4.10: Categorical Syllogisms

Categorical Syllogisms

Now, on to the next level, at which we combine more than one categorical proposition to fashion logical arguments. A categorical syllogism is an argument consisting of exactly three categorical propositions (two premises and a conclusion) in which there appear a total of exactly three categorical terms, each of which is used exactly twice.

One of those terms must be used as the subject term of the conclusion of the syllogism, and we call it the minor term of the syllogism as a whole. The major term of the syllogism is whatever is employed as the predicate term of its conclusion. The third term in the syllogism doesn’t occur in the conclusion at all, but must be employed in somewhere in each of its premises; hence, we call it the middle term.

Since one of the premises of the syllogism must be a categorical proposition that affirms some relation between its middle and major terms, we call that the major premise of the syllogism. The other premise, which links the middle and minor terms, we call the minor premise.

Consider, for example, the categorical syllogism:

- No geese are felines.
- Some birds are geese.
- Therefore, Some birds are not felines.

Clearly, “Some birds are not felines” is the conclusion of this syllogism. The major term of the syllogism is “felines” (the predicate term of its conclusion), so “No geese are felines” (the premise in which “felines” appears) is its major premise.
Similarly, the minor term of the syllogism is “birds,” and “Some birds are geese” is its minor premise. “geese” is the middle term of the syllogism.

**Home** Standard Form

In order to make obvious the similarities of structure shared by different syllogisms, we will always present each of them in the same fashion. A categorical syllogism in **standard form** always begins with the premises, major first and then minor, and then finishes with the conclusion. Thus, the example above is already in standard form. Although arguments in ordinary language may be offered in a different arrangement, it is never difficult to restate them in standard form. Once we’ve identified the conclusion which is to be placed in the final position, whichever premise contains its predicate term must be the major premise that should be stated first.

Medieval logicians devised a simple way of labelling the various forms in which a categorical syllogism may occur by stating its **mood and figure**. The mood of a syllogism is simply a statement of which categorical propositions (A, E, I, or O) it comprises, listed in the order in which they appear in standard form. Thus, a syllogism with a mood of OAO has an O proposition as its major premise, an A proposition as its minor premise, and another O proposition as its conclusion; and EIO syllogism has an E major premise, and I minor premise, and an O conclusion; etc.

**Home** Since there are four distinct versions of each syllogistic mood, however, we need to supplement this labelling system with a statement of the **figure** of each, which is solely determined by the position in which its middle term appears in the two premises: in a first-figure syllogism, the middle term is the subject term of the major premise and the predicate term of the minor premise; in second figure, the middle term is the predicate term of both premises; in third, the subject term of both premises; and in fourth figure, the middle term appears as the predicate term of the major premise and the subject term of the minor premise. (The four figures may be easier to remember as a simple chart showing the position of the terms in each of the premises:

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<table>
<thead>
<tr>
<th>M</th>
<th>P</th>
<th>P</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>S</td>
<td>M</td>
<td>S</td>
<td>M</td>
</tr>
<tr>
<td>M</td>
<td>S</td>
<td>M</td>
<td>S</td>
</tr>
</tbody>
</table>
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All told, there are exactly 256 distinct forms of categorical syllogism: four kinds of major premise multiplied by four kinds of minor premise multiplied by four kinds of conclusion multiplied by four relative positions of the middle term. Used together, mood and figure provide a unique way of describing the logical structure of each of them. Thus, for example, the argument “Some merchants are pirates, and All merchants are swimmers, so Some swimmers are pirates” is an **IAI-3** syllogism, and any **AEE-4** syllogism must exhibit the form “All P are M, and No M are S, so No S are P.”

**Home** Form and Validity

This method of differentiating syllogisms is significant because the validity of a categorical syllogism depends solely upon its **logical form**. Remember our earlier definition: an argument is **valid** when, if its premises were true, then its conclusion would also have to be true. The application of this definition in no way depends upon the content of a specific categorical syllogism; it makes no difference whether the categorical terms it employs are “mammals,” “terriers,” and “dogs” or “sheep,” “commuters,” and “sandwiches.” If a syllogism is valid, it is impossible for its premises to be true while its conclusion is false, and that can be the case only if there is something faulty in its general form.

Thus, the specific syllogisms that share any one of the 256 distinct syllogistic forms must either all be valid or all be
invalid, no matter what their content happens to be. Every syllogism of the form $\text{AAA-1}$ is valid, for example, while all syllogisms of the form $\text{OEE-3}$ are invalid.

This suggests a fairly straightforward method of demonstrating the invalidity of any syllogism by “logical analogy.” If we can think of another syllogism which has the same mood and figure but whose terms obviously make both premises true and the conclusion false, then it is evident that all syllogisms of this form, including the one with which we began, must be invalid.

Thus, for example, it may be difficult at first glance to assess the validity of the argument:

All philosophers are professors.
All philosophers are logicians.
Therefore, All logicians are professors.

But since this is a categorical syllogism whose mood and figure are $\text{AAA-3}$, and since all syllogisms of the same form are equally valid or invalid, its reliability must be the same as that of the $\text{AAA-3}$ syllogism:

All terriers are dogs.
All terriers are mammals.
Therefore, All mammals are dogs.

Both premises of this syllogism are true, while its conclusion is false, so it is clearly invalid. But then all syllogisms of the $\text{AAA-3}$ form, including the one about logicians and professors, must also be invalid.

This method of demonstrating the invalidity of categorical syllogisms is useful in many contexts; even those who have not had the benefit of specialized training in formal logic will often acknowledge the force of a logical analogy. The only problem is that the success of the method depends upon our ability to invent appropriate cases, syllogisms of the same form that obviously have true premises and a false conclusion. If I have tried for an hour to discover such a case, then either there can be no such case because the syllogism is valid or I simply haven’t looked hard enough yet.

**Diagramming Syllogisms**

The modern interpretation offers a more efficient method of evaluating the validity of categorical syllogisms. By combining the drawings of individual propositions, we can use Venn diagrams to assess the validity of categorical syllogisms by following a simple three-step procedure:

1. First draw three overlapping circles and label them to represent the major, minor, and middle terms of the syllogism.
2. Next, on this framework, draw the diagrams of both of the syllogism’s premises.
   - Always begin with a universal proposition, no matter whether it is the major or the minor premise.
   - Remember that in each case you will be using only two of the circles in each case; ignore the third circle by making sure that your drawing (shading or $\times$) straddles it.
3. Finally, without drawing anything else, look for the drawing of the conclusion. If the syllogism is valid, then that drawing will already be done.

Since it perfectly models the relationships between classes that are at work in categorical logic, this procedure always
provides a demonstration of the validity or invalidity of any categorical syllogism.

Consider, for example, how it could be applied, step by step, to an evaluation of a syllogism of the EIO-3 mood and figure,

\[
\text{No M are P.} \\
\text{Some M are S.} \\
\text{Therefore, Some S are not P.}
\]

First, we draw and label the three overlapping circles needed to represent all three terms included in the categorical syllogism:

Second, we diagram each of the premises:

Since the major premise is a universal proposition, we may begin
with it. The diagram for "No M are P" must shade in the entire area in
which the M and P circles overlap. (Notice that we ignore the S circle
by shading on both sides of it.)

Now we add the minor premise to our
drawing. The diagram for "Some M are S"
puts an × inside the area where the M and
S circles overlap. But part of that area (the
portion also inside the P circle) has already
been shaded, so our × must be placed in
the remaining portion.

Third, we stop drawing and merely look at our result. Ignoring the M circle entirely, we need only ask whether the
drawing of the conclusion "Some S are not P" has already been drawn.

Remember, that drawing would be like the one at left, in which there is an × in the area inside
the S circle but outside the P circle. Does that already appear in the diagram on the right
above? Yes, if the premises have been drawn, then the conclusion is already drawn.

But this models a significant logical feature of the syllogism itself: if its premises are true, then
its conclusion must also be true. Any categorical syllogism of this form is valid.

Here are the diagrams of several other syllogistic forms. In each case, both of the premises have already been drawn in
the appropriate way, so if the drawing of the conclusion is already drawn, the syllogism must be valid, and if it is not, the
syllogism must be invalid.

**AAA-1 (valid)**

\[
\text{All M are P.} \\
\text{All S are M.} \\
\text{Therefore, All S are P.}
\]
AAA-3 (invalid)

All M are P.
All M are S.
Therefore, All S are P.

OAO-3 (valid)

Some M are not P.
All M are S.
Therefore, Some S are not P.

EOO-2 (invalid)

No P are M.
Some S are not M.
Therefore, Some S are not P.

IOO-1 (invalid)

Some M are P.
Some S are not M.
Therefore, Some S are not P.

Practice your skills in using Venn Diagrams to test the validity of Categorical Syllogisms by using Ron Blatt’s excellent Syllogism Evaluator.

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