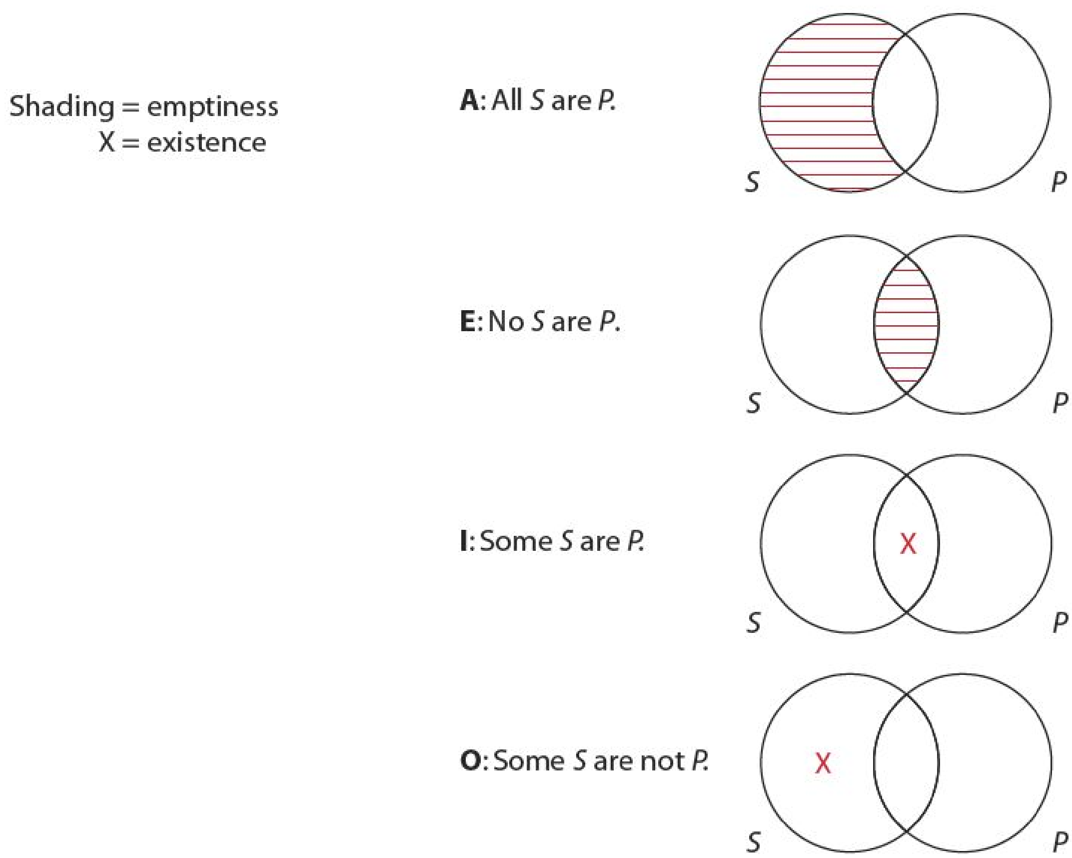
Immediate Inferences and Three Operations

As we discussed last time, given the rules by which the Modern Square is generated, there are a series of inferences that necessarily follow given the truth of any A, E, I, or O categorical propositions. The benefit of this is that given any single premise argument, we can test if the conclusion follows validly.

> **Immediate Inference**: an argument that has only one premise.

How will we test whether immediate inferences are valid? We will use a system that you are probably familiar with, though you may have not used it in rigorous way. We are going to use a diagrammatic system developed by John Venn. Standard two-circle Venn diagrams are excellent for our purposes given that immediate inferences involve only a single premise. Since our categorical propositions have a subject term and a predicate term, we will let one of the circles represent the subject class, and the other circle will represent the predicate class.

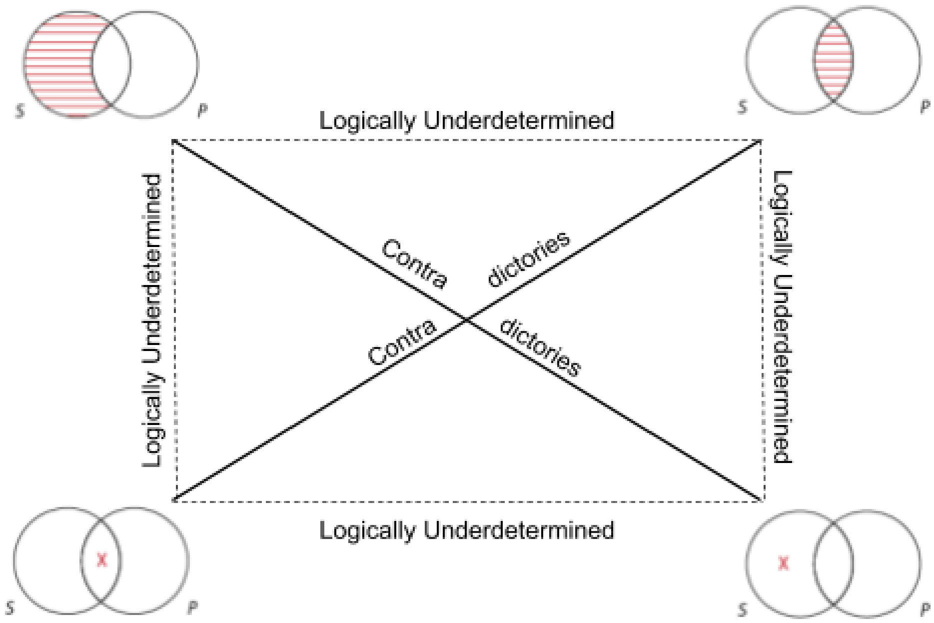


Though this may be intuitive, we also need to discuss *negation* and how it changes of our four propositions. Thankfully, though Hurley does not discuss this in any detail in this chapter, negation works in a way such that we can use our definition of contradiction to help illuminate it. If we want to express that a categorical proposition is false, we will use the following prefix: 'It is false that…'.[1]

So, if we want to say that an A proposition is false, we would say: It is false that all S are P. But what would this mean? Well, we know from our definition of contradictories that two propositions are contradictories if and only if the truth of one entails the falsity of the other, and vice versa. Therefore, the falsity of one categorical proposition means that another categorical proposition is true. 'It is false that all S are P', has the same truth value as 'It is true that some S are not P' given the relationships diagrammed in our modern square. Hence, negation both works to tell us one thing is false, but also that another thing is true. This will arise later in the semester also and will give rise to a definition for *equivalence*. I won't provide a definition of equivalence here, but you can understand what I just described as claiming that 'It is false that all S are P' is equivalent with 'It is true that some S are not P'. In essence, they tell you the same information.

Given that we now have a diagrammatic way to represent each A, E, I, and O proposition, we can insert these into our modern square of opposition:

[1] The Hurley book adopts the convention of putting 'it is false ...' in front of our categorical propositions even though this ungrammatical. To be fully grammatical the example should read: All S are P is false. We will let it slide, but please be aware of this.



So, now we can begin testing for validity by turning our immediate inferences into Venn diagrams and using our square. Take the following example:

> It is false that all meteor showers are viewed by humans.
> Therefore, some meteor showers are not viewed by humans.

We begin by treating the premise as ***true*** (remember our definition of validity). Next, we create Venn diagrams for both the premise and the conclusion. Then, we check the square and note that ‘all meteor showers are viewed by humans’ is the contradictory of ‘some meteor showers are not viewed by humans.’ Hence, since we are treating the premise as true, and this means the A proposition is false, its contradictory must be true given our definition of contradictories. Since our conclusion is that contradictory, we know the conclusion is true. Hence, if the premise is true the conclusion must be true - which is just our definition of validity. Therefore, the argument is valid!

This method also allows us to test for invalid arguments. Take the following example:

> It is false that all meteor showers are viewed by humans.
> Therefore, no meteor showers are not viewed by humans.

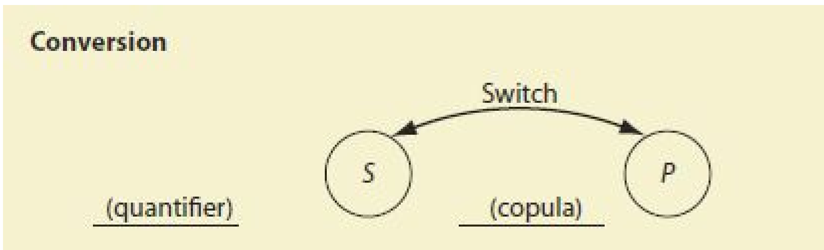
First, we create the Venn diagrams for each proposition. We then note their place on the square. This time, however, the argument is claiming that there is a logical relationship between an A and E proposition. Our square tells us this is logically underdetermined. Therefore, this argument is invalid.

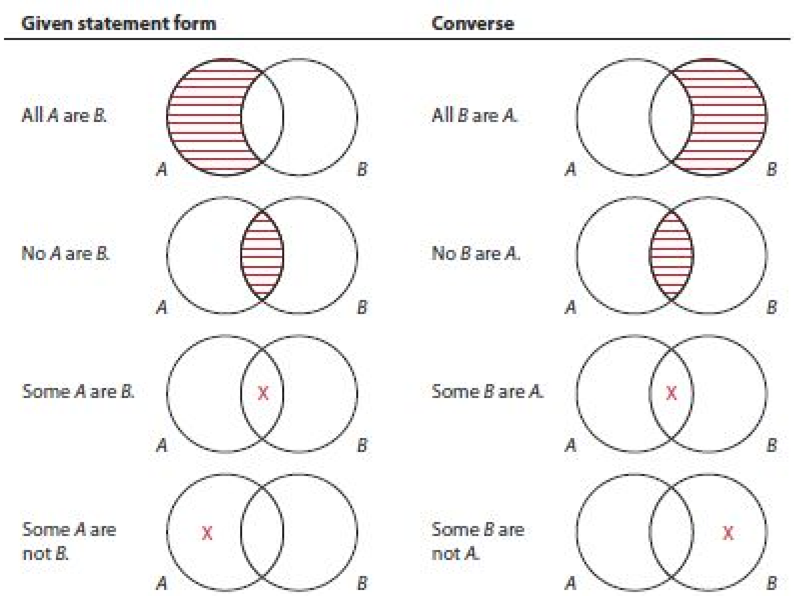
A particular kind of invalid argument occurs when the **existential fallacy** is committed. As we learned last time, the existential fallacy is when we infer the existence of something from premises which do not license such an inference. The existential fallacy is easy to detect. Just look for a pair of diagrams in which the **premise diagram contains shading** and the **conclusion diagram contains an X**. If the X in the conclusion diagram is in the same part of the left-hand circle that is unshaded in the premise diagram, then the inference commits the existential fallacy.

Section 4.4
Now that we've seen some of the obvious relations amongst different categorical propositions, we will explore some operations that can be performed on propositions, and why.

Conversion
Conversion will be the easiest operation to understand. You simply

(1) Switch the subject term and the predicate term.





Note: Every E and I conversion is equivalent (has the same truth-value) as its original. A and O are logically underdetermined.

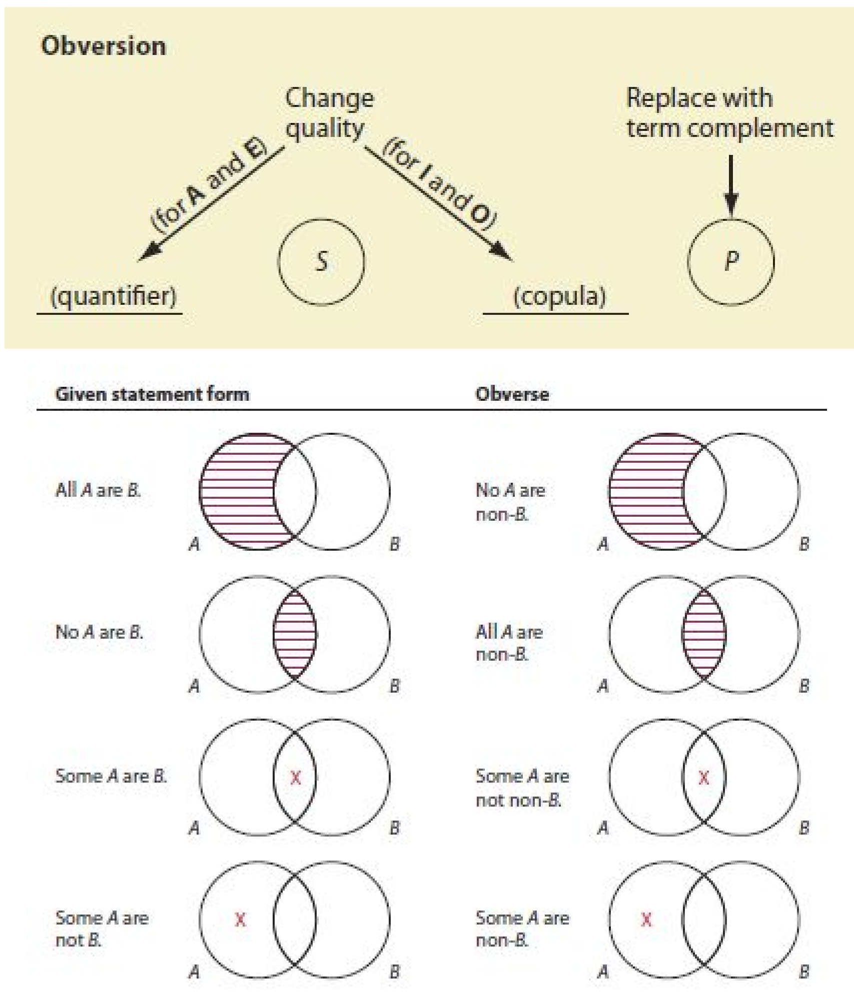
Obversion

Obversion is less intuitive. Obversion requires two steps:

(1) changing the quality (without changing the quantity), and
(2) replacing the predicate with its term complement.

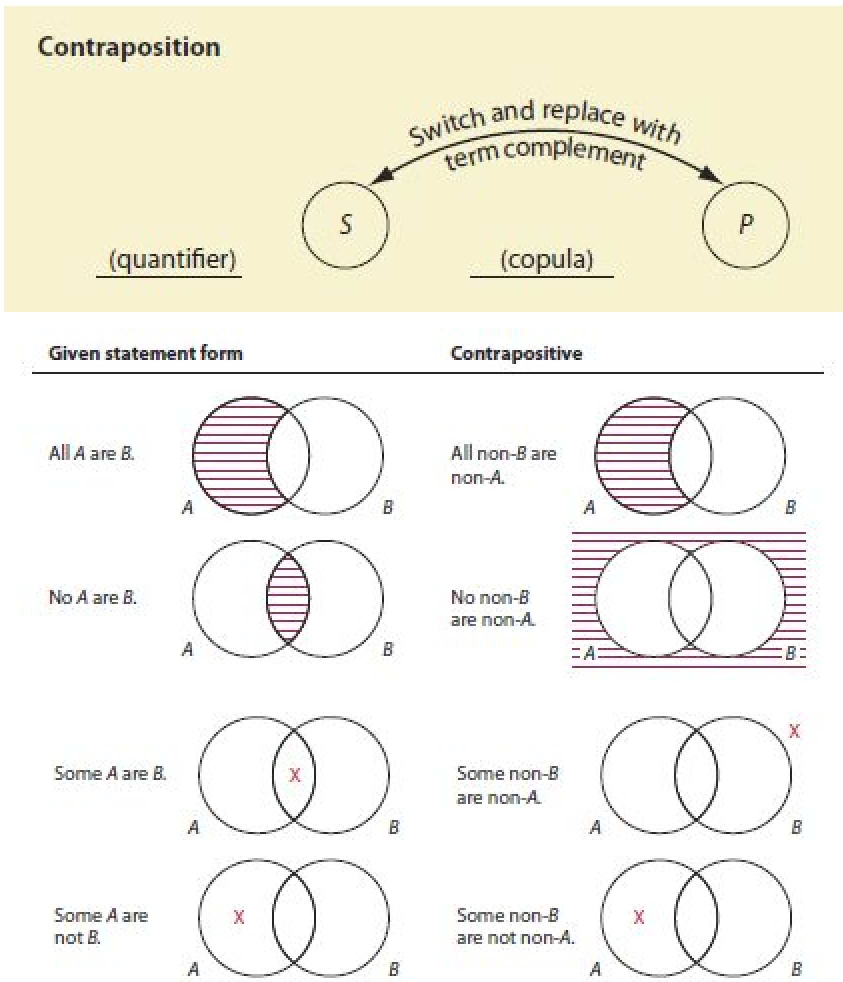
The first part of this operation was treated in Exercise 4.2. It consists in changing “No S are P” to “All S are P” and vice versa, and changing “Some S are P” to “Some S are not P” and vice versa.

Note: Every categorical proposition is equivalent to its obverse.



Contraposition
Contraposition requires two steps:

(1) switching the subject and predicate terms and
(2) replacing the subject and predicate terms with their term complements.



Note: Every A and O proposition is equivalent to its contrapositive. E and I propositions are underdetermined.

Recap:

Conversion: Switch Subject and Predicate Terms

Given Statement	Converse	Truth Value
E: No *A* are *B*.	No *B* are *A*.	Same truth value as given statement
I: Some *A* are *B*.	Some *B* are *A*.	
A: All *A* are *B*.	All *B* are *A*.	Undetermined truth value
O: Some *A* are not *B*.	Some *B* are not *A*.	

Obversion: Change Quality; Replace Predicate with Term Complement

Given Statement	Obverse	Truth Value
A: All *A* are *B*.	No *A* are non-*B*.	Same truth value as given statement
E: No *A* are *B*.	All *A* are non-*B*.	
I: Some *A* are *B*.	Some *A* are not non-*B*.	
O: Some *A* are not *B*.	Some *A* are non-*B*.	

Contraposition: Switch Subject and Predicate Terms; Replace Each with Its Term Complement

Given Statement	Contrapositive	Truth Value
A: All *A* are *B*.	All non-*B* are non-*A*.	Same truth value as given statement
O: Some *A* are not *B*.	Some non-*B* are not non-*A*.	
E: No *A* are *B*.	No non-*B* are non-*A*.	Undetermined truth value
I: Some *A* are *B*.	Some non-*B* are non-*A*.	