International Catholic University

Logic

Eighth Lesson: The Principles and Varieties of Syllogism.

Introduction

In our last lecture we looked at the definitions of the syllogism and its parts. The syllogism is speech in which from two given statements, called propositions, a third, called the conclusion, follows necessarily. The propositions are made up of terms joined by a "being" verb. The conclusion follows just from the terms of those propositions.

I want to emphasize, however, that the syllogism is a tool in words thorough which the mind reasons well. Therefore, we need to know more about the syllogism than its definition: we need to know how to make and use good syllogisms. That is the purpose of this lecture: to make and use good syllogisms. We will make them by using the correct principles, and we will identify the good varieties of it. Therefore, our first task is to look at the principles of the syllogism, our second to look at its varieties.

Principles of the Syllogism

After Aristotle defines the syllogism he divides it, not into two kinds, but into degrees, into the perfect and imperfect. The difference between the perfect and imperfect does not concern necessity: the conclusion follows necessarily from

the premisses in both cases. The difference concerns how evident, how obvious, it is that the conclusion follows from the premisses. The perfect syllogism needs no other proposition than the ones given in order to make it clear that the conclusion follows. The imperfect syllogism requires that another proposition be added to make it obvious that the conclusion follows from the premisses.

For example, in the syllogism "all triangles have three sides, all three-sided figures have 180 degrees, therefore all triangles have 180 degrees" it is obvious that the conclusion follows necessarily. But I can give another syllogism, "no book is metal, all coins are metal, therefore no book is a coin," in which it is not obvious that the conclusion follows. The conclusion does follow necessarily, but it is hard to see that it does. To see that it does follow, we need to add another statement, "no metal thing is a book."

If you are alert, you will object, remembering from the definition of the syllogism that the conclusion follows from the premisses without the addition of any other premiss or term. Aristotle would reply that the added premiss is not necessary for the conclusion to follow, it is added to make it clear that the conclusion follows. The added premiss comes from the original premisses, and contributes nothing new to the terms of the argument. In our example, the added premiss, "no metal thing is a book" added no new terms, and it follows from the original premiss, "no book is metal." It merely clarifies that the conclusion follows. Still, since a syllogism is supposed to make us see that the conclusion follows, the need to clarify indicates that this syllogism is imperfect.

Aristotle next discusses the principles of the syllogism. First, he discusses the principles of all syllogisms, and second, he discusses additional principles which are helpful only for the imperfect syllogism. This is how Aristotle explains the first:

> We say that one term is predicated of all of another, whenever no instance of the subject can be found of which the other term cannot also be asserted. To be predicated of none must be understood in the same way.

Aristotle is saying that the two principles of syllogisms are the meanings of the phrases "said of all" and "said of none." We should first ask ourselves what these phrases mean, and then how they are the principles of all syllogisms.

We can best explain by giving an example. We saw before that the phrase,

"white is said of man" means that white is predicated of man. This occurs in the statement "man is white." White is said of all men when the subject "man" is used universally in the resulting statement, "all men are white." Thus, the phrase "said of all" indicates the predicate is attributed to the subject universally, and not in virtue of a part. In a parallel way, the phrase "said of none" means that the predicate is denied of the subject universally: for example, that no man is white.

Furthermore, the universal affirmation and denial are principles of every syllogism because a syllogism works only when at least one premiss is universal. It will become obvious why this is so later, when we look at the particular useful varieties of the syllogism. But it is already clear that if we do not understand what universal statements mean, or if we misunderstand what they mean, then we will necessarily misunderstand the syllogism, both perfect and imperfect.

Digression on the Order of Logical Doctrine

This leads me to an important digression on the order of Aristotle's logic. Aristotle begins his logic with a study of simple expressions, moves on to statements, and discusses discursive reasoning last in order. At first, there seems nothing odd about this proceeding, but an examination of the history of logic affords this curious observation: only Aristotle and his disciples follow this order. Other logicians, both ancient and modern, start with the logic of the third operation, and work their way back to that of the second and the first. It is very fruitful for a deeper comprehension of logic to investigate the causes of the difference.

It seems that this is the way the other logicians thought. Logic is most obviously about discursive reasoning because discursive reasoning is what most obviously needs the guidance of an art. But in order to complete the study of discursive reasoning, you need to give an account of its parts, the proposition and the term. Therefore, logic in a secondary way studies also the proposition and the term, but these only when and insofar as they are needed to illuminate discursive reasoning.

The genius of Aristotle lies in recognizing the distinction between the order in which we come to see what a science is about and the order in which the science must be studied. He gives the classic example of this in his Metaphysics. Now the Metaphysics is a philosophical book of wisdom, and

therefore Aristotle asks at the very beginning what wisdom is about. He finds that wisdom is most obviously about the First Causes of all being. Yet it is also clear that wisdom is not just about the First Causes, because it is about the First Causes as principles of all being. Therefore, wisdom must also be about being as being. And since wisdom must study everything that follows from being as being, it must also study the first statements of all knowledge, the axioms. So wisdom is about three things: most obviously it is about First Causes; less obviously it is about being as being; and least obviously it is about the axioms.

But the First Causes are the hardest things to understand, while we can only understand being as being by applying the first principles of all knowledge, the axioms, to it. That is, the most knowable things are the axioms, then being as being, and the First Causes are the least knowable to us. We come to see what wisdom is about in this order: first, the First causes; then, being as being; and finally, the axioms. But the science itself considers these subjects in the opposite order: first, it considers the axioms, then being as being, and last of all the first causes. The order in which we uncover the subject of a science is not necessarily the order in which we study the science.

The same kind of thing happens in logic. It is most obvious that logic is about discursive reasoning, but we can use this to discover that logic must also be about statements. And if it is about statements, then it must also be about the simple terms which make up statements. Thus, the order in which we uncover the subject of logic is: syllogism, statement, simple expression. But, Aristotle implicitly contends, the logic of the syllogism cannot be understood well unless the logic of the statement has been completely understood. And the logic of the statement cannot be understood without understanding the logic of the simple expression. Therefore, the order in which we study logic should be: simple term, statement, and syllogism. The order reverses in the same way as that of metaphysics.

Aristotle confirms this analysis in a passage from his Metaphysics. There he commends Socrates as the founder of logic, writing:

> Socrates was occupying himself with the excellences of character, and in connexion with them became the first to raise the problem of universal definition. . . . it was natural that Socrates should be seeking the essence, for he was seeking to syllogize, and 'what a thing is' is the starting-point of syllogisms.

We can say that Socrates was the real founder of logic. He wanted to make syllogisms about ethical matters, but he realized he could not do that unless he knew the definitions of the virtues. Thus, in trying to define the virtues he was the first to investigate the means of defining the universal term. What is clear from this passage is that Aristotle sees the logic of the first operation, which makes a definition, as being prior in the order of learning to the logic of the third operation, which makes a syllogism.

We could approach the same conclusion from another angle. Aristotle makes our understanding of the phrases "said of all" and "said of none" to be principles of understanding the syllogism. Those phrases hearken back to the universal statements, of course, but these latter cannot be understood without a prior understanding of the universal term as described in the Isogoge and the Categories. St. Albert the Great, St. Thomas' teacher, therefore concludes that everything in logic must be able to be traced back to a correct understanding of the universal term. Thus, the logic of the first operation is fundamental for a correct understanding of the later parts of logic.

A glance at what happens when the opposite approach is taken makes clear the necessity of following the proper order. Most modern logic texts begin by looking at discursive reasoning. Since their authors failed to start with the universal, they have a hard time seeing that "said of all" and "said of none" are the fundamental principles of syllogizing. Thus, their books try to account for reasoning without using those principles. They consequently reduce reasoning to a kind of accounting, an adding and subtracting of symbols. Then when they go back to consider the logic of the simple term, they always reduce the universal to a collection of individuals. Perhaps we should say this: after reducing reasoning to the manipulation of symbols, the only consistent account they can give of the universal is as a collection. "Dog" becomes, not a name which is predicable of many having the same nature, but a symbol we use to collect many things regardless of their nature. The begin with an ignorance of the universal, but they end by denying it. The lesson we can learn from them is this: to learn logic in a different order than that of Aristotle is to tend toward the corruption of logic. We might even say that Aristotle's most important contribution to the art of logic was not determining many individual logical rules, but teaching us logic in its proper order.

Return to Discussion of Principles of the Syllogism

We said that "said of all" and "said of none" are the principles of all syllogisms,

but the imperfect syllogisms need more principles in order to make their utility obvious. Those principles are the rules for the conversion of propositions, and those rules are the subject of our next discussion.

To convert a proposition is to switch the subject and the predicate of it. For example, the conversion of the proposition "no book is metal" is "no metal thing is a book." Before we look at the rules for conversion, I should explain why Aristotle discusses the conversion of propositions here, rather than in the previous book, Peri Hermeneias. There are two reasons. First, he discusses conversions here because it is a principle for seeing the imperfect syllogism, and the syllogism is the main subject of the Prior Analytics. More importantly, he discusses conversion here because you cannot discuss it before. Only propositions, which are parts of syllogisms, can be converted. Statements cannot be converted.

Remember, the proposition and statement are not the same. The proposition is the statement that is part of a syllogism. Because of this difference, the statement and the proposition are broken down into parts in different ways. The statement has the parts that are necessary to signify the true and the false, which are the noun and verb. Since the verb must always be the predicate, the parts of a statement cannot be switched or converted. The noun must always be the subject of a statement, and the verb the predicate. But the proposition is broken into three parts, two terms and the "being" word. Each term, because neither is in itself a verb, can be both a subject and a predicate. In our sample syllogism, the term "three-sided figure" is part of two propositions, and it is the subject of one and the predicate of the other. Thus, unlike the noun and verb, the two terms of a proposition can be switched. Aristotle, then, is right to discuss the rules for that switching, the rules of conversion, when he discusses the principles of the syllogism.

There are four rules for the conversion of ordinary propositions, one for each kind of proposition. The first rules is for the universal denial. If it is true that no B is A, it will also be true that no A is B. In our example above, if no book is metal, then no metal thing is a book.

The second rule concerns the universal affirmation. If every B is A, then by conversion some A is B. For example, if every man is an animal, then some animals are men. Notice that the universal affirmation only converts to a particular affirmation, not to another universal affirmation. That this is so is clear through our example: since all men are animals, it is clear that some animals

must also be men, but we also know that not all animals are men.

The third rule is the conversion of the particular affirmation: if some B is A, then some A is B. For example, if some men are tan, then some tan things are men.

The last rule concerns the particular denial: the particular denial does not convert. If the particular denial converted, it would convert into another particular denial. Yet in fact, there are many cases in which the original particular denial is true, yet the attempted conversion into another particular denial is false. For example, it is true that some animals are not men, but it is not true that some men are not animals. In sum, the universal denial converts into a universal denial, the universal affirmation converts into a particular affirmation, as does the particular affirmation, but the particular denial cannot be converted. The rules are summarized in the charts which accompany this lesson.

The phrases, "said of all" and "said of none," and the rules of conversion are all the principles of the syllogism. Thus, we are ready to look at the varieties of syllogisms. Aristotle first discusses the perfect syllogisms, and then the imperfect ones. Aristotle identifies four perfect syllogisms, which the scholastics call the four moods of the perfect syllogism. First we are going to look at the process that Aristotle uses to discover those perfect syllogisms, then we are going to look at the results of that process, and finally we are going to find and label the parts of the resulting syllogisms.

Varieties of the Syllogism

Every syllogism is made of two propositions and will produce one main conclusion. Those two propositions come in four varieties, the four kinds of propositions. Therefore, there are going to be sixteen possibilities for perfect syllogisms. Aristotle goes through all sixteen, and finds that only four are syllogisms, that is, that only four combinations of premises directly result in necessary conclusions.

He shows that these four work by relating them back to the principles of the syllogism, the "said of all" and "said of none." He shows that the other twelve do not work by showing that the truth of both premises is compatible with the truth of contradictory conclusions. Since a syllogism which could have contradictory conclusions would be useless, it follows that these are bad syllogisms, or rather, that they are not syllogisms at all.

Let us look at two examples, one of a good syllogism, the other of a bad one. Aristotle writes:

> If A is predicated of all B, and B of all C, A must be predicated of all C: we have already explained what we mean by predicated of all.

That is, when we are given the first proposition, A is said of all B, we know that this means that A belongs to everything that B belongs to. But the next proposition tells us that B belongs to every C. Therefore, by the meaning of the phrase "said of all," it is obvious that A also belongs to every C. For example, if every three-sided figure has 180 degrees, and every triangle has three sides, then just by the meaning of "said of all" it is clear that every triangle has 180 degrees. This is a concrete example of a perfect syllogism.

On the other hand, Aristotle gives the follow example of a combination of premisses which does not yield a syllogism, or what later logicians will call an invalid syllogism. Aristotle writes:

> If the first term belongs to the middle, but the middle to none of the last, there will be no syllogism between the extremes. . . . As an example of a universal affirmative relation, between the extremes we may take the terms animal, man, and horse; of the universal negative relation, the terms animal, man, stone.

That is, nothing necessarily follows if the attempted syllogism has the following premisses: every B is A and no C is B. That is because, granted that the premisses are true, it is possible for opposite conclusions to be true. Take Aristotle's example: the two premisses no stone is a man and every man is an animal are true and compatible with a universally negative conclusion, no stone is an animal. Yet if we use just one different term, but the same kind of premisses, they are true and yet compatible with the truth of a conclusion which has the contrary character: no horse is a man, and every man is an animal, but it is not true that no horse is an animal. On the contrary, every horse is an animal. Thus, this possible arrangement of premisses does not yield a true syllogism, one in which some definite kind of conclusion necessarily follows.

Syllogisms of the First Figure				
BARBARA			**CELARENT**	
A	Every B is A.	E	No B is A.	
A	Every C is B.	A	Every C is B.	
A	Therefore, every C is A.	E	Therefore, no C is A.	
DARII			**FERIO**	
A	Every B is A.	E	No B is A.	
I	Some C is B.	I	Some C is B.	
I	Therefore, some C is A.	O	Therefore, some C is not A.	

Chart 5

We are going to skip the rest of the details. The results of Aristotle's inquiry is summarized in Chart #5. Notice that each mood of the perfect syllogism has been given a name. This name is a mnemonic device invented by the medieval logicians which identifies the premisses and conclusion of each mood. With this chart we are going to do two things: we will label the parts and structure of the perfect syllogisms and we will explain the mnemonic devices.

Every three-sided figure has angles equal to 180 degrees.
Every triangle is a three-sided figure.
Therefore, every triangle has angles equal to 180 degrees.

No book is metal.
Every coin is metal.
Therefore, no book is a coin.

Chart 4

Take the first mood, **Barbara**. It has two propositions, one conclusion, but only three terms. Each term is used twice. The term that is used in both premisses, B, is called the middle term. It is also the case that the middle term is the subject in one premiss, the predicate in the other. The term which is predicated of the middle term, C, is called the major term because what is predicated has

more the nature of the universal than what is subject. And major means greater, more universal. The term which the middle is predicated of, C, is therefore called the minor term, the lesser term. In the conclusion, the major term A is always predicated of the minor term C. The proposition with the major term in it is called the major premiss, and that with the minor term in it is called the minor premiss. In the example given in Chart #4, the middle term is "three-sided figure," the major term "has 180 degrees," the minor term "triangle." The major premiss is "every three-sided figure has 180 degrees," the minor premiss "every triangle is three-sided."

The names of the syllogisms work as follows: each vowel represents the quantity and quality of a proposition, the first vowel standing for the major premiss, the second vowel for the minor premiss, and the third vowel for the conclusion. The vowels are assigned as we assigned them before in our discussion of statements. Thus, A is the universal affirmation, E the universal denial, I the particular affirmation, and O the particular denial. The first consonant is taken alphabetically, skipping vowels: the first mood begins with B, the second with C the third with D, and the fourth with F. For example, **Barbara** is a syllogism in which both premisses and also the conclusion are universal affirmations. In **Ferio**, on the other hand, the major premiss is a universal denial, the minor premiss is a particular affirmation, and the conclusion is a particular denial. The other names work in the same way.

One more thing to remember about the perfect syllogism: the middle term, B, is the predicate in one proposition, and the subject in another. Aristotle calls the position of the middle term the "figure" of the syllogism. He calls the perfect syllogisms first figure syllogisms because the middle term is always subject of the major term, and predicate of the minor term in perfect syllogisms. In the imperfect syllogisms the middle term will have a different position. In fact, the reason that the other syllogisms are imperfect is that the middle term has a different positions in them.

Three Figures of Aristotle's Syllogisms
(based upon the position of the middle term in the premisses)

First Figure:
B is [not] A
C is [not] B

Second Figure:
A is [not] B.
C is [not] B.

Third Figure:
B is [not] A.
B is [not] C.

Chart 6

Aristotle divides the imperfect syllogisms into two figures, and so we have a total of three figures for the syllogism, as seen on Chart #6. In the first figure, the middle term is subject in one premiss, predicate in the other. In the second figure, the middle term is predicate in both premisses. In the third figure, the middle term is the subject in both premisses. These are all of the possible figures, and Aristotle finds that there are four valid moods in the first figure, four in the second, and six in the third, making a total of fourteen valid syllogisms.

FIRST FIGURE

1. Barbara	2. Celarent
Every B is A Every C is B Every C is A	No B is A Every C is B No C is A
3. Darii	**4. Ferio**
Every B is A Some C is B Some C is A	No B is A Some C is B Some C is not A

SECOND FIGURE

Cesare	Camestres
No A is B Every C is B No C is A	Every A is B No C is B No C is A
Festino	**Baroco**
No A is B Some C is B Some C is not A	Every A is B Some C is not B Some C is not A

THIRD FIGURE

Darapti	Felapton
Every B is A Every B is C Some C is A	No B is A Every B is C Some C is not A
Disamis	**Datisi**
Some B is A Every B is C Some C is A	Every B is A Some B is C Some C is A
Bocardo	**Ferison**
Some B is not A Every B is C Some C is not A	No B is A Some B is C Some C is not A

Chart 7

We are going to skip the details of these moods, which are given in Chart #7. I want to finish today's discussion with two topics: the way in which Aristotle sorts out the good from the bad in the imperfect syllogisms; and the way we can use

the mnemonic devices of the names in the second and third figures.

In the first figure, he showed that certain syllogisms do work by appealing to the principles "said of all" and "said of none." He cannot do that with the second and third figures, because they are imperfect. Those principles are necessary, but not sufficient, for them. So he uses the other principles, the rules for conversion, to show that the good syllogisms in the second and third figures work. That is, he most often shows that second and third figure syllogisms work by converting one or more of their propositions to show that they are equivalent to syllogisms in the first figure.

The syllogism called **Celarent** is in the first figure. An example of it would be "no metal thing is a book, all coins are metal, therefore, no coin is a book." Now the syllogism called **Cesare** is in the second figure. And example of it would be "no books is metal, all coins are metal, therefore no coin is a book," which is the example given in Chart #4. The difference between the two syllogisms is in one proposition, "no metal thing is a book" as compared to "no book is metal." But by the rules of conversion we know that the second proposition is equivalent to the first: "no book is metal" converts into "no metal thing is a book." Thus, the second figure **Cesare** is shown to be a syllogism by making it equivalent to, or reducing it to, the first figure **Celarent**. The accompanying charts go over the reductions of all imperfect syllogisms in detail.

A couple of syllogisms cannot be reduced to the first figure by conversion. They are reduced, however, by a process called "reduction by contradiction." That is, Aristotle shows that two syllogisms, one each in the second and third figure, must work because, if they do not, one in the first figure, **Barbara**, would then also not work. We are going to examine **Baroco**, a syllogism of the second figure.

If "every A is B" is true, and "some C is not B" is true, then it is necessary that "some C is not A." For, if that conclusion did not follow, then sometimes its contradictory, "all C is A," would be true. Suppose that this happened once. Then, it would be true that "all C is A," and it would also be true that "all A is B." From these, by **Barbara**, it would follow that "all C is B." That cannot happen, since we are given that it is true that "some C is not B," which is the contradictory of "all C is B." Thus, the conclusion "some C is not A" must follow.

We do not want to worry about memorizing all the details. For our purposes it is enough to be able to work these problem when we need to. That is what the

mnemonic devices, the names, help us to do. They show us how second and third figure syllogisms are in some way reduced to those of the first figure. Thus, if we know the first figure, and we know how to reduce other syllogisms, then we are in the position to evaluate every proposed syllogism in the way that Aristotle did. The charts which accompany this lesson explain the details of the system.

Conclusion

That concludes our discussion of the intricacies of the syllogism. The syllogism is the main subject of the first part of the judging part of logic, so we are now ready to move on to the second part of judging logic, a consideration of the demonstrative syllogism.

Chart of the Three Figures of the Syllogism

FIRST FIGURE	
1. Barbara Every B is A Every C is B Every C is A	2. Celarent No B is A Every C is B No C is A
3. Darii Every B is A Some C is B Some C is A	4. Ferio No B is A Some C is B Some C is not A

SECOND FIGURE	
Cesare No A is B Every C is B No C is A	Camestres Every A is B No C is B No C is A
Festino No A is B Some C is B Some C is not A	Baroco Every A is B Some C is not B Some C is not A

THIRD FIGURE	

Darapti Every B is A Every B is C Some C is A	Felapton No B is A Every B is C Some C is not A
Disamis Some B is A Every B is C Some C is A	Datisi Every B is A Some B is C Some C is A
Bocardo Some B is not A Every B is C Some C is not A	Ferison No B is A Some B is C Some C is not A

Reducing imperfect syllogisms to perfect syllogisms.

The following is a chart which explains how the names of the imperfect syllogisms can help us reduce them to perfect syllogisms. Each letter in a name has the following meaning:

B = syllogism reduces to Barbara.
C = (if the first letter) syllogism reduces to Celarent.
D = syllogism reduces to Darii.
F = syllogism reduces to Ferio.
s or p = the preceding premiss is converted.
m = the order of premisses is reversed.
c = (if not the first letter) syllogism reduces by contradiction.

Examples of reductions:

I.
Cesare
No car is wooden. [No A is B.]
Every wagon is wooden. [Every C is B.]
Therefore, no wagon is a car. [Therefore, no C is A.]

C = reduce to Celarent, s = convert the premiss before it (in this case the major premiss, "No car is wooden," is converted into "No wooden thing is a car").

Celarent
Thus, no wooden thing is a car. [No B is A.]
Every wagon is wooden. [Every C is B.]
Therefore, not wagon is a car. [Therefore, no C is A.]

II.
Disamis.
Some cars are metal. [Some B is A.]
Every car is a vehicle. [Every B is C.]
Therefore, some vehicle is metal. [Some C is A.]

D = reduce to Darii, the first s = convert the previous premiss ("Some cars are metal" becomes "Some metal things are cars"), m= switch the premisses, the second s = convert the conclusion ("some vehicle is metal" becomes "some metal thing is a vehicle")

Darii
Every car is a vehicle. [Every B is A.]
Some metal things are cars. [Some C is B.]
Therefore, some metal thing is a vehicle. [Some C is A.]
III. Reduction by contradiction. The form of argument is reduction to the absurd. Reduction to the absurd is the form of argument which shows that something is true by arguing that its denial leads to an absurdity. If we want to show by reduction by contradiction that a proposed syllogism is valid, we assume that it is invalid and show that this assumption leads to an absurdity. That is, we assume that the premisses of the syllogism are true, and yet the contradictory of the conclusion is true. This leads to an absurdity through a Barbara syllogism.

Baroco
Every A is B.
Some C is not B.
Therefore, some C is not A.

Suppose that this conclusion did not follow. Then it would be possible that:

Every A is B.
Some C is not B.
And every C is yet A. (This is the contradictory of "Some C is not A.")

But if:

Every A is B.
And every C is A.
Then it follows by Barbara that every C is B. But then we have an absurdity because contradictory statements are both true, namely, every C is B (as

concluded here) and Some C is not B (which is one of the premisses in the original syllogism). Thus, assuming the contradictory of the conclusion leads to an absurdity. Therefore, the original conclusion follows necessarily from the premisses of Baroco. The syllogism Baroco must be valid.

Exercises

Exercise 1: Identify the parts of the following syllogisms, the conclusion and premisses, the middle, major, and minor terms, and the major and minor premisses. (Note: although the chart always places the major premiss first, in real syllogisms it often is placed second.)

Every self-mover determines its own motion.
Every animal is a self-mover.
Therefore, every animal determines its own motion.

Every induction is a tool of discursive reasoning.
Every tool of discursive reasoning has a likeness to the syllogism.
Therefore, every induction has a likeness to a syllogism.

No symbol is used in Aristotelian logic.
Every symbol is a sign.
Therefore, some signs are not used in Aristotelian logic.

Exercise 2: Assign the proper conclusion to the following syllogisms. If no conclusion can be drawn, mark the syllogism as invalid. Then state the figure and mood of the syllogism.

1. No first movers are self-movers.
   But every animal is a self-mover.

2. Every quadrilateral has angles equaling 360 degrees.
   Every square, however, is a quadrilateral.

3. No self-movers are first movers.
   But every animal is a self-mover.

4. Every science is both syllogistic and certain.

5. Every virtue is honorable, and some virtues are also good qualities of intellect.

Exercise 3: Reduce every imperfect syllogism to a perfect one.