Introduction to Logical Reasoning

Lecture #20

More Advanced (ategorical Statements

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Four Standard Forms of Categorical Statements



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Complex Statements

The categorical statements we often encounter in English often require a little more thought in order to recognize (1) the categories involved and (2) which of the four forms is being asserted.

Identify the Categories

When faced with a categorical claim, your first priority is to carefully identify the subject (S) and predicate (P) terms involved in the statement.

For instance, consider this categorical statement:

No nation can survive without secure borders.

What are the two categories involved here? What is being asserted about them in this statement?

Identify the Categories

No nation can survive without secure borders.

The subject term (S) is nations and the predicate term (P) is things that can survive without secure borders.

With this laid out, it should now be easier to see that this is an **E**-type categorical statement:

No nation is a thing that can survive without secure borders. (No *S* is *P*.)

Recognize Quantity and Quality

Even if you do identify the terms, it may still be difficult to determine the type of categorical statement involved.

Recall that the basic elements determining a categorical statement are its *quality* and its *quantity*. So ask yourself:

Quantity: Does this refer to *all* things in the subject term (S) or just about *some* things in that category.

Quality: Does this *affirm* or *deny* a relationship between the two terms?

Recognize Quantity and Quality

Equivalent Universal Affirmatives (A statements):

Every computer is logical.

Whatever is a computer is logical.

Computers are logical.

Equivalent Universal Negatives (E statements):

Nothing valuable is rubbish.

Valuables are not rubbish.

Whatever is valuable is not rubbish.





Recognize Quantity and Quality

Equivalent Particular Affirmatives (I statements):

A few entrepreneurs are rich.

Most entrepreneurs are rich.

There are entrepreneurs who are rich.

Equivalent Particular Negatives (O statements):

Many journalists are not happy.

A few journalists are not happy.

There are journalists who are not happy.





Singular Statements

Sometimes a statement might not seem categorical. Consider this:

Shamila is a good reader.

This seems to just be about one person and not a category of things at all. In general, a **singular statement** like this makes an assertion about one single, particular thing.

Singular Statements

Shamila is a good reader.

We can still work with this statement by creating a category to accommodate its singular entity, like so:

All persons identical with Shamila are good readers.

Now this is just a simple **A** statement:



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Only vs. The Only

Consider the following two statements:

Black mushrooms are **only** poisonous mushrooms.

Black mushrooms are **the only** poisonous mushrooms.

Are these just expressing the exact same thing?

(If it helps, imagine you have a black mushroom. Are you certain in both instances that it is poisonous?)

Only vs. The Only



Black mushrooms are the only poisonous mushrooms.



All poisonous mushrooms are black mushrooms. (A Statement)

It turns out that these are two very different claims—if you want to eat a black mushroom for dinner, this makes a huge difference!

Complement

For any category, we may consider its complement. The **complement** of a category contains *everything* that is *not* in that category. The complement of category *X* is denoted as non-*X*. Of particular importance, the compliment of the subject term *S* is denoted as non-*S* and the complement of the predicate term *P* is denoted as non-*P*.

In English, for example, the complement of the category of "students" is "non-students", while the complement of "poisonous mushrooms" is "non-poisonous mushrooms".

Complement

The use of complements allows us to consider even more sophisticated categorical statements.

For instance, consider this categorical statement:

Some students are non-journalism majors.

What are the subject (S) and predicate (P) terms of this statement?

The subject term (S) is students, whereas the predicate term (P) is journalism majors.

When using complements, the focus should always remain on the main categories involved. In this case the categories are students and journalism majors. Yes, *grammatically* the predicate of the above statement is indeed non-journalism majors, but *logically* the predicate term (*P*) is journalism majors. Non-journalism majors is logically represented as the complement of the predicate term (i.e., as non-*P*).

Now how do we diagram this statement?

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This is an **I**-type categorical statement of the form "Some S is non-P".

Recall that for "normal" **I** statements like "Some *S* is *P*", we create the Venn diagram by putting a dot-*x* in the zone that *S* and *P* share.

However, this statement is different: it has non-P instead of P!

That is okay. We just follow the same pattern for **I** statements by putting a dot-*x* in the zone that *S* and non-*P* share.

This is an **I**-type categorical statement of the form "Some *S* is non-*P*". So we are putting a dot-*x* in the zone that *S* and non-*P* share.



Complement

Some students are non-journalism majors.

This is an **I**-type categorical statement of the form "Some *S* is non-*P*". So we are putting a dot-*x* in the zone that *S* and non-*P* share.



S consists of zones 2 and 3.

Complement

Some students are non-journalism majors.

This is an **I**-type categorical statement of the form "Some *S* is non-*P*". So we are putting a dot-*x* in the zone that *S* and non-*P* share.



Non-*P* consists of the zones *outside* of *P*: zones 1 and 2.

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This is an **I**-type categorical statement of the form "Some *S* is non-*P*". So we are putting a dot-*x* in the zone that *S* and non-*P* share.



It is zone 2 that *S* and non-*P* share.

This is an **I**-type categorical statement of the form "Some *S* is non-*P*". So we are putting a dot-*x* in the zone that *S* and non-*P* share.



So zone 2 gets the dot-x!

Statement 1

Draw a Venn diagram for the following statement:

No non-mushroom is poisonous.

First, identify the categories: the subject term (*S*) is mushrooms and the predicate term (*P*) is poisonous things. Notice that *grammatically* "non-mushrooms" is indeed the subject, but *logically* "mushrooms" is the subject term. As always, logic treats that "non" part as a complement.

Second, recognize quantity and quality:

Quantity: This is about *all* non-mushrooms, making it *universal*.

Quality: This *denies* a relationship, making it *negative*.

So this is an **E** (universal negative) statement of the form "No non-S is P".

This is an **E**-type categorical statement of the form "No non-*S* is *P*".

Recall that for "normal" **E** statements like "No *S* is *P*", we create the Venn diagram by shading in the zone that *S* and *P* share.

However, statement 1 is different: it has non-*S* instead of *S*!

That is okay. We just follow the same pattern for **E** statements by shading in the zone that non-*S* and *P* share.

This is an **E**-type categorical statement of the form "No non-*S* is *P*". So we are shading in the zone that non-*S* and *P* share.



This is an **E**-type categorical statement of the form "No non-*S* is *P*". So we are shading in the zone that non-*S* and *P* share.



Non-S consists of the zones *outside* of S: zones 1 and 4.

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This is an **E**-type categorical statement of the form "No non-*S* is *P*". So we are shading in the zone that non-*S* and *P* share.



P consists of zones 3 and 4.

This is an **E**-type categorical statement of the form "No non-*S* is *P*". So we are shading in the zone that non-*S* and *P* share.



It is zone 4 that non-*S* and *P* share.

This is an **E**-type categorical statement of the form "No non-*S* is *P*". So we are shading in the zone that non-*S* and *P* share.



So zone 3 gets shaded in!

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Categorical Statements and Venn Diagrams

Now you are in position to create a Venn diagram for any categorical statement taking one of the four traditional forms, with and without complements involved. Just remember these four rules:

(A) All X is Y: Shade in all of X not shared with Y.

- (E) No *X* is *Y*: Shade in all of *X* shared with *Y*.
- (**I**) Some *X* is *Y*: Dot-*x* in *X* shared with *Y*.

(**O**) Some X is not Y: Dot-x in X not shared with Y.

Note: It is okay for a complement like non-S or non-P to substitute X or Y. E.g., we just did the **E** rule for "No non-S is P" (statement 1), where non-S was X and P was Y.

Next Class...

We will have a workshop on identifying categorical statements and drawing their Venn diagrams.

Also, please do not forget to turn in your response to the Lecture #19 Questionnaire on your way out.