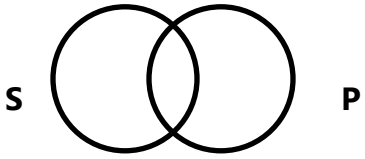
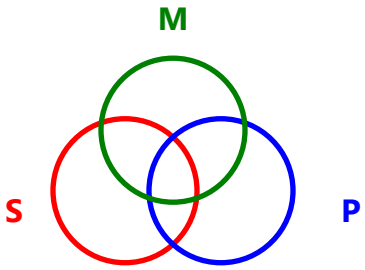
# 5.2 Venn Diagrams, part 2

We have seen how Venn diagrams work for categorical PROPOSITIONS. Here, we will draw Venn diagrams for categorical SYLLOGISMS.

**1. Drawing Venn Diagrams:** Recall that diagrams for single propositions used 2 circles like this:




When diagramming syllogisms, we will draw TWO diagrams—one for each of the premises. But, since the two premises share one term (the middle term), there are only 3 different terms total (the major term, the minor term, and the middle term). So, we will only need 3 different circles, like this:




Recall that, in a categorical syllogism with the correct form, the first (major) premise will have the **major term (P)** and the **middle term (M)**. So, the diagram of the first premise will use ONLY the blue and green circles. Meanwhile, the second (minor) premise will have the **minor term (S)** and the **middle term (M)**. So, the diagram for the second premise will use ONLY the red and green circles.

**2. Assessing Validity:** When diagramming an argument, we will first need to diagram one premise, and then the other premise.

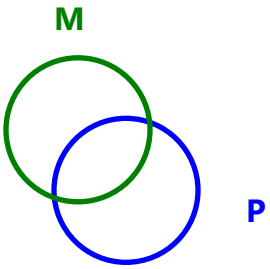
*Note: In cases where there is ONLY ONE universal premise ("A" or "E"), you will need to diagram that premise FIRST. In all other cases, it does not matter which premise is diagrammed first.*

Once we have diagrammed the premises, we consider BUT DO NOT DRAW the information contained in the conclusion. For all **valid arguments**, all of the information contained in the conclusion will already be contained within the Venn diagrams we've drawn for the two premises. **Invalid arguments** will have conclusions containing information that we have NOT already drawn in our premise diagrams.

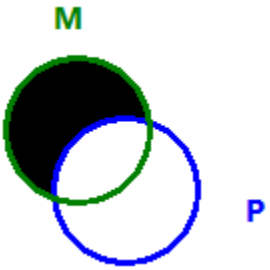
Let's try one. Let's draw the diagram for an argument from the previous lecture:

1. All **mammals** are **creatures that have hair**.
2. All **dogs** are **mammals**.
3. Therefore, all **dogs** are **creatures that have hair**.

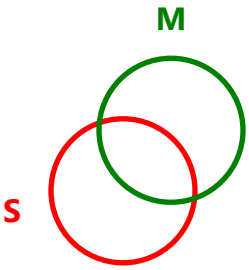
Recall that this was a valid "AAA-1" syllogism. Now, we need to diagram each of the premises one at a time. Since both of the premises are universal propositions, it does not matter which premise we diagram first. So, let's diagram the first premise. Since it only has the **middle term (M)** and the **major term (P)**, we only need the **green** and **blue** circles:




The first premise states that "All **mammals** are **creatures that have hair**." So, we know that there are not any individuals in the M-circle that are NOT also inside of the P-circle. So, we shade in that part of the M-circle that does not overlap with the P-circle, like this:

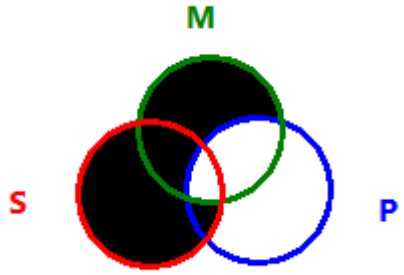



Now, let's diagram the other premise. Since it only has the **middle term (M)** and the **minor term (S)** we only need the **green** and **red** circles:

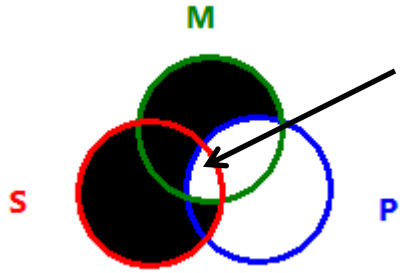



The second premise states that "All **dogs** are **mammals**." So, we know that there are not any individuals in the S-circle that are NOT also inside of the M-circle. So, we shade in that part of the S-circle that does not overlap with the M-circle, like this:


Now, we need to combine both premises into one Venn diagram with 3 circles:




Now we look at the conclusion and assess validity. The conclusion states that "All **dogs** are **creatures that have hair**." So, we know that there are not any individuals in the S-circle that are NOT also inside of the P-circle. Now, we look at our Venn diagram. Does it indicate that all of the S's are also P's? In other words, are all of the unshaded portions of the S-circle inside of the P-circle? Yes! They are! There is only one tiny portion of the S-circle that is NOT shaded, and it IS inside of the P-circle. It is the tiny portion in the very middle of this diagram, with the arrow pointed to it:

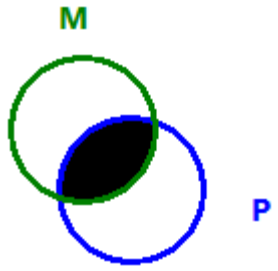



Now, let's try another argument from the previous lecture:

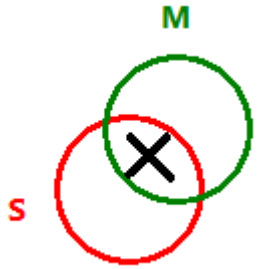
1. No **states with coastlines** are **states that are landlocked**.
2. Some **U.S. states** are **states that are landlocked**.
3. Therefore, some **U.S. states** are not **states with coastlines**.

Recall that this was a valid "EIO-3" syllogism. Let's diagram it now.

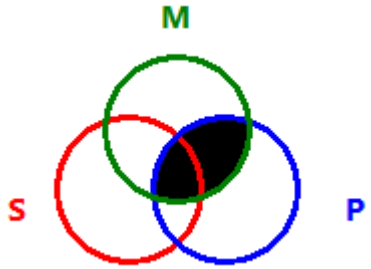
*Note: Since this syllogism contains ONLY ONE universal premise (namely, premise 1, which is an "E" proposition), we MUST diagram that premise first. It looks like this:*



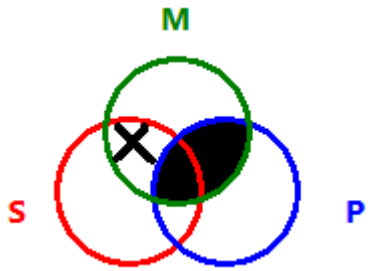

Since the premise is, "No **states with coastlines** are **states that are landlocked**," we know that there are no individuals in the P-circle that are also in the M-circle. So, we shade the overlapping region. Let's do the next premise:




Since the premise is, "Some **U.S. states** are **states that are landlocked**," we know that there is at least one individual in the S-circle that is ALSO in the M-circle. So, we draw an 'X' in the overlapping region. Now, let's see what the diagram looks like when all 3 circles are combined. First, we'll do premise 1:

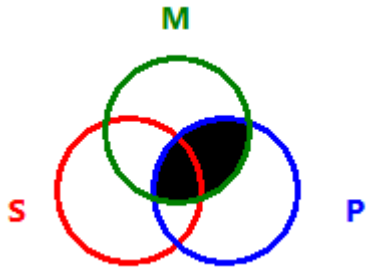



Next, we add premise 2. Since part of the region where we need to draw the 'X' is ALREADY blacked out, we can only put the 'X' in the OTHER small region, like this:

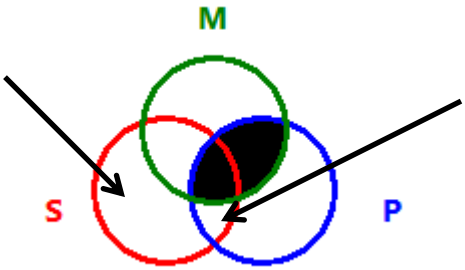



Now, let's look at the conclusion and assess validity. The conclusion states that "Some **U.S. states** are not **states with coastlines**." So, it tells us that something exists within the S-circle that is NOT also inside of the P-circle. Does our Venn diagram have an 'X' which IS inside of the S-circle, but is NOT inside of the P-circle? Sure enough, it does! So, this argument is valid.

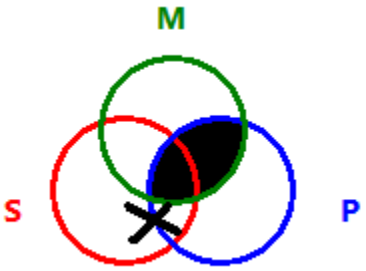
**3. A Note About 'X'-Placement:** One last thing to note. In the previous example, there was only one region left to place our 'X' in. But, this will not always be the case. Sometimes there will be TWO regions that are both candidates for where to draw an 'X'. For instance, imagine that we already have the following diagram, and we want to ADD markings for the proposition, "Some S are not M."




All that "Some S are not M" tells us is that there needs to be an 'X' that IS in the S-circle, but is NOT in the M-circle. But there are TWO regions that fit that description:




The arrows point to the TWO different regions in the S-circle that are not inside of the M-circle. We need to draw an 'X' somewhere in those 2 regions. When this happens, and we don't know whether to draw the 'X' in one region or the other, we simply draw the 'X' so that it OVERLAPS the 2 regions, like this:




When an 'X' straddles 2 regions, we know that something exists in at least ONE of those 2 regions, **but we do not know which one of the two regions something exists in**. For instance, in the diagram above, the 'X' straddles the line that separates the region where S's **are not** P's and the region where S's **are** P's. Even so, we CANNOT infer that "Some S are P". Similarly, we CANNOT infer that "Some S are not P." Yes: One (or both) of these two things must be true, **but we don't know which one**.

*Note: Do homework for section 5.2 at this time.*