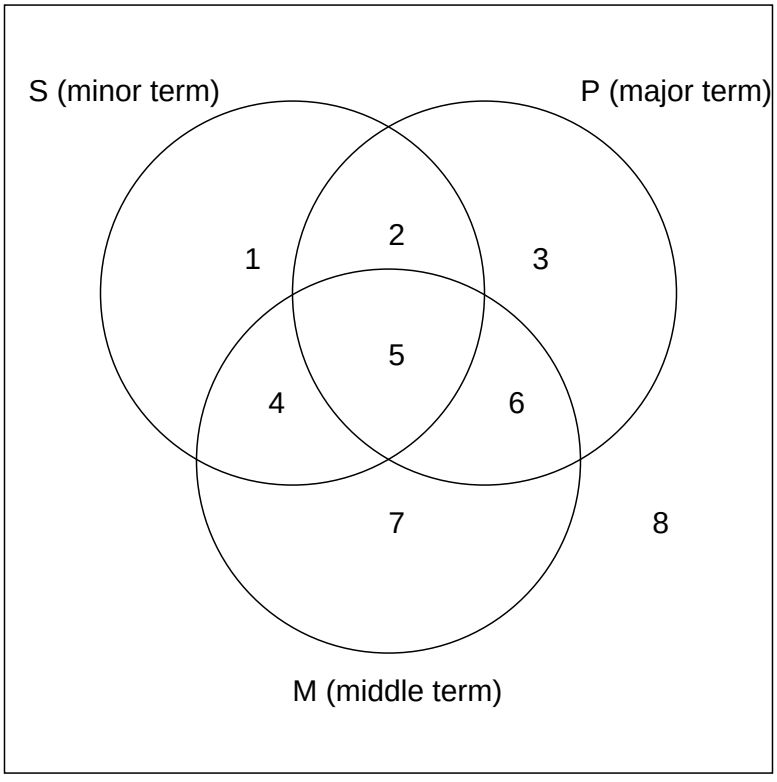
6.3 Venn Diagrams and Categorical Syllogisms

Comment: In a deductively valid argument, the content of the conclusion is already contained implicitly in the premises. A Venn diagram of the premise enables us to see this explicitly.

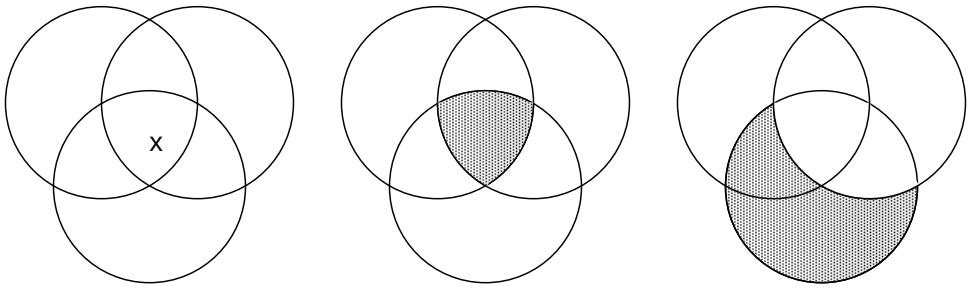
Now that we know how to diagram the four types of categorical sentences, we can use Venn diagrams to evaluate arguments for validity.

Since there are three terms in every syllogism, we need three overlapping circles in any Venn diagram:



Comment: The numbers 1 through 8 are not part of a standard Venn diagram, but are added in this figure to enable us to conveniently refer to various areas of the diagram. Each area represents a possible relationship among the three classes being represented.

Examples



Determining Validity with Venn Diagrams

1. Diagram the premises

2. Look to see if the conclusion is true in the resulting diagram

If the conclusion is true in the diagram, the syllogism is valid; if not, not.

Comment: In a bit more detail, after diagramming the premises think of what you would need to do to diagram the conclusion. The argument is valid if the conclusion is *already diagrammed*, simply in virtue of diagramming the premises. This shows validity, once again, because, in a valid argument (and only in a valid argument), the information expressed by the conclusion is implicit in the premises; it's already there. That's why, in a valid argument, the conclusion *must* be true if the premises are. By contrast, in an invalid argument, after diagramming the premises there will be more work to do to diagram the conclusion. That is just what you'd expect, because in an invalid argument, the information expressed by the conclusion is *not* implicit in the premises; the conclusion says something more than the premises do.

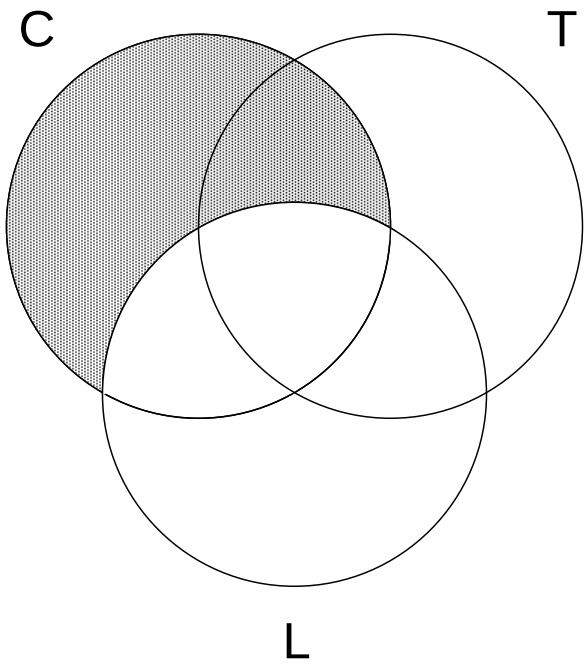
An Example

1. People who shave their legs don’t wear ties.
2. All cyclists shave their legs.
3. Therefore, no cyclist wears a tie.

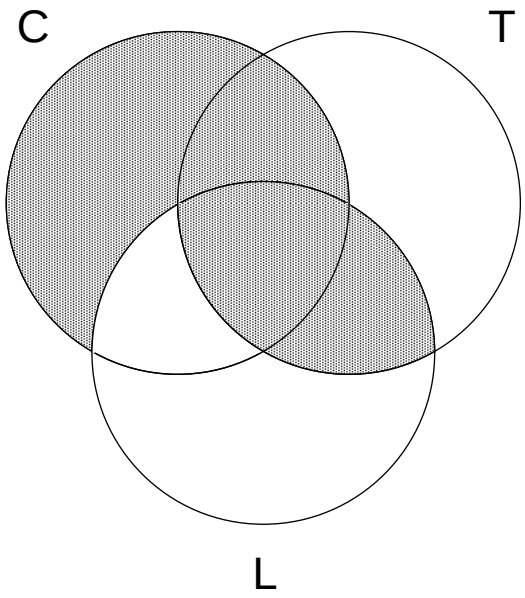
Or, put in standard form:

1. No leg shavers are tie wearers.
2. All cyclists are leg shavers.
3. Therefore, no cyclists are tie wearers.

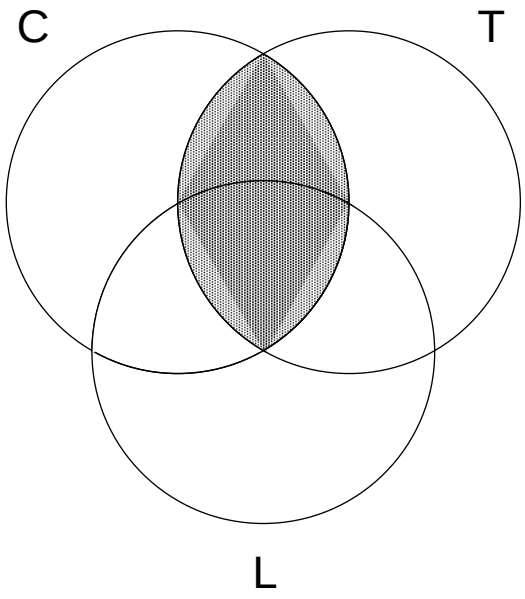
If both our premises are universal, as in this argument, we can diagram either premise first. So lets diagram the minor premise:



And then the major premise:



Now we look to see if the content of the conclusion is already there. If we were to diagram it separately, it would look like this:



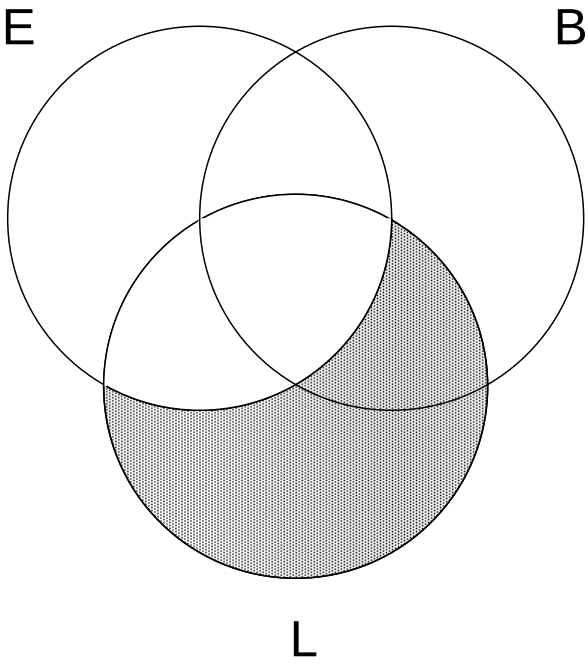
But we see that the shaded region here was shaded automatically when we diagrammed the premises. So the argument is valid.

Another Example

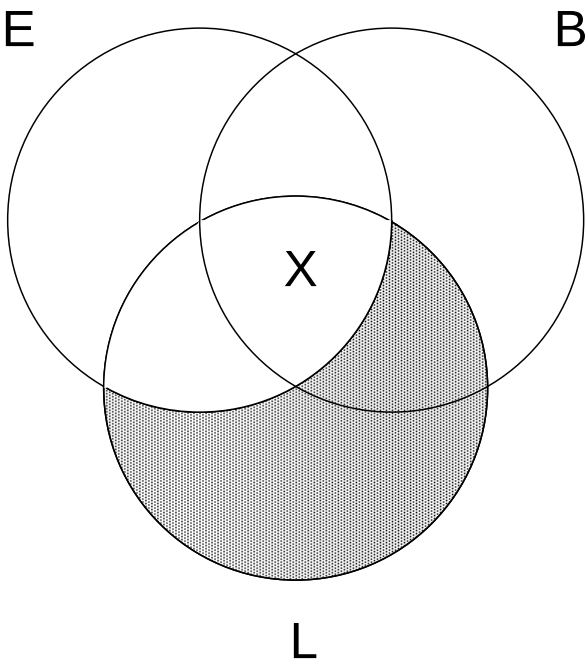
1. Some logicians are beer lovers.
2. All logicians are exceptional people.
3. Therefore, some exceptional people are beer lovers.

NOTE: If the two premises of a categorical syllogism differ in quality, *diagram the universal premise first*.

Thus, diagramming the minor premise first, we have:



Diagramming the major premise in turn yields:



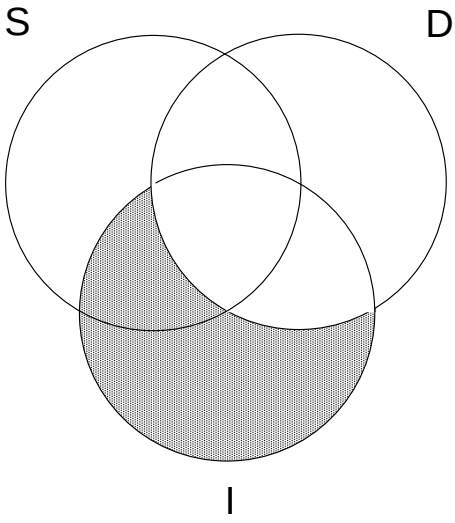
And again we see that there is no work to be done to represent the content of the conclusion; we have an X in the overlap of **Exceptional people** and **Beer lovers**. So the argument is valid.

Examples Indicating Invalidity

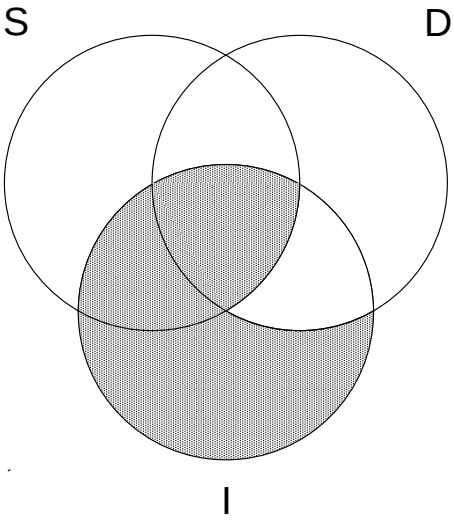
The examples above illustrate how the method of Venn Diagrams works for valid syllogisms. What if a syllogism is invalid?

1. All immoral persons are psychologically disturbed persons.
2. No saints are immoral persons.
3. Therefore, no saints are psychologically disturbed persons.

Diagramming the first premise, we have:



And diagramming the second:



For the content of the conclusion to be represented in this diagram, however, we would need the entire area of overlap between the **S** and the **D** circles to be filled in. Hence, the argument is invalid.

Invalidity with universal and particular premises

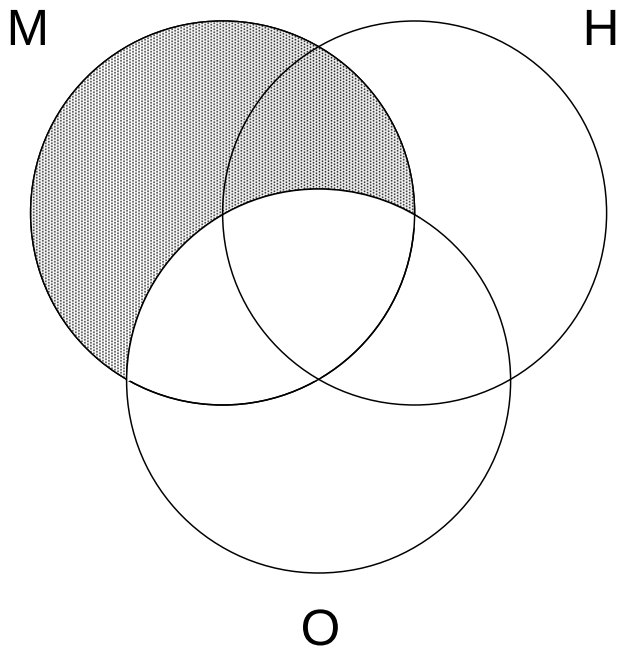
Consider a further example that illustrates a slight complication in the method of Venn Diagrams.

1. Some obsessive people are not healthy.
2. All marathon runners are obsessive.
3. Therefore, some marathon runners are not healthy.

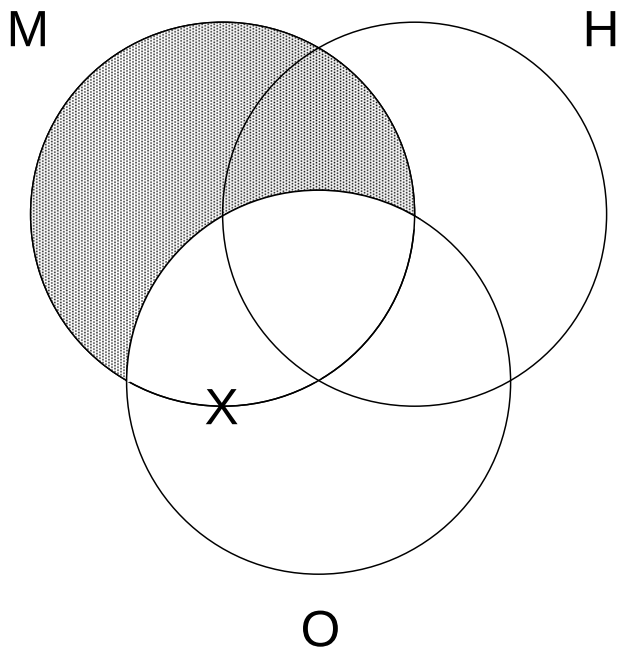
Or in standard form:

1. Some obsessive people are not healthy people.
2. All marathon runners are obsessive people.
3. Therefore, some marathon runners are not healthy people.

We diagram the minor premise first, since it is universal and the major premise is particular:



But what do we do with the major premise? Where does the X go? It has to be placed inside the **O** circle but the outside the **H** circle, but where do we put it relative to **M**? We can't put it inside **M**, since that would indicate that our arbitrary unhealthy, obsessive person is a marathon runner, and we don't know that. But, similarly, we can't put it *outside* **M**, since that would indicate that he or she *is not* a marathon runner, and we don't know that either. Consequently, we must put the X in the only place that doesn't indicate one way or the other, namely, right on the line:



And now we see that the information in the conclusion is not represented in the diagram. To capture that information the X would have to be fully inside the **M** circle. But it's not, so the diagram shows that the argument is invalid; the information in the conclusion is not implicit in the premises.