

The statement, "Man is an animal," for example, expresses a judgment. In this judgment, the subject is *man.* It is the concept about which we are going to affirm or deny something. What are we going to affirm or deny about it? In this case, we are affirming that it is an animal. The concept *animal* is the predicate.

D. What is a Proposition?

1. At its most simple level, a proposition can be defined as the verbal expression of a judgment. A more proper definition of proposition, however, would be *a sentence or statement which expresses truth or falsity.*

2. Elements of the Proposition: There are three elements of any proposition:

The *subject-term*
The *predicate-term*
The *copula*

We will use **S** to describe the subject-term, **P** to describe the predicate-term, and *c* to describe the copula. The subject-term is the verbal expression of the subject of a judgment, the predicate-term is the verbal expression of the predicate of a judgment. The copula is the word in the proposition that connects or relates the subject to the predicate. The copula is usually some form of the verb *to be.* The copula is usually expressed by *is* or *are.*

Man^{S} is^{c} an animal^{P}.

But things are not always so simple. A subject can contain many words and so can the predicate. For example, we can say: The little brown-haired boy is very loud. In this sentence, the subject-term is not just *boy*, but *The little brown-haired boy*; and the predicate-term is not just *loud*, but *very loud.* The subject-term includes not only *boy but* all the words that modify *boy.* The same is true for the predicate.

3. The logical form of a sentence (basics):

The form a sentence must have in order to be handled logically is called a proposition's *logical form.*

Example: The little brown-haired boy screams very loudly.

If we look at this sentence very careful, let's ask ourselves the question, "Does this sentence have a subject-term (S), a predicate-term (P) and a copula (c) that are easily distinguished?

The little brown-haired boy is S. But what about *screams very loudly*? Which part of this is P, and which part is c? It is hard to tell. So, we need to change the wording.

The best way to change such sentences into logical form is to rework the predicate-copula portion of the proposition so that it has a form of the *to be* verb and a relative clause. For example, we can take the proposition:

The litttle-brown-haired boy screams very loudly.

and change it to:

The little brown-haired boy is **a child who** screams very loudly.

Exercises:

6. What is the definition of *judgment*?

7. In the sentence, “Man is an animal,” what two things are we separating by denying?

8. Explain what a subject is as we use it in judgment.

9. T F A proposition is the verbal expression of a judgment.

10. T F The subject and the copula are united by the predicate.

E. The Four Statements of Logic

In formal logic, there are four basic categorical propositions. They take the following form:

A: All S are P.
E: No S are P.
I: Some S are P.
O: Some S are not P.

As you can see, each of these propositions is indicated by a letter. **A** stands for the first vowel in ***affirmo***, the Latin word for affirm. That is because the A proposition , “All S are P,” affirms something about S; namely that all S are P.

E stands for the first vowel in the word ***nego***, the Latin word for *negate*, a form of the word *negative.* That is because id doesn’t say anything affirmative about S. It doesn’t say what S is. It is negative. It says something about what S is not; namely, S is not P.

I stands for the second vowel in ***affirmo***. And that is because it also affirms something about S -- not all S’s, but some. It says that some S’s are P’s.

O stands for the second vowel in the word ***nego***. It also says something negative about S -- not all S’s, but some. It says that some S’s are not P’s.

We are using letters for the subject-term and the predicate-term in these examples. Each one of these propositions is representative of statements we use in real life. Real life examples of these statements would be the following:

A: All men are mortal; All cars are fast; All boys are rude; All girls are pretty, etc.

E: No men are mortal; No cars are fast; No boys are rude; No girls are pretty.

I: Some men are mortal; Some cars are fast; Some boys are rude; Some girls are pretty, etc.

O: Some men are not mortal; Some cars are not fast; Some boys are not rude; Some girls are not pretty.

F. The Quantifier

In addition to the subject-term, the predicate-term and the copula, there is the *quantifier*. In the proposition **A**, the quantifier is **all**. In the proposition **E**, the quantifier is **No**. in the **I** proposition, the quantifier is **Some**. In the **O** proposition, the quantifier is **Some ...not**.

All propositions we will use in our study will have one of four kinds of quantifiers:

All
Some
No
Some ... not

These quantifiers tell us important things about the propositions in which they appear. They tell us what both the **quality** and **quantity** of a proposition is.

__The Quality

The quality of a proposition has to do with whether it is **affirmative** or **negative**. In other words, if I ask you the question, "What is the quality of this statement?" what I mean is, "Is it affirmative or negative?" If we ask that question of the A proposition, we would say it is affirmative. If I say, for example, "All men are mortal," I am affirming something about all men; namely that they are mortal. Similarly, if we say "Some men are mortal," we are affirming something about some men; namely that they are mortal. In both of these kinds of propositions we are affirming something about the subject-term *men.* On the other hand, we are denying something about the subject *men* in the statements "No men are mortal," or "Some men are not mortal."

The A and I statements, are said to be *affirmative.* The E and O statements, are said to be *negative*.

Again, whether a proposition is affirmative or negative is a question of ***quality***.

__The Quantity

There is another characteristic about these statements that is important for logical purposes. We cannot only ask about the quality of a proposition, but also about its *quantity.* The *quantity of* a proposition has to do with whether it is universal or particular. A proposition is universal if it says something about *all* of the members of the class referred to by the subject of the proposition. A proposition is particular if it says something about only *some* members of the class referred to by the subject of the sentence.

In other words, if I ask you the question, "What is the quantity of this statement?" what I mean is, "Is it universal or particular?" The A proposition refers to ALL members, so it is universal. The E proposition refers to ALL members, so it is *universal*. (Example: "No dogs are cats." This describes ALL dogs as being things that are not cats.) The I and O propositions refer to SOME of the members, so they are said to be *particular.*

__Distinguishing Universal Statements.

Many statements have no quantifier. In these cases, we must try to determine, without benefit of a quantifier, whether the statements are universal or particular. For example, if we say, "Frogs are ugly," we likely have in mind the idea that *all* frogs are ugly. Therefore, we could easily rewrite such a statement to say just that: "All frogs are ugly."

The general rule for statements that do not contain a quantifier is that *all* is intended, unless *some* is clearly indicated.

If, for example, we hear someone say, "Men have gone to the North Pole," we can clearly see, even though the word *some* is not expressed in the statement, that the speaker does not really mean that *all* men have gone to the North Pole. It is pretty clear that what the statement really means is, "Some men have gone to the North Pole."

There are also statements in which the subject-term indicated is an individual. When we say, for example, "Socrates is a man," we see that the subject term is *Socrates*. Is it universal or particular? Actually, it sounds rather awkward either way: "All Socrates are men" doesn't sound right. Nor does "Some Socrates are men." The statement is universal, since we wish to indicate that every person

indicated by the term Socrates is a man. In the statement, we are, of course, talking only about one individual.

Summary:

A: Affirmative - Universal
E: Negative - Universal
I: Affirmative - Particular
O: Negative - Particular

Exercises:

11. Why is “All S are P” called an A statement?

12. Why is “No S are P” called an E statement?

13. Why is “Some S are P” called an I statement?

14. Why is “Some S are not P” called an O statement?

15. With what does the quality of a proposition have to do?

16. With what does the quantity of a proposition have to do?

17. What do we mean when we say that a proposition is universal?

18. What do we mean when we say that a proposition is particular?

19. Tell which of the following statements are universal and which are particular:

Caesar is a great general.
Mary is the mother of Jesus
The soldiers are tired.
Christians pray.
Romans are cruel.

20. Tell the quality AND quantity of each proposition:

All kings are good.
No truth is simple.
Some generals are great.
Some Gauls are not brave.
All Romans are brave.

Some wars are not cruel.
No wars are peaceful.

G. Contradictory and Contrary Statements

There are two relationships categorical statements can have to one another. The first is the relationship of *opposition.* The second is the relationship of *equivalence.* There are four different kinds of opposing relationships and three different kinds of equivalent relationships. In this chapter, we will discuss the first two of the four different relationships of *opposition.*

When we use the term *opposition,* we mean the relationship that we observe in things we call *opposite.* If we say something is the opposite of another thing, we are saying the two things have a relationship of opposition. Statements that are in opposition *affirm* and *deny* the same predicate of the same subject.

There are four ways that any two of these four statements - A, E, I , and O - can be related in opposition. In other words, any one of these statements can be said to be opposite to another in any one of four different ways. They can be *contradictory* to one another; they can be *contrary* to one another; they can be *subcontrary;* and *subalternate.*

__Rule of Contradiction:

Contradictory statements are statements that differ in both quality and quantity.

• **Quantity and Quality of the Four Categorical Statements.**

		QUALITY	
		Affirmative	**Negative**
Quantity	**Universal:**	**A** **All S are P**	**E** **No S are P**
	Particular:	**I** **Some S are P**	**O** **Some S are not P**

Consider the A statement, “All S are P.” What is the quality of the A statement? Affirmative. What is the quantity of the A statement? Universal. So the quality is affirmative and the quantity is universal. Which of the other three propositions, the E, I or O statements, are contradictory to A? We know that whichever statement it

is has to differ from A in both quality and quantity. It's easy to see that it is the O proposition, because it is negative and particular. So the O proposition is said to be contradictory to the A proposition.

Let's look at the E statement, "No S Is P." What is the quality and the quantity? Negative and Universal. Which of the others is the opposite in both quality and quantity? The I statement is affirmative and particular. So I is contradictory to the E proposition.

What does this all mean?

__**First Law of Opposition:**

The First Law of Opposition: Contradictories cannot at the same time be true nor at the same time be false.

__**First Rule of Contraries**

Two statements are contrary to one another if they are both universals but differ in quality.

There is only one combination of statements that are contrary. Only two statements are universals so: A: "All S are P," and E: "No S are P" are said to be contraries. Note that while they are both universals, one is affirmative and one is negative.

__**The Second Law of Opposition:** This law applies to contraries:

Contraries cannot at the same time both be true, but they can at the same time both be false.

Example: "All men are white" and "No men are white."

Exercises:

21. Tell which of the following pairs are contradictory, which are contrary, and which (if any) are neither.

a. All logic problems are difficult
Some logic problems are difficult.

b. Some omelets are tasty
No omelets are tasty

c. Some soldiers are not brave.
All soldiers are brave

d. No houses are well-built
All houses are well-built.

e. Some men are white.
Some men are not white.

22. Explain why the A statement, “All S are P,” and the O statement, “Some S is not P are not contrary.

23. T F Two statements are contradictory if they differ from each other in quality, but are the same in quantity.

24. T F The quality of the statement “All S are P” is universal.

25. T F The quantity of the statement “Some S is P” is particular.

26. T F The A statement and the O statement differ in quality and quantity.

27. T F The statements “All S are P” and “No S is P” can both be false at the same time.

28. T F Contrary statements cannot at the same time be false, but they can both be true.