Logic 05 Reading

Section 1: Distribution of Terms

Introduction.
In the last reading, we studied the ways in which propositions are different from (or ***opposed to***) one another; in other words, how these propositions are logically different. In Section 2 of this reading, we will discuss the different ways in which they are equivalent to one another – in other words, the ways in which they are logically the same. But before we discuss in what ways statements are equivalent, we need to familiarize ourselves with what is called ***distribution***.

_____ **What is Distribution?** Distribution may be defined as follows:

Distribution is the status of a term in regard to extension.

All of the categorical statements we learned about (A, E, I, and O) have a subject. The subject of a statement is the term the statement is about. In the statement, "All S is P," *S* is the subject. In the statement, "All men are mortal," *men* is the subject.

In addition, all of the statements we learned about have a predicate. A predicate is the term we use to say something about the subject. In the statement, "All S is P," *P* is the predicate. In the statement, "All men are mortal," *mortal* is the predicate.

We will be asking whether the terms used as subject and predicate in each one of the four statements we learned are ***distributed***. When we say that a term is distributed, we mean that the term refers to all the members of the class of things denoted by the term. When we use the term *man* in a statement, for example, are we referring to it universally – in other swords, are we referring to all men? Or are we referring to it particularly – are we referring to only some men? If we ae using it universally, we say it is distributed.

When we use the term *mortal* in a statement, are we using it universally – are we reffing to all mortal things? Or are we using it particularly – are we referring only to some mortal things?

We say that a term is distributed when it us used universally – if it refers to all the members of the class denoted by the term. If it is used particularly – if it refers to only some members of the class denoted by the term, then we say it is ***undistributed***.

_____ Distribution of the Subject Term

It is fairly easy to determine whether the subject-term is distributed. The rule for determining the distribution of the subject-term:

The subject-term is distributed in statements whose quantity is universal and undistributed in statements whose quantity is particular.

Determining the distribution of the subject-term is easy because the quantifier (All, Some, No and Some … not) tells us all we need to know. If it says "All S is P," we know it refers to *all* S's. It refers to all the members of the class it denotes. If we say "All men are morta," we know it means *all* men. It refers to all the members of the class it denotes. A subject-term in an A statement, then, is taken universally, and is therefore distributed.

The same goes for the E statement. It says "No S is P." To how many members of the class denoted by S does this E statement refer? To all of them. To say "No S is P" is the same as saying "All S is not P." In other word the subject-term of the E statement is taken universally and is therefore distributed.

Likewise, when we say "Some S is P," we are obviously not referring to all S's, only some of them. And when we say "Some men are mortal," we are only referring to some men, not all of them. In both of these cases the subject-terms are undistributed.

The O statement too, "Some S is not P," obviously has a subject term that is not universal and therefore is undistributed.

In the case of the subject-term, the quantifier tells us all we need to know.

We can see how distribution works with the subject-term in this diagram:

Diagram of the Distribution of Terms in A, I, E, and O Statements

Type of Sentence	Subject-Term
A	**Distributed**
E	**Distributed**
I	**Undistributed**
O	**Undistributed**

_____ Distribution of the Predicate-Term

The rule for determining the distribution of the predicate-term is not quite as straightforward as for the subject:

In affirmative propositions the predicate-term is always taken particularly (and therefore undistributed) and in negative propositions the predicate is always taken universally (and therefore distributed).

Distribution of the Predicate-Term in A statements. When we say “All S is P,” is P taken universally? Are we talking about all P’s? To make it a little clearer, let’s take a real statement. When we say “All men are animals,” we know we are talking about all men: the sentence say so quite plainly. But are we talking about all animals? We know, if the statement is true, that all men are animals, but are all animals men? Obviously not. Although the statement is about all men, it is only about those animals who are men. We are talking about all men, but only some animals, since only some animals are men. The predicate-term is therefore taken particularly, and is therefore undistributed.

So, in A statements, the predicate-term is undistributed.

Distribution of the predicate-term in I statements: In I statements, “Some S is P,” we can also see that, not only are we talking about some S’s, but we are also only talking about some P’s. When we say, “Some dogs are vicious things,” we are only talking about some dogs, not all and some vicious things (the ones that are dogs) not all vicious things. There are other dogs that are not vicious. And there are other vicious things (wolverines, Tasmanian devils, etc.) that are not dogs.

So, in I statements, the predicate-term is undistributed.

Distribution of the Predicate-Term in E statements: As in A statements, the subject of an E statement is universal and therefore distributed. But what about the predicate? When we say “No man is a reptile,” we are talking about all men. But are we saying something about all reptiles? Can we infer from the statement that “No man is a reptile,” that “All reptiles are not men?” We certainly can. We *are* talking about all reptiles. We are talking reptiles universally, and therefore it is distributed.

Distribution in O statements: When we look at the O statement, “Some S is not P,” we see that the subject-term is not distributed (we are only talking about *some*, not *all* S’s). But what about P’s? If we said, for example, “Some men are not blind,” we know we can’t say that all men are not blind (only some of them are not blind). But these *some men* who are *not blind* – are they excluded from only part of the class of blind things or are they excluded from the entire class? The some men who are not blind are, of course, excluded from the whole class of blind things. Therefore, in the O statement, we are taking P universally. It is therefore distributed.

So, in E and O statements, the predicate is distributed, but in A and I statements the predicate is undistributed. Let’s reformulate our diagram to show the distribution of both the subject and the predicate in all four of our categorical statements:

Diagram of the Distribution of Terms in A, I, E, and O Statements

Type of Sentence	Subject-Term	Predicate-Term
A	**Distributed**	**Undistributed**
E	**Distributed**	**Distributed**
I	**Undistributed**	**Undistributed**
O	**Undistributed**	**Distributed**

Section 2: Obversion, Conversion, and Contraposition

Introduction.
In an earlier reading we said that there are two kinds of relationships among categorical propositions: relationships of opposition and relationships of equivalence.

In logic, the way we say two statements are logically the same (even though they may use slightly different words) is by calling them ***logically equivalent***. Equivalent propositions can be converted into each other in various ways.

There are three ways to convert propositions into their logical equivalents:

Obversion
Conversion
Contraposition

_____ Obversion.
To obvert a sentence, you must do two things:

1. Change the quality of the sentence
2. Negate the predicate

To change the quality is easy. If the statement is affirmative, you simply make it negative. If the statement is negative, you simply make it affirmative. But be careful. Do not change the quantity of the statement. For example, if you say, "All S is P," you change it to "No S is P." Do not change it to "Some S is not P." If you did the latter, you would be changing the quality, but you would also be changing the quantity.

Here are a few examples of how this first step works:

All S is P -----------------→ No S is P
No S is P-----------------→ All S is P

Some S is P-----------------→Some S is not P
Some S is not P-----------------→Some S is P

To negate the predicate is also easy: you simply place a ***not*** in front of it. If you say, for example, "All S is P," and, in accordance with step 1, change the quality, you get "No S is P." Negating the predicate, as step 2 requires, would yield "No S is not P."

Obversion, unlike conversion and contraposition, works on all four kinds of propositions, A, E, I, and O. In other words, if we obvert any of these four statements, we will get a statement that is logically equivalent to the original.

Once we have applied both step 1 and step 2, we end up with statements that do not look as if they mean the same thing, but they are in fact logically equivalent.

Let's look at the statements we started out with and see what they look like after both steps 1 and 2 have been applied:

All S is P -----------------→ No S is not P
No S is P-----------------→ All S is not P
Some S is P-----------------→Some S is not non-P
Some S is not P-----------------→Some S is not P

If, for example, we want to obvert "All men are mortal," we say "No men are not mortal." Logically, the mean the same thing. And if we want to obvert "No men are gods," we say "All men are not Gods." Again, they mean the same thing for the purposes of logic.

______ Double Negation of the Predicate in I statements.
Let's take a close look at the I statement. Notice that with the I statements, you get two negations in the predicate after you obvert: "Some S is P" gets turned into "Some S is not non-P." This is because, under step 1 of obversion, you changed the quality from affirmative to negative (which in a particular statements you perform by negating the predicate), and then under step 2, you negate the predicate. In other words, you end up negating the predicate twice.

You handle this in any one of four different ways: First, you can simply have two *nots* in the statements, right next to each other. Secondly, you can make the *not* directly in front of the predicate (i.e. the second *not)* a *non,* which means the same thing, but can sometimes sound better. Thirdly, you can incorporate the second negation in the predicate word itself by placing an *im,* an *un*, and *in*, or an *ir* at the beginning of the word you are using in the predicate. For example, if the original predicate was *mortal*, you could take care of the second negation by using the word *immortal*. But, be careful, since there are some words which, when *im, un, in or* *ir* are placed at the beginning of the word, are not the actual negation of the original word. Finally, you can apply the rule of double negation.

Be careful that you do not negate the predicate term by using an antonym. An antonym is a word which has a definition that is opposite of another word. For example, if the predicate-term is *large*, do not negate it by using the word *small*. The negation of the thing to which the predicate refers may not be either large or small, but somewhere in between.

_____Double Negation.
How do you apply step 2, which involves putting a *not* in front of the predicate, if there is already a *not* there? You can apply one of the first three ways of negating the predicate of an I statement, but sometimes this can sound rather awkward. For example, obverting "Some men have brown hair" to "Some men do not have non-brown hair" simply doesn't sound right.

The solution to this difficulty lies in applying the logical rule of ***double negation.***

The rule of double negation says that a term which is not negated is equivalent to a term that is negated twice (and vice-versa).

In other words, "not not P" is logically equivalent to "P." In short, they have exactly the same logical meaning.

In O statements, if we do not apply double negation, we could end up with a triple negation, "Some S is not not not P." We can get rid of two *nots* by applying double negation, yielding, "Some S is not P," which, of course, is the same statement with which you began. In regard to O statements, then it is best just to remember that the obverse of an O statement is the same as the original O statement. In other words, in practical terms it really doesn't change at all.

We do not always need to apply the rule of double nnegation, but we can. There are times when applying double negation sounds awkward. In cases such as this, we do not need to use the rule.

_____ Conversion.
Conversion is even easier than obversion, since it involves only one step. It is as follows:

Interchange the subject and predicate.

Here are the ways in which sentences are converted:

No S is P --------→ No P is S
Some S is P ----→ Some P is S

Notice that we have converted only the E statement and the I statements. That is because conversion only yields a logically equivalent statement with these two kinds of statements. Conversion, in other words, does not work with A and O statements.

We can convert “No men are gods” and get “No gods are men.” And we can convert “Some men have brown hair” and get “Some things that have brown hair are men.” In both of these cases we get a logically equivalent sentence as a result. But if we try to convert “All men ae animals,” we get “All animals ae men.” But these two statements are obviously not logically equivalent. And if we convert “Some men are not accountants,” we get “Some accountants are not men.” These are obviously not logically equivalent.

Partial Conversion of the A statement: We should add that A statements can be partially converted. If an A statement is true, it can be converted into a true I statement, but it must be done in a slightly different way.

The partial conversion a A can be accomplished by interchanging the subject and the predicate just as is ordinary conversion, but also changing the quantity. If we say “All dogs are animals,” we cannot do a normal conversion and say “All amimals are dogs.” But we can do a partial conversion resulting in “Some animals are dogs.” (See subalterns, that makes this possible.)

We need to think about this only briefly to see the sense of it. If, for example, all men are mortal, doesn’t that imply that some mortals are men? If all the members of your family are eating dinner, are not at least one of the people eating dinner members of your family?

Again, partial conversion of the A statement is done by interchanging the subject and predicate and changing the statement from universal to particular.

_____ Contraposition.

Contraposition, the third method of converting statements into their equivalents, is accomplished in three steps:

1. Obvert the statement
2. Convert the statement
3. Obvert the statement again

Only the A and O statements can be converted in this way. It is not to be used with I and E statements (E statements can be partially converted, but we will not discuss that here).

Here is an example of how to convert an A statement:

Original sentence: All men are mortal.

Step 1, Obvert:	No men are non-mortal
Step 2, Convert:	No non-mortals are men
Step 3, Obvert:	All non-mortals are non-men

As we mentioned, this can also be done with O statements. Here are the ways in which statements be contraposed:

A: All S is P ---------→ All non-P is non-S
O: Some S is not P -------→ Some non-P is S

You can …
Obvert: A, E, I, and O.
Convert: E and I (and partial on A)
Contrapose: A and O