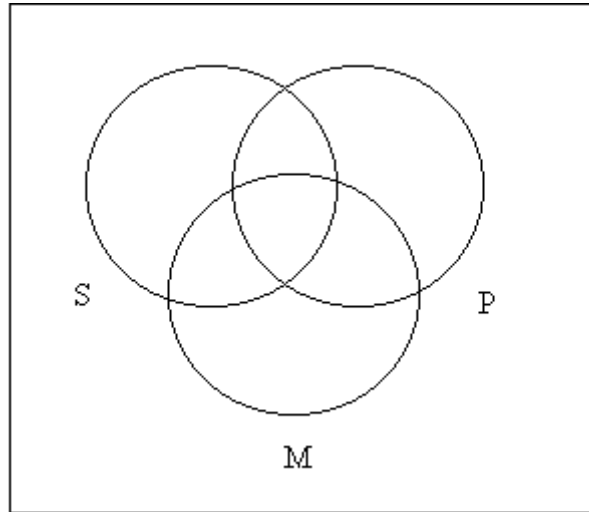# Venn Diagrams of Arguments

Venn diagrams can be used to test syllogistic forms for validity or invalidity. An argument form is valid if and only if it has no substitution instances with true premises and a false conclusion. Otherwise it is invalid.

To construct a Venn diagram for a categorical syllogistic form, we need three interlocking circles, as below.


The top left circle represents the minor term of the syllogism. The top right circle represents the major term of the syllogism. The bottom circle represents the middle term of the syllogism.

To check a syllogistic form for validity, we diagram each of the premises. If the argument form is valid, in diagramming the premises, we will have already diagrammed the conclusion. We can also check for validity by seeing if it would be possible, having diagrammed the premises, to diagram the contradictory of the conclusion. If it is impossible to diagram the contradictory of the conclusion, the argument form is valid.

Let's use AAA-1 as our first example. The schema is

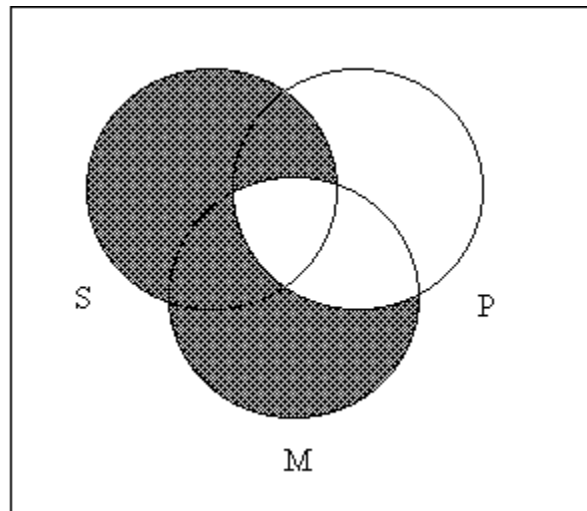<p style="text-align:center">All M are P.
<u>All S are M.</u>
All S are P.</p>

Diagramming the major premise gives us
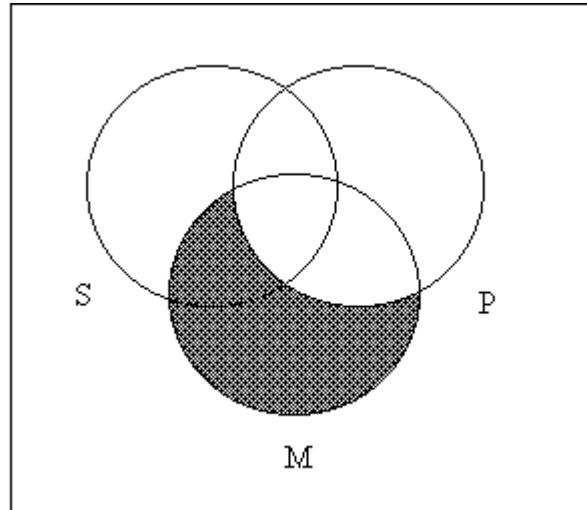
In diagramming "All M are P," we ignore the S circle, shading out all the M circle that does not overlap with the P circle.

We next add the minor premise to the diagram.

In diagramming the minor premise, we carefully ignore the P circle, shading our all the S that is not included in the M.

Now check to see if the conclusion has been diagrammed in the process of diagramming the premises. The conclusion, "All S are P," requires that the portions of the S circle that are not within the P circle be shaded. Indeed they are, so the schema AAA-1 is valid.
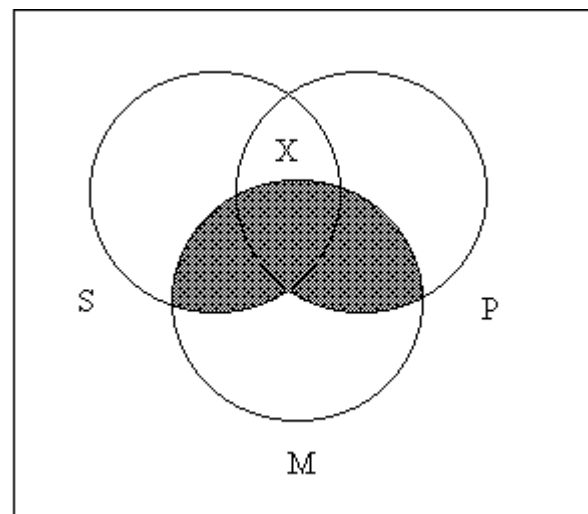
The next example is an EEE-3. The schema is

> No M are P.
> No M are S.
> No S are P.

The diagram is
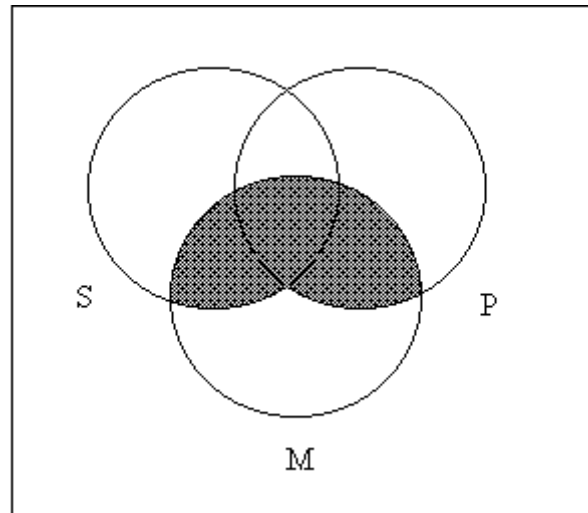
If this were a valid argument schema, the entire lens between the S and P circles would be shaded out. The top portion, however, is not shaded. The form is invalid. The other test is whether the contradictory of the conclusion could be diagrammed. The contradictory of "No S are P" is "Some S are P." That could be diagrammed as below.


The premises in the examples we have used so far have all been universal. We now need to look at some special cases that arise with schemata containing particular premises.

The next example is IAI-4. The schema is

Some P are M.
All M are S.
Some S are P.

Above, we diagrammed the major premise first. However, whenever you have a universal and a particular premise, it is easier to diagram the universal before the particular. Diagramming the minor premise, "All M are S," gives
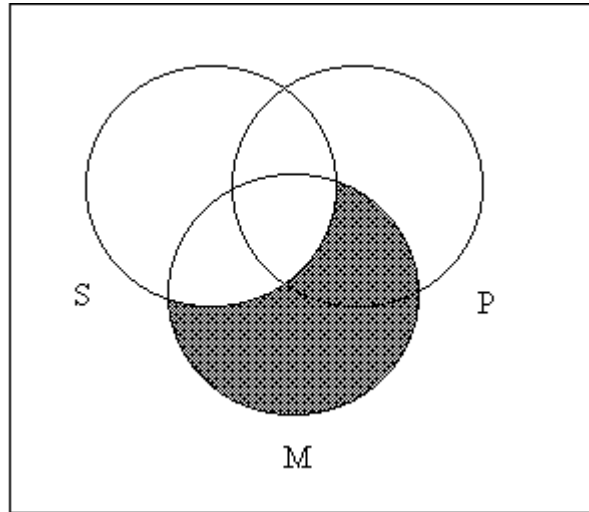
The major premise, "Some P are M," requires an X in the lens between the P and M circles. Having first diagrammed the universal premise, we see that the X must go in the left portion of that lens, as below.
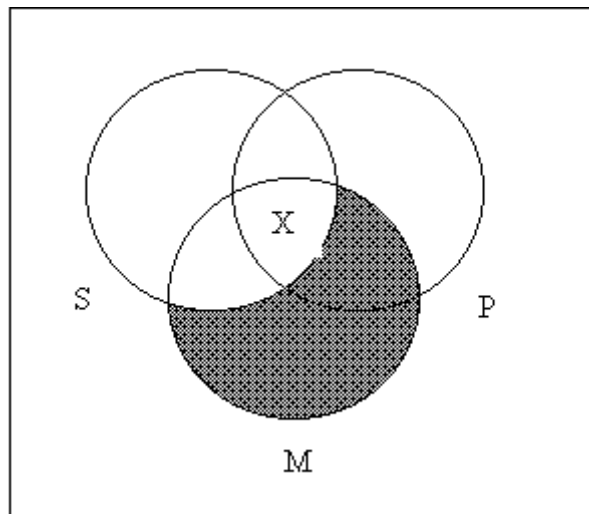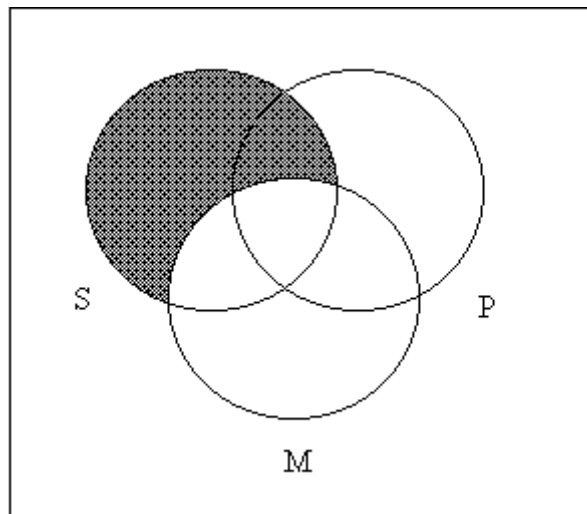

The conclusion, "Some S are P," has been diagrammed in the process of

diagramming the conclusion. The schema is valid.

In some cases, the placing of the X for a particular premise is not clearly determined. This is the case for the IAI-2.

<div style="text-align:center">

Some P are M.
All S are M.
Some S are P.

</div>

Diagramming only the minor premise, we have

When we try to diagram the major premise, "Some P are M," we find two different locations where the X could be placed. It could go in the upper left portion of the lens, where it would be an S as well as a PM, or it could go in the lower right portion, where it would be a PM that was non-S. When the position of the X is undetermined, as it is here, the X goes on the line.
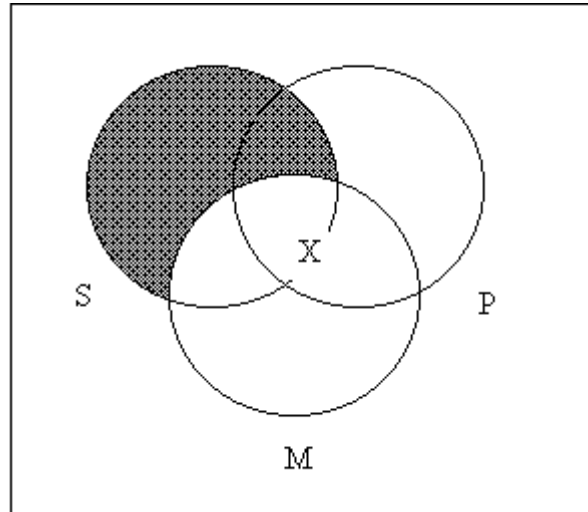
The X is on the line because it could be either an SPM or a non-SPM. It
position indicates that though the premises be true, the conclusion could be
either true or false. The argument is invalid.

Exercise 13.1

Use Venn diagrams to determine the validity or invalidity of the following syllogistic
schemata.

1. AAA-2	2. EAE-3
3. IEO-4	4. EAA-4
5. OAI-3	6. OAO-3
7. EIA-2	8. EIO-2
9. AAI-1	10. AEO-1
11. AEE-3	12. AEE-2
13. AOI-1	14. OEO-4
15.EIO-1	16. IEO-1
17. IAI-2	18. OAO-1
19. EAE-1	20. EII-3