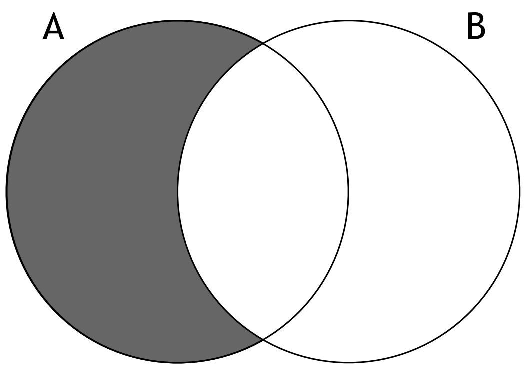
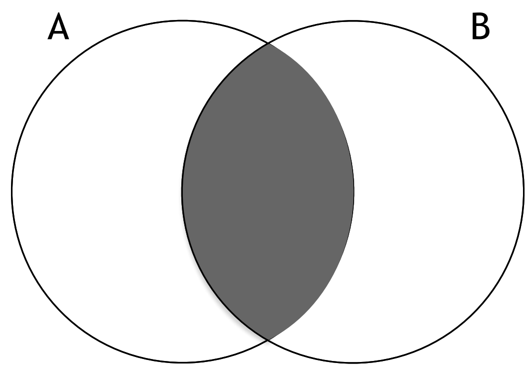
6.3 Venn Diagrams and Categorical Syllogisms

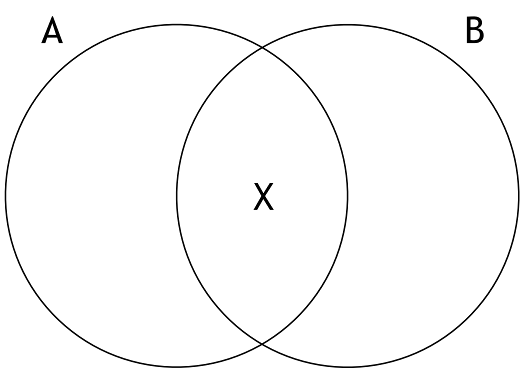
Recall the simple 2-circle representations of the meanings of our four categorical statements that we provided in §5.1:*



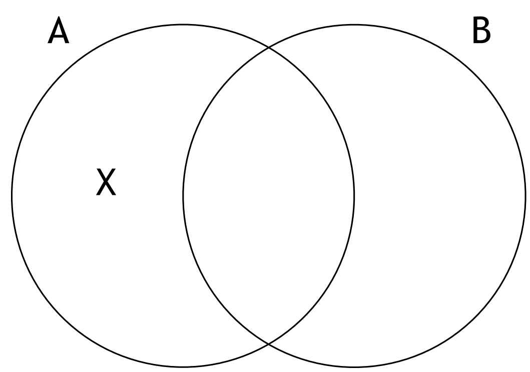
All A are B



No A are B



Some A are B



Some A are not B

The Venn Diagram method makes clever use of these representations to determine whether or not any given syllogism is valid.

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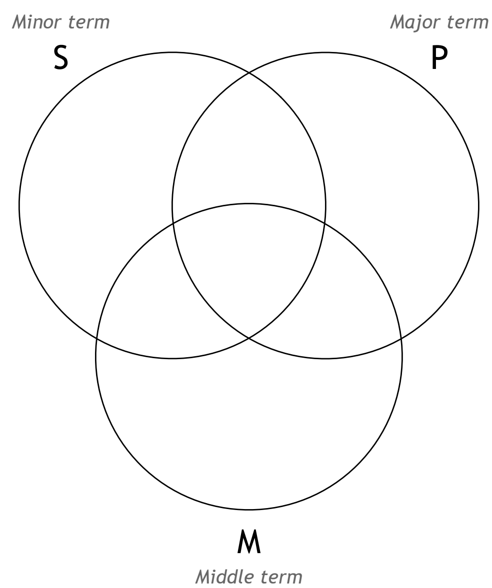
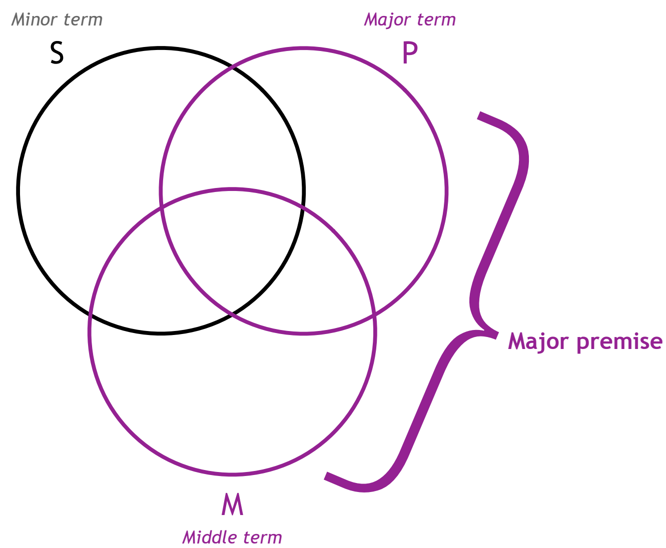
* Our text also discusses these representations a bit more rigorously in §6.2.

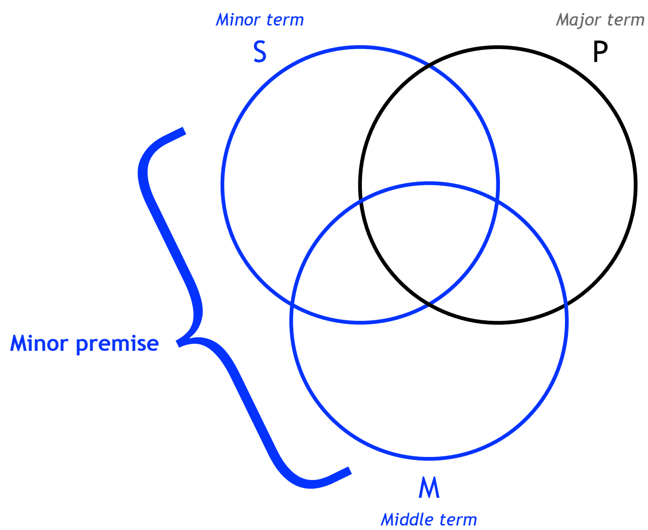
Since every categorical syllogism consists of three categorical statements and contains a total of three terms — the minor term (S), the major term (P), and the middle term (M) — we can combine our 2-circle representations of all three statements in a single diagram of the following form:



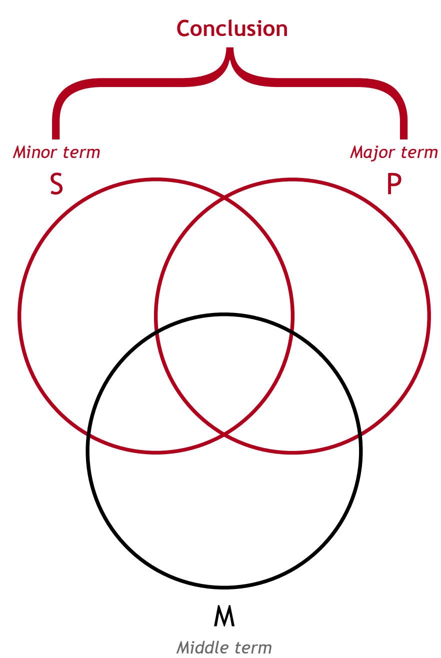
The P and M circles together will be used to represent the content of the major premise:



The S and M circles will be used to represent the content of the minor premise:



After the premises are diagrammed, the S and P circles together will represent as much of the content of the conclusion as is implicit in the premises — this could be *all* of its content, *some* of its content, or *none* of its content:



The Venn Diagram Method

Recall that an argument is *valid* if it is not possible for the premises of the argument to be true and the conclusion false. The reason for this is that, in a valid argument, the content of the conclusion is already implicit in the premises; the argument simply draws this content out and makes it explicit. The Venn Diagram method enables us vividly to *see* when this connection between premises and conclusion holds.

Specifically, the method consists of three steps:

1. Diagram the premises.
2. Look to see if the content of the conclusion is represented in the resulting diagram.
3. If it is, conclude the syllogism is valid; if not, conclude it is invalid.

If, after diagramming the premises, the content of the conclusion is represented, this shows that the content of the conclusion was already implicit in the premises and, hence, that the argument is valid.

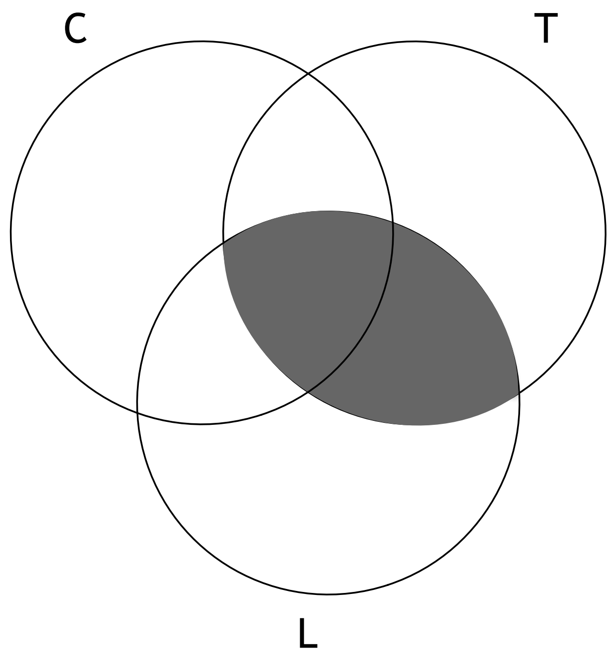
An Example

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

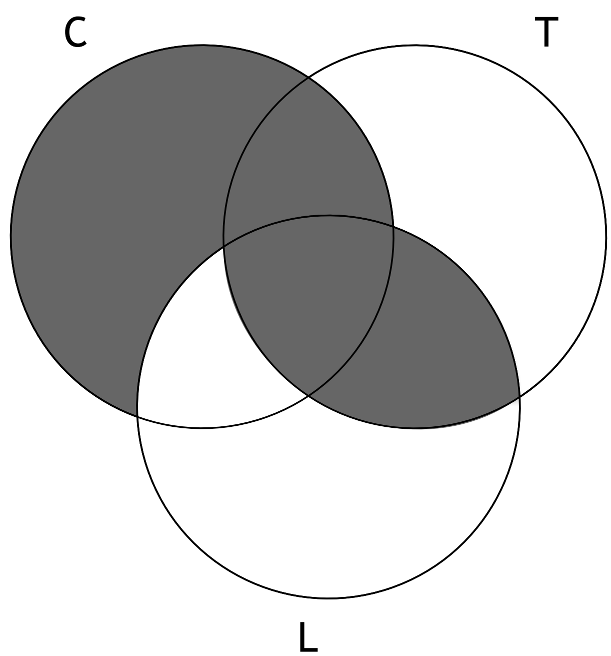
Or, put in standard form:

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

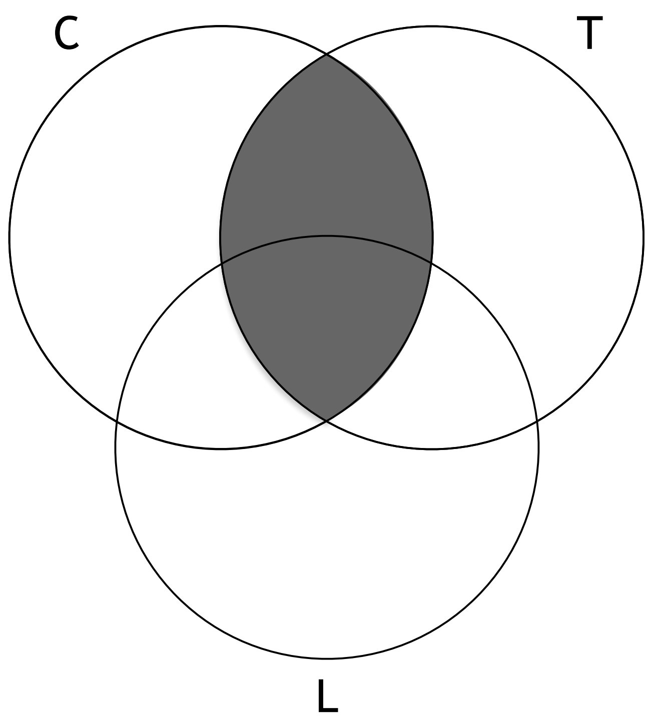
Since both our premises are universal, we can diagram either premise first. So let's just start with the major premise:



Now let's add the minor premise:



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



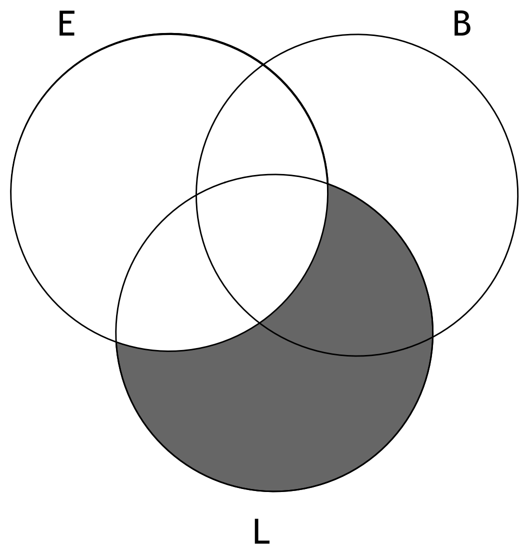
But we see that the shaded region here was shaded automatically when we diagrammed thes premises, indicating that the content of the conclusion was indeed implicit in the premises. So the diagram shows that the argument is valid.

Another Example

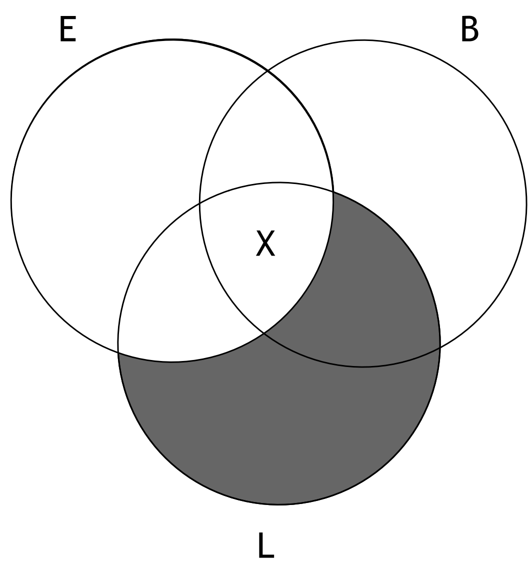
1. Some logicians are beer lovers.
2. All logicians are exceptional people.
3. Therefore, some exceptional people are beer lovers.

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

Thus, diagramming the minor premise first, we have:



Diagramming the major premise in turn yields:



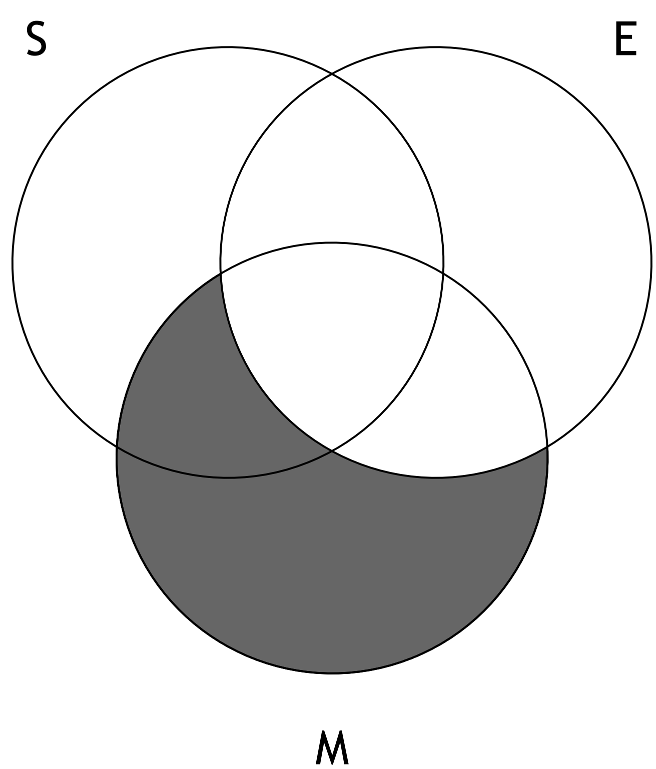
And again we see that there is no work to be done to represent the content of the conclusion; we have an X in the overlap of **Exceptional people** and **Beer lovers**. So the argument is valid.

Examples Illustrating Invalidity

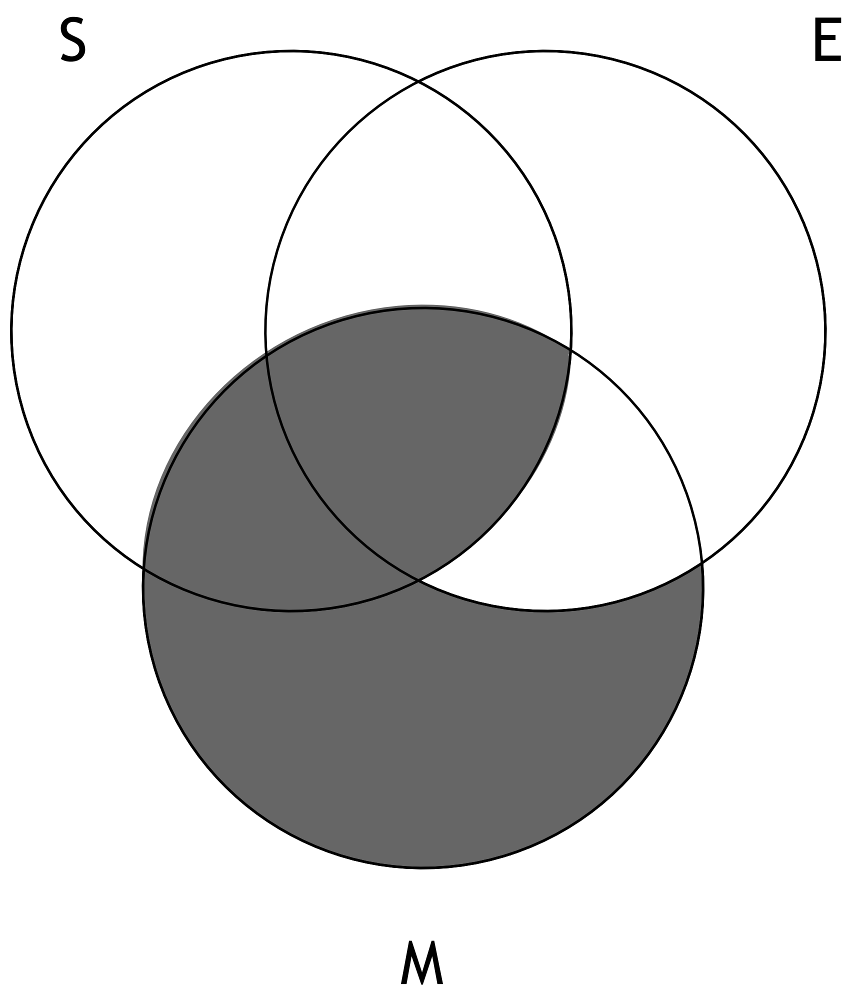
In contrast to what happens in the case of a valid argument, after diagramming the premises of an invalid argument there will be more work to do to diagram the conclusion. That is just what you'd expect, because in an invalid argument, the information expressed by the conclusion is *not* implicit in the premises; the conclusion says something more than the premises do. Let us see how this plays out with a couple more examples.

1. All movie stars are egotists.
2. No saints are movie stars.
3. Therefore, no saints are egotists.

Diagramming the first premise, we have:



And diagramming the second:



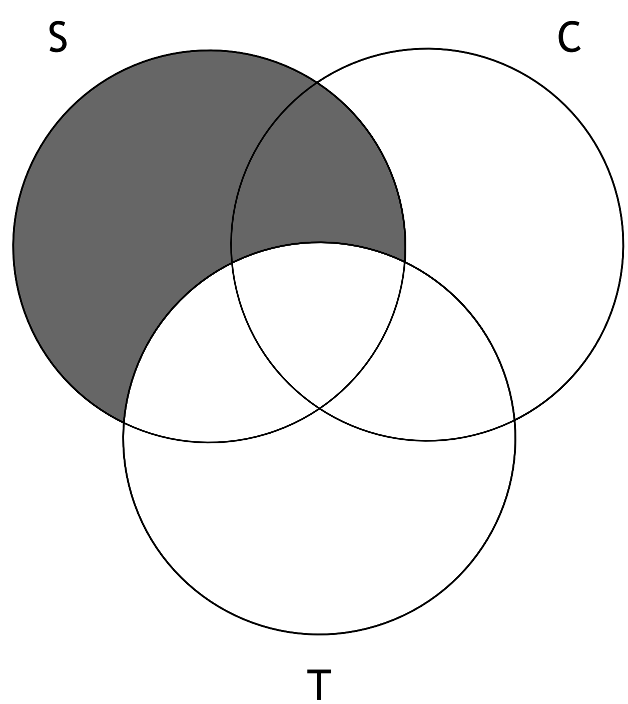
For the content of the conclusion to be represented in this diagram, however, we would need the entire area of overlap between the **S** and the **E** circles to be filled in. Hence, the argument is invalid.

Invalidity with universal and particular premises

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

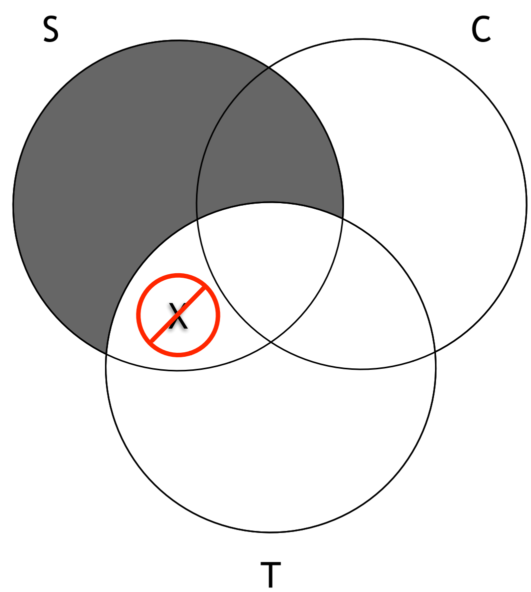
1. Some theologians are not Calvinists.
2. All seminarians are theologians.
3. Hence, some seminarians are not Calvinists.

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

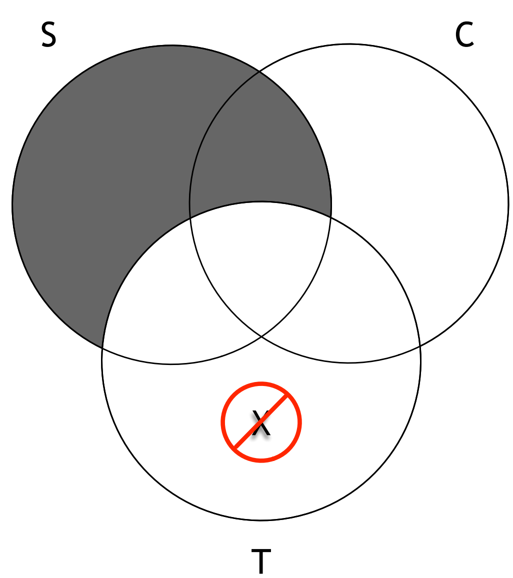


But how do we diagram the major premise? Where do we put the X that will represent our non-Calvinist theologian? It has to be placed inside the **T** circle (since X represents a theologian) but outside the **C** circle (since X also represents a non-Calvinist), but where do we put it relative to **S** circle?

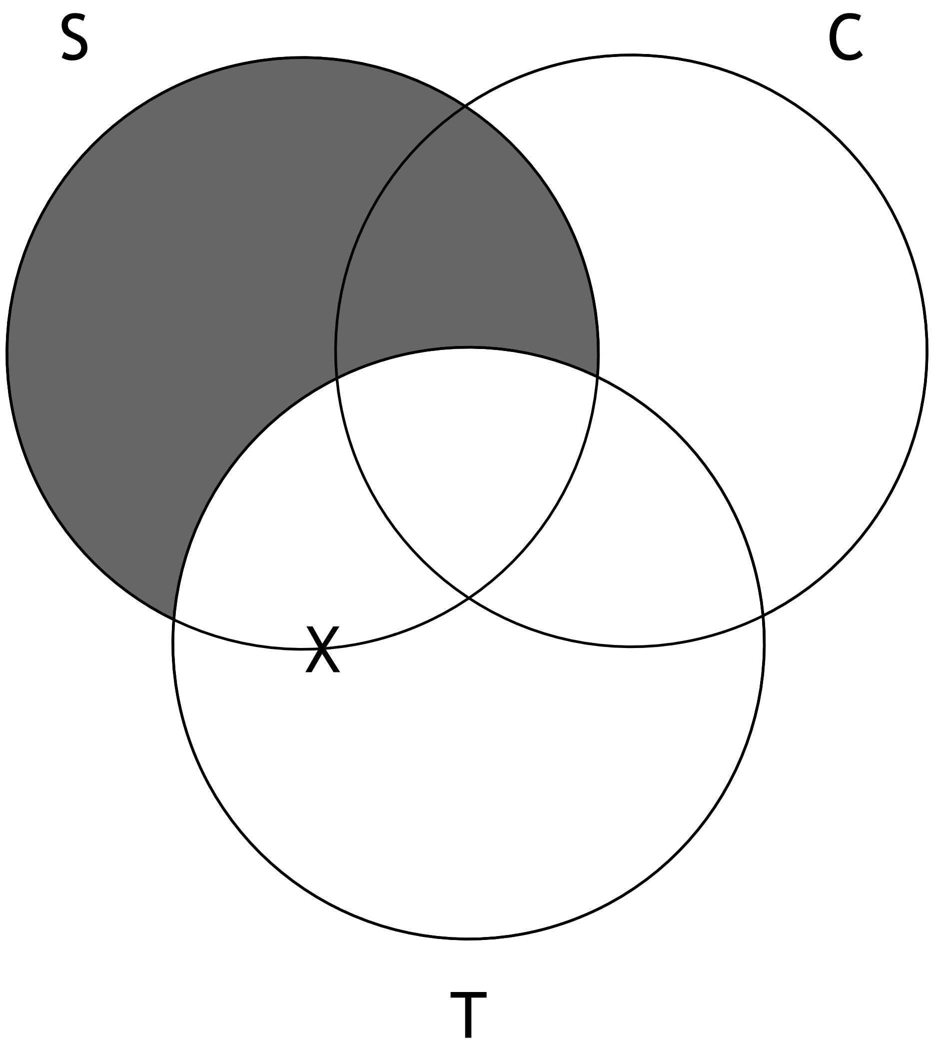
We can't put it inside the **S** circle, since that would indicate that our non-Calvinist theologian is a seminarian, and we don't know that.



But, similarly, we can't put it *outside* the **S** circle, since that would indicate that he or she *is not* a seminarian, and we don't know that either!



Consequently, we must put our X in the only place that doesn't indicate one way, namely, right on the line:



And now we see that the information in the conclusion — that some seminarians are not Calvinists — is not represented in the diagram. For, to represent that information, the X would have to be fully inside the **S** 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.