6.5 Rules for Evaluating Syllogisms

Comment: Venn Diagrams provide a clear semantics for categorical statements that yields a method for determining validity. Prior to their discovery, categorical syllogisms were evaluated by a set of rules, some of which are more or less semantic in character, others of which are entirely syntactic. We will study those rules in this section.

Rule 1: A valid standard form categorical syllogism must contain exactly three terms, and each term must be used with the same meaning throughout the argument.

Comment: A *fallacy of equivocation* occurs if a term is used with more than one meaning in a categorical syllogism, e.g.,

> Some good speakers are woofers. All politicians are good speakers. So, some politicians are woofers.
>
> In the first premise, “speakers” refers to an electronic device. In the second, it refers to a subclass of human beings.

Definition (sorta): A term is *distributed* in a statement if the statement “says something” about every member of the class that the term denotes. A term is *undistributed* in a statement if it is not distributed in it.

Comment: To say that a statement “says something” about every member of a class is to say that, if you know the statement is true, you can legitimately infer something nontrivial about any arbitrary member of the class.

*The subject term (but not the predicate term) is distributed in an **A** statement.*

Example 1

All dogs are mammals says of each dog that it is a mammal. It does not say anything about all mammals.

Comment: Thus, if I know that "All dogs are mammals" is true, then if I am told that Fido is a dog, I can legitimately infer that Fido is a mammal. If, however, someone simply tells me that Fido is a mammal, I can legitimately infer nothing at all about Fido (other than trivial information such as that either Fido is a dog or Fido is not a dog).

*Both terms are distributed in an **E** statement.*

Example 2

No birds are mammals says of each bird that it is not a mammal, and of each mammal that it is not a bird.

*Neither term is distributed in an **I** statement.*

Example 3

Some politicians are prevaricators does not say anything about *every* politician or about *every* prevaricator. If I am told that George is a politician, I cannot legitimately infer that George is a prevaricator, and vice versa.

*The predicate term is distributed in **O** statements.*

Example 4

Some computers are not laptops says that *every* laptop is distinct from at least one computer.

Summary of distribution

Letter Name	*Form*	*Terms Distributed*
A	All S are P.	S
E	No S are P.	S and P
I	Some S are P.	None
O	Some S are not P.	P

Rule 2: In a valid, standard form categorical syllogism, the middle term must be distributed in at least one premise.

Example 4

The syllogism

> Some politicians are not Americans. All Texas senators are politicians. Therefore, some Texas senators are not Americans.

violates Rule 2.

A violation of Rule 2 is called a *fallacy of the undistributed middle.*

Comment: Why is Rule 2 effective? The middle term serves as the logical "link" between the minor term and the major term in a categorical syllogism. If the middle term is undistributed in both premises, then neither premise says anything about *all* the members of the class C denoted by the middle term, and hence the possibility arises that the minor term relates to one part of C and the major term a different part — the result being that there is no guaranteed logical link between the two.

Rule 3: In a valid, standard form categorical syllogism, a term must be distributed in the premise in which it occurs if it is distributed in the conclusion.

Example 5

The following syllogism violates Rule 3:

> Some animals are not birds. All robins are birds. Therefore, some robins are not animals.

In this syllogism, the major term is distributed in the conclusion but not the major premise. This is called the *fallacy of the illicit major.*

Example 6

The following syllogism also violates Rule 3:

> All politicians are prevaricators. All politicians are wealthy persons. Hence, all wealthy persons are prevaricators.

In this syllogism, the minor term is distributed in the conclusion but not the minor premise. This is called the *fallacy of the illicit minor.*

Comment: Why is Rule 3 effective? If a term is distributed in the conclusion, then the conclusion says something about all the members of the class C that it denotes. So it the same term is not distributed in the premise in which it occurs (and hence does not say something about *all* the members of C), then the conclusion contains more information than the premises, and so the argument will be invalid.

Rule 4: In a valid, standard form categorical syllogism, the number of negative premises must be equal to the number of negative conclusions.

Comment: Since there is only one conclusion in a syllogism, this rule in effect says that if the conclusion is negative, there must be exactly one negative premise, and if the conclusion is affirmative there must be no negative premises.

Example 7

The following syllogisms violate Rule 4:

> No dogs are cats. Some cats are not collies. Therefore, some collies are not dogs.
>
> No tigers are wolves. Some felines are tigers. So, some felines are wolves.
>
> All collies are dogs. Some animals are collies. Hence, some dogs are not animals.

Comment: Rules 1-4 are complete for the "Aristotelian" logic that held sway until the 19th century — they categorize all and only the syllogisms that are valid from the Aristotelian perspective. This perspective adds the assumption that all terms signify nonempty classes, an assumption that modern logicians do not wish to make, as the question of whether or not a given class is empty is not a logical matter but an empirical one, one to be decided by observation. Hence, modern logicians add one more rule, which, together with the four above, yield a complete set of rules for determining the syllogisms that are valid according to modern logic.

Rule 5: No valid, standard form categorical syllogism with a particular conclusion can have two universal premises.

Example 8

Here is a syllogism that is valid according to Rules 1-4, but which becomes invalid when we add Rule 5:

> No humans are morally perfect beings. All 150 year old men are human. So, some 150 year old men are not morally perfect beings. (*Hence, there exists at least one 150 year old man!!*)