Categorical Logic 2.0

Level II:
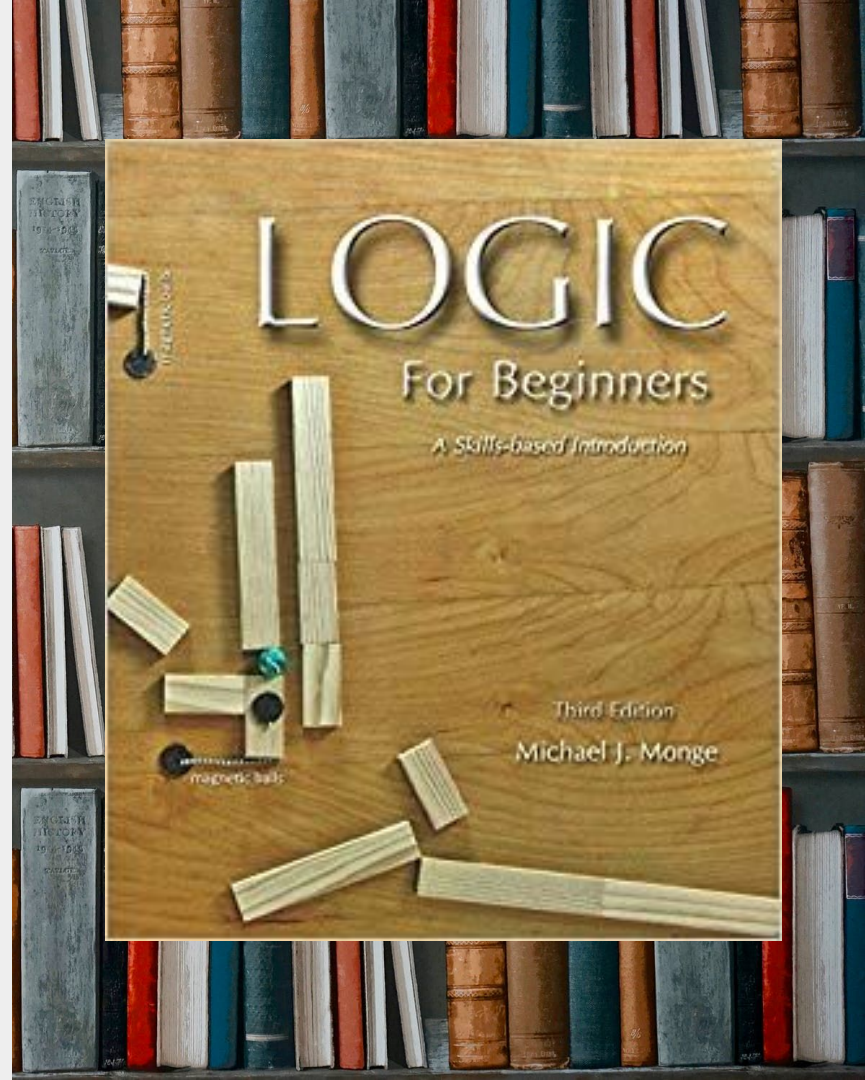# Categorical Syllogisms

Step 1:

Standard Form for a Categorical Syllogism

Important Concepts

"One advance that Aristotle made when dealing with categorical syllogisms was that we should try to standardize them as much as possible.

Once we take a jumbled mess and organize it, it is often easier to see connections and similarities which are otherwise obscured" (Monge 2017: 179).

A **categorical proposition** is a proposition that describes the relationship between two classes of objects.

A **syllogism** is an argument containing exactly two premises that work together to support a conclusion.

A categorical syllogism in standard form is a syllogism with the following properties:
A.   The syllogism must be composed of three standard-form categorical statements.
B.   The subject term of the conclusion must occur once and only once in the second premise, and not in the first premise.
C.   The predicate term of the conclusion must occur once and only once in the first premise, and not in the second premise.
D.   The other term in the first premise must also occur in the second premise.

For example...

1. All echidnas are monotremes.
2. All monotremes lay eggs.
3. So, all echidnas lay eggs.

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Major Term

The **major term** is the predicate term of the conclusion.

For example...

1. All monotremes are things that lay eggs.
2. All echidnas are monotremes.
3. So, all echidnas are things that lay eggs.

Minor Term

The **minor term** is the subject term of the conclusion.

For example…

1. All monotremes are things that lay eggs.
2. All echidnas are monotremes.
3. So, all echidnas are things that lay eggs.

Middle Term

The **middle term** is the term that appears once in each premise.

For example...

1. All monotremes are things that lay eggs.
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Mood

The **mood** of the argument is simply a chain of three letters, which marks the letter type of each statement in order.

For example...

1. All monotremes are things that lay eggs.
2. All echidnas are monotremes.
3. So, all echidnas are things that lay eggs.

A
A
A

Figure

The figure of a standard form categorical syllogism is a number between 1 and 4 which signifies the placement of the terms in the premises.

Figure 1	Figure 2	Figure 3	Figure 4
M P S̲ M̲ S P	P M S̲ M̲ S P	M P M̲ S̲ S P	P M M̲ S̲ S P

Monge (2017), Table 12.1, p. 181.

For example...

AAA-1

1. All monotremes are things that lay eggs. A
2. All echidnas are monotremes. A
3. So, all echidnas are things that lay eggs. A

Step 2:
Assessing for Validity

Figure 1	Figure 2	Figure 3	Figure 4	Monge (2017), Table 12.2, p. 182.
AAA–1 EAE–1 AII–1 EIO–1	AEE–2 EAE–2 AOO–2 EIO–2	AII–3 IAI–3 EIO–3 OAO–3	AEE–4 IAI–4 EIO–4	Unconditionally valid
AAI–1 EAO–1	AEO–2 EAO–2		AEO–4	Valid when the existential assumption is added (for subject term of conclusion)
			AAI–4	Valid when the existential assumption is added (for predicate term of conclusion)
		AAI–3 EAO–3	EAO–4	Valid when the existential assumption is added (for middle term)

Rule:

If an argument mood and figure is on the preceding table (Table 12.2), then the argument is valid.

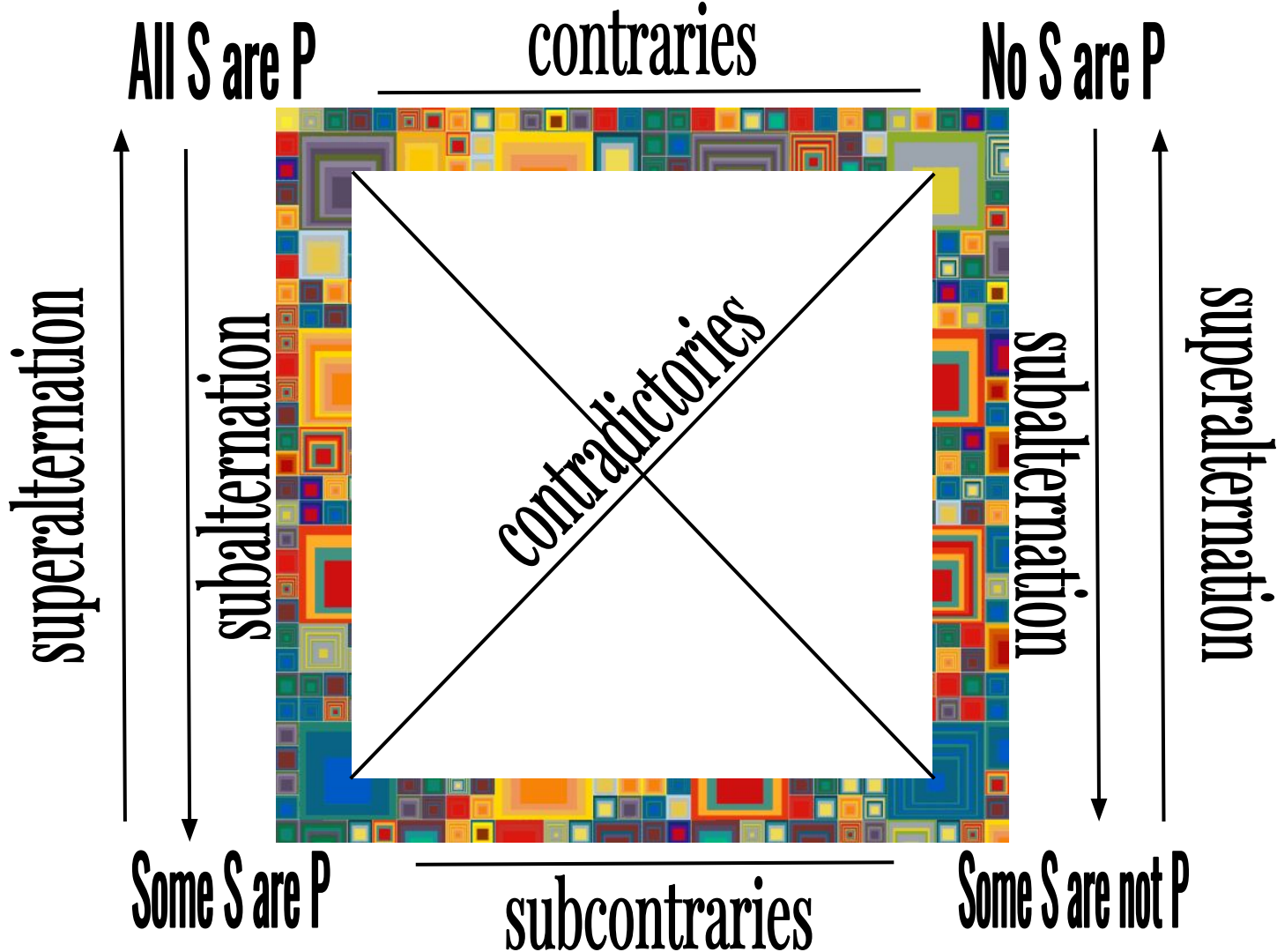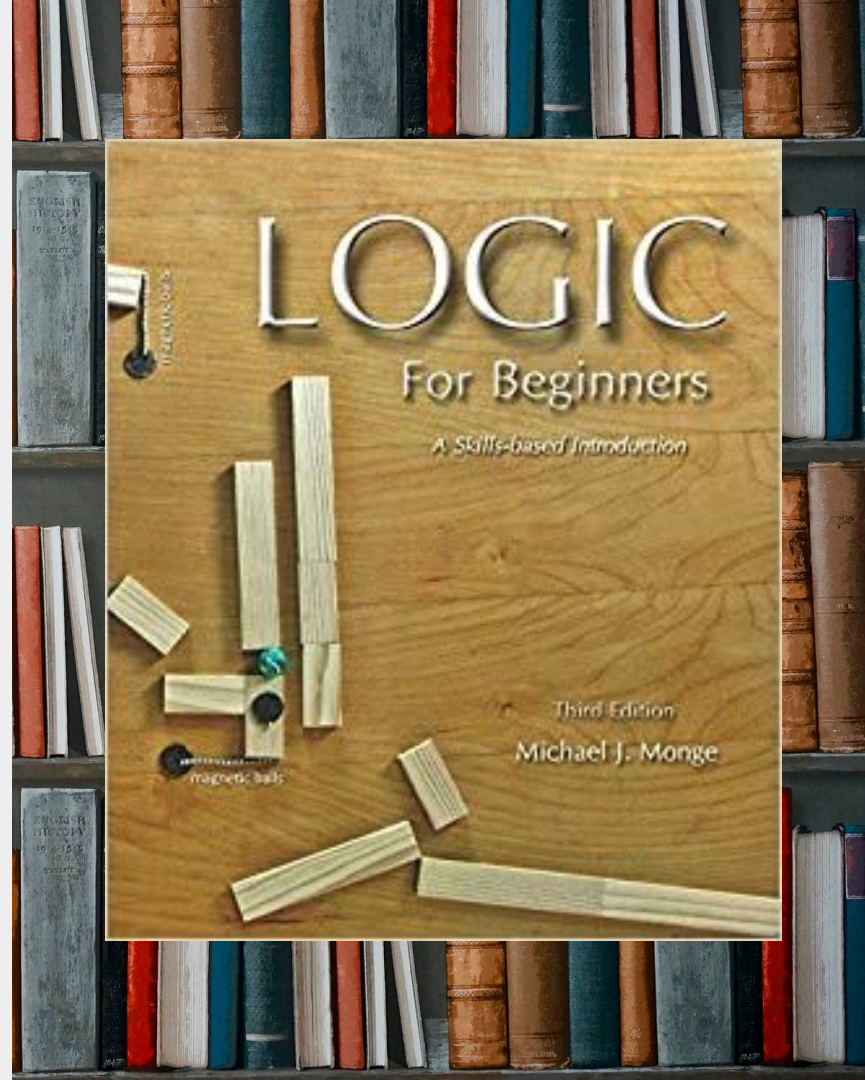If not, then the argument is invalid.

It's Valid!

Food for thought...

Question:
Is there something like the Square of Opposition for categorical syllogisms?
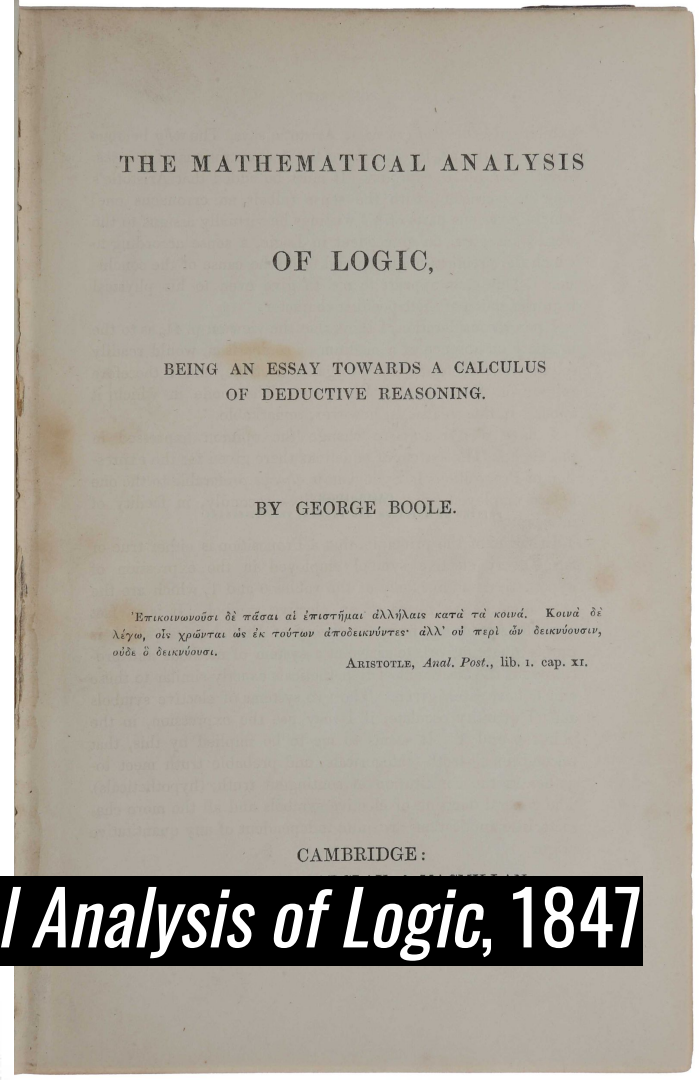
All S are P   contraries   No S are P

superalternation   subalternation   contradictories   subalternation   superalternation
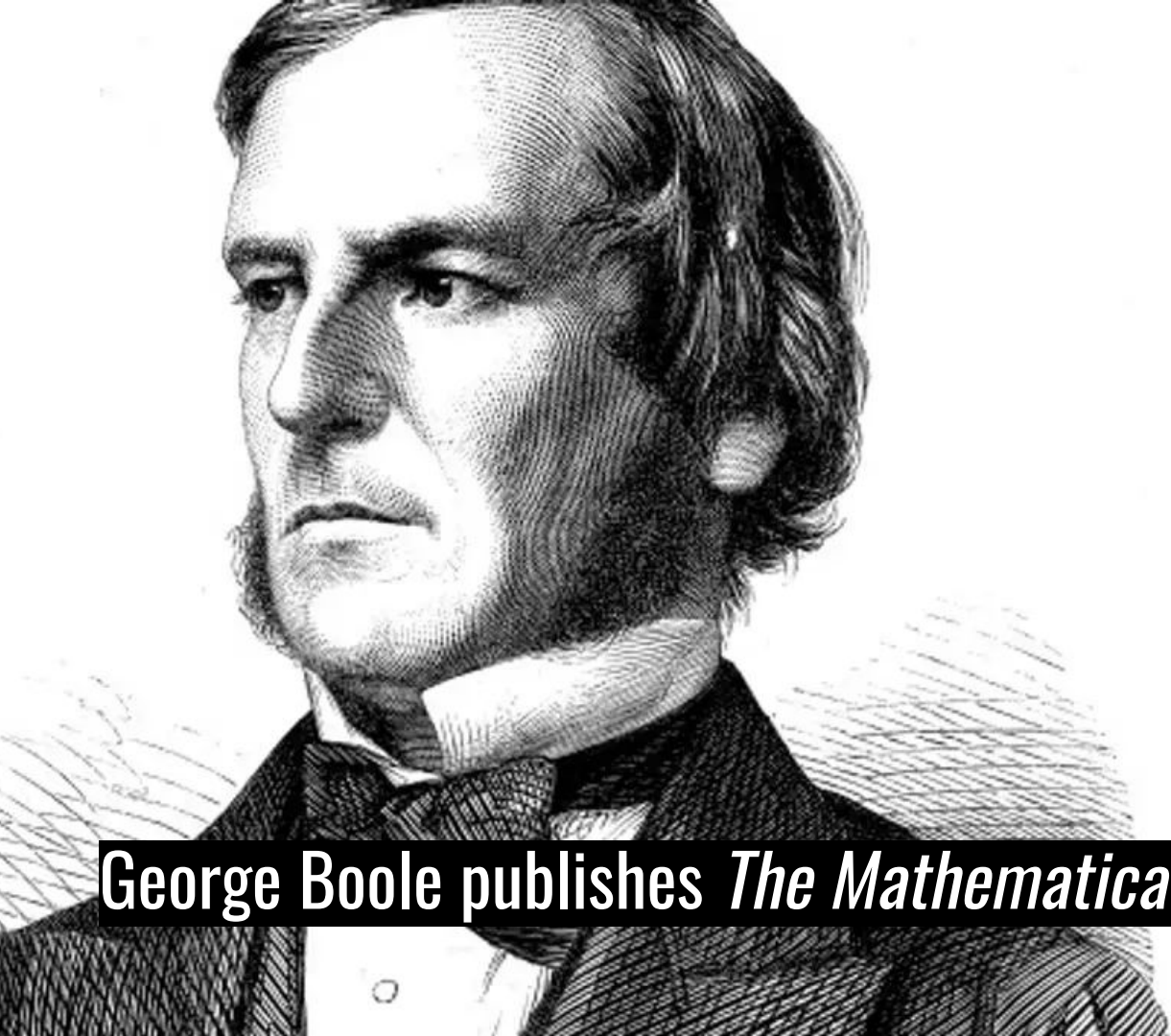
Some S are P   subcontraries   Some S are not P

The Circle of Opposition

See chapter 11 of Monge (2017) for how to use the Circle of Opposition.

Storytime!

THE MATHEMATICAL ANALYSIS

OF LOGIC,

BEING AN ESSAY TOWARDS A CALCULUS
OF DEDUCTIVE REASONING.

BY GEORGE BOOLE.

Ἐπικοινωνοῦσι δὲ πᾶσαι αἱ ἐπιστῆμαι ἀλλήλαις κατὰ τὰ κοινά. Κοινὰ δὲ
λέγω, οἷν χρῶνται ὡς ἐκ τούτων ἀποδεικνύντες· ἀλλ' οὐ περὶ ὧν δεικνύουσιν,
οὐδὲ ὃ δεικνύουσι.

ARISTOTLE, Anal. Post., lib. I. cap. XI.

CAMBRIDGE:

George Boole publishes *The Mathematical Analysis of Logic*, 1847

SYMBOLIC LOGIC

BY

JOHN VENN, M.A.,

FELLOW, AND LECTURER IN THE MORAL SCIENCES,

GONVILLE AND CAIUS COLLEGE, CAMBRIDGE.

"Sunt qui mathematicorum rigorem extra ipsas scientias, quas vulgo mathematicas appellamus, locum habere non putant. Sed illi ignorant, illam esse mathesin veram quæ in forma, ut logici vocant, radicatam."

Leibniz, *De vera methodo Philosophiæ et Theologiæ* (about 1686).

"Vere no tibi imponant mathematici lujil, qui splendidius suas figuras et algebraicos nomadicos universæ inventionis veri medium crepant."

Huygens, *De seriis seri et fuici*, Lib. II. Cap. iv. § 22. (1722).

London:

John Venn publishes *Symbolic Logic*, 1881

"Another revolutionary development in nineteenth-century logic was the discovery, by the English logician and philosopher John Venn (1834-1923), of a radically new way to show that a categorical syllogism is valid.

Venn's method allows us to visually represent the information content of categorical sentences, in such a way that we can actually see the relations between the sentences of a syllogism" (Herrick 2013: 176).

SYMBOLIC LOGIC

1881

[All Rights reserved.]
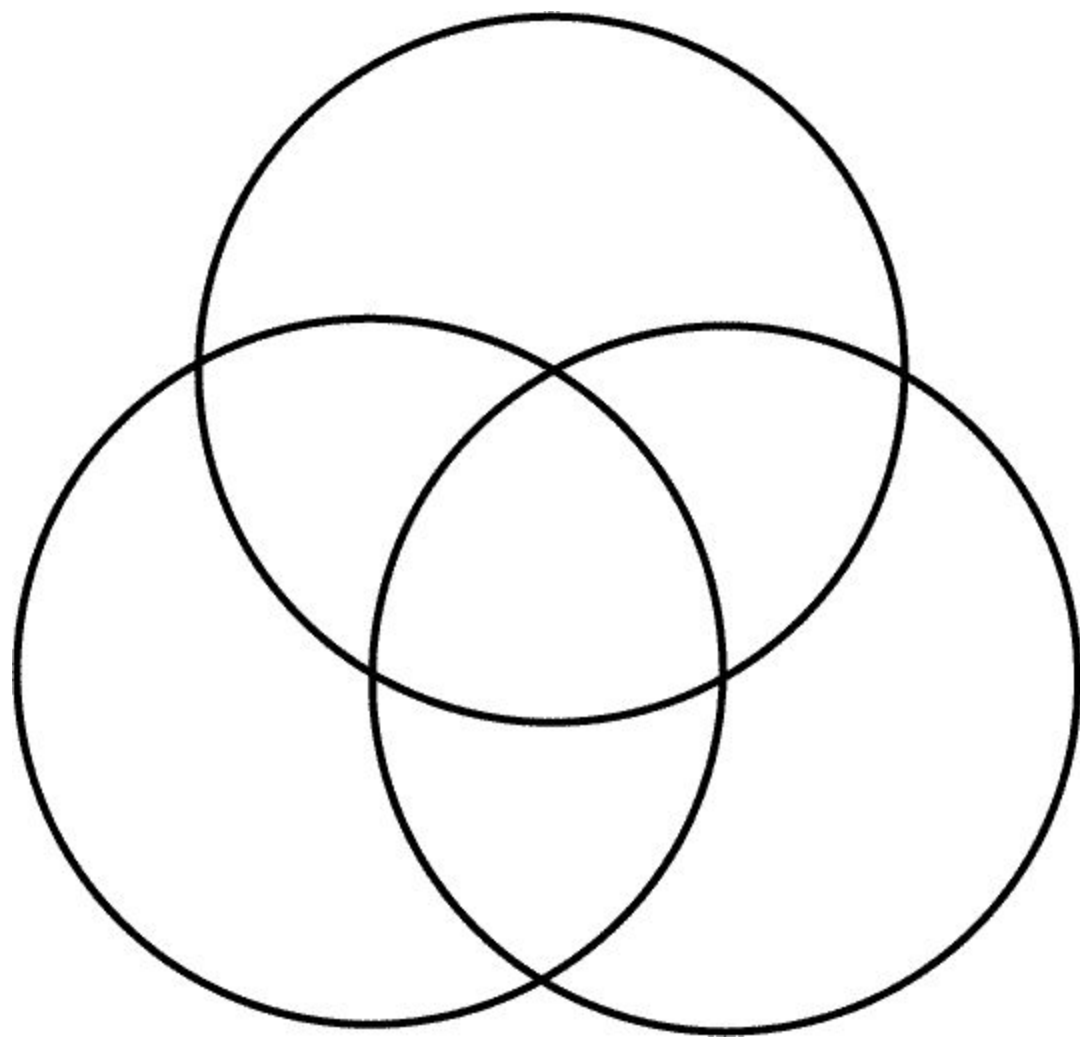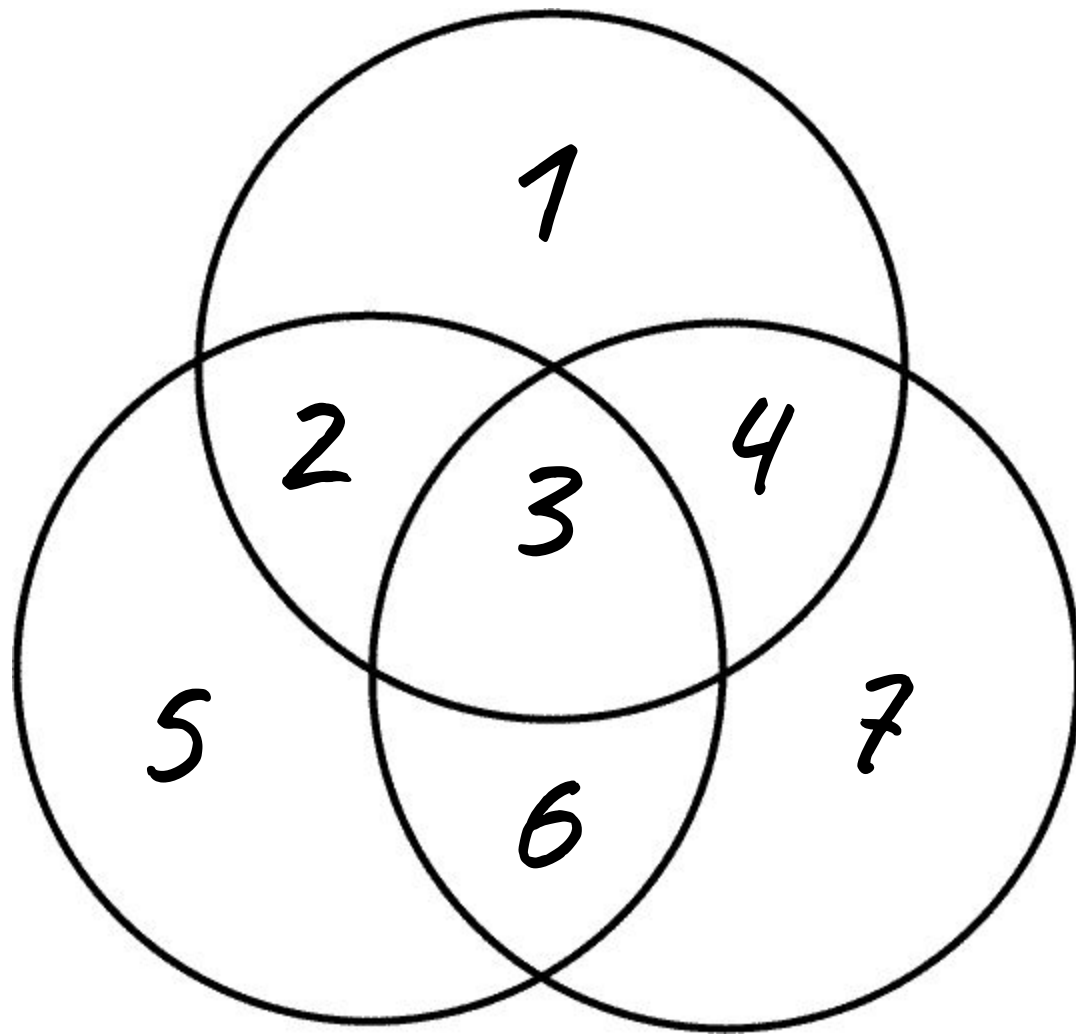
Steps for the Venn Diagram Test of Validity

1. Abbreviate.

   Abbreviate the argument, replacing each category with a single capital letter.

2. Draw and Label.

   Label the circles (with capital letters) using the subject term of the conclusion for the lower left circle, the predicate term of the conclusion for the lower right circle, and the middle term on the middle circle.

Steps for the Venn Diagram Test of Validity

3. Decide on Order.
   Note: If the argument contains a universal premise, enter its information first. If the argument contains two universal premises or two particular premises, order doesn't matter.
4. Enter Premise Information.
   Universal statements get shaded.
   Particular statements get an X.

Note:

When placing an X in an area, if one part of the area has been shaded, place the X in an unshaded part.

When placing an X in an area, if a circle's line runs through the area, place the X directly on the line separating the area into two regions. In other words, the X must "straddle" the line, hanging over both sides equally.

An X straddling a line means that, for all we know, the individual represented by the X might be on either side of the line, or on both sides; in other words, it is not known which side of the line the X is actually on.

Steps for the Venn Diagram Test of Validity

5. Remember to decide if you are taking the hypothetical viewpoint or the Aristotelian viewpoint.

Note: Look at the two circles standing for the subject terms of your premises. If these terms refer to existing things, and if there is only one region unshaded in either or both circles, place an X in that unshaded region (thereby presenting the existential viewpoint). If these terms refer to things that do not exist or the arguer does not wish to assume exist, then you are finished (thereby presenting the hypothetical viewpoint). Repeat for the middle and predicate terms.

Steps for the Venn Diagram Test of Validity

6. Assess for validity.

A categorical syllogism is valid if, by diagramming only the premises, we have also diagrammed the information found in the conclusion.

A categorical syllogism is invalid if, when we have diagrammed the information content of the premises, information must be added to the diagram to represent the information content of the conclusion.

CAUTION:

If no X or shading appears in an area, this does **not** say that nothing exists in the area; rather, it indicates that **nothing is known** of the area.

Again, it only means we have no information about the area.

Thus, for all we know, the area might be empty, or it might contain one or more things.

Steps for the Venn Diagram Test of Validity

7. Label the argument valid or invalid.
8. Look over your work.

Homework!
[This](#)!