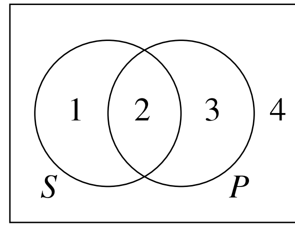
Philosophy 57 — Day 9

- Quiz #2 Returned Today (Solutions Posted on Website)
  - Curve to be announced in class . . .
    - ∗ stay tuned for curve . . .
- Quiz #3 is next Tuesday 03/04/03 (on chapter 4, through Thursday)
- Back to Chapter 4 — Categorical Statements (sections 4.5–4.6 *skipped*)
  - Venn Diagrams, Simple Arguments, and the Square of Opposition
  - Conversion, Obversion, and Contraposition
  - Translating from English into Categorical Logic

Chapter 4: Categorical Statements — Venn Diagrams & The Square of Opposition I



The box stands for the class of "all things".

Region 1 = the class of things which are inside S but outside P.
Region 2 = the class of things which are inside S and inside P.
Region 3 = the class of things which are outside S and inside P.
Region 4 = the class of things which are outside S and outside P.

(A) All S are P. = No members of S are *outside* P (nothing in 1).

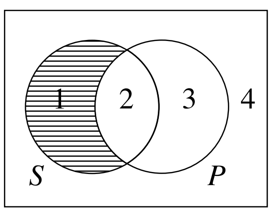
(E) No S are P. = No members of S are *inside* P (nothing in 2).

(I) Some S are P. = At least one S is inside P (something in 2).

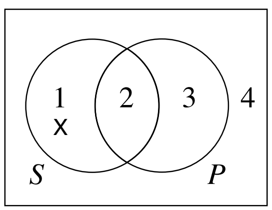
(O) Some S are not P. = At least one S is outside P (something in 1).

Chapter 4: Categorical Statements — Venn Diagrams & The Square of Opposition II

- Three steps: (1) Draw the Venn Diagram for the premise, (2) Draw the Venn Diagram for the conclusion, (3) Does the premise-diagram contain the information in conclusion-diagram? If so, then the inference is valid.
- Example: $\frac{\mathbf{A}}{\therefore \mathbf{O}}$. Putting the **A** and **O** diagrams side by side, we have:



$\not\Rightarrow$

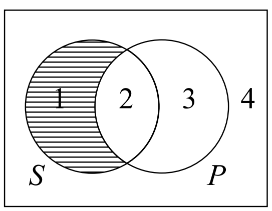


(**A**) All S are P. (**O**) Some S are not P.

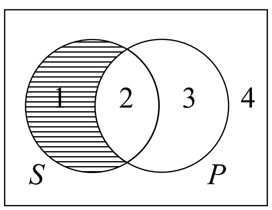
- We can see that the premise-diagram does not contain the information of the conclusion diagram. So, the argument $\frac{\mathbf{A}}{\therefore \mathbf{O}}$ is *invalid* (**A** $\not\Rightarrow$ **O**).
- What about the argument from **A** to the *denial* of **O**?

Chapter 4: Categorical Statements — Venn Diagrams & The Square of Opposition III

- To draw the Venn diagram for the *denial* of a categorical claim, one marks the same regions as for the categorical claim itself — *but in the opposite ways*. Instead of putting an "X" in a region, one shades it (and *vice versa*).
- So, the *denial* of an **O** claim would look like this:



$=$

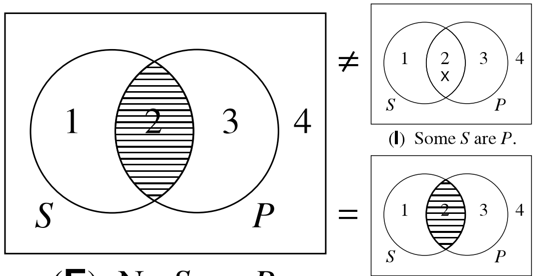


(**A**) All S are P. not–(**O**) It is not the case that Some S are not P.

- But, this *is* just the **A**-diagram! That is, the **A**-diagram contains the information in the *not*-**O**-diagram. Hence, $\frac{\mathbf{A}}{\therefore \textit{not-}\mathbf{O}}$ *is valid* (**A** $\Rightarrow$ *not*-**O**).

Chapter 4: Categorical Statements — Venn Diagrams & The Square of Opposition IV

- We can use the same technique to analyze $\frac{\mathbf{E}}{\therefore \mathbf{I}}$ and $\frac{\mathbf{E}}{\therefore \textit{not-}\mathbf{I}}$. Let's do $\frac{\mathbf{E}}{\therefore \textit{not-}\mathbf{I}}$.
- Let's draw the diagrams for **E**, **I**, and the *denial* of **I**:



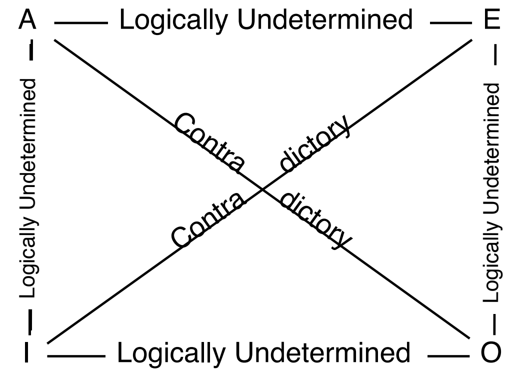
(**E**) No *S* are *P*.

(**I**) Some *S* are *P*.

not–(**I**) It is not the case that Some *S* are *P*

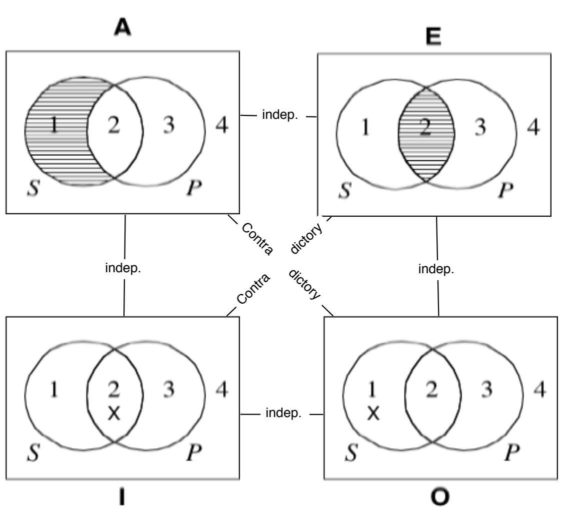
- We can see plainly that **E** $\not\Rightarrow$ **I**, **I** $\not\Rightarrow$ **E**, **E** $\Rightarrow$ *not*-**I**, and *not*-**I** $\Rightarrow$ **E**.
- Also: **I** $\not\Rightarrow$ *not***O**, **A** $\not\Rightarrow$ **I**, **A** $\not\Rightarrow$ *not*-**I**, **E** $\not\Rightarrow$ **O**, **E** $\not\Rightarrow$ *not*-**O**. These logical relationships between **A**, **E**, **I**, **O** are summarized in the Square of Opposition.

Chapter 4: Categorical Statements — Venn Diagrams & The Square of Opposition V



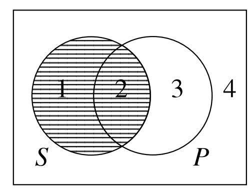
- This Square is just a handy way of summarizing the following 12 logical relationships between the four standard form categorical claims:
  - **A** $\Rightarrow$ *not*-**O**, **O** $\Rightarrow$ *not*-**A**, **E** $\Rightarrow$ *not*-**I**, **I** $\Rightarrow$ *not*-**E**, **I** $\not\Rightarrow$ **O**, **I** $\not\Rightarrow$ *not*-**O**, **A** $\not\Rightarrow$ **I**, **A** $\not\Rightarrow$ *not*-**I**, **E** $\not\Rightarrow$ **O**, **E** $\not\Rightarrow$ *not*-**O**, **A** $\not\Rightarrow$ **E**, **A** $\not\Rightarrow$ *not*-**E**.

Chapter 4: Categorical Statements — Venn Diagrams & The Square of Opposition VI

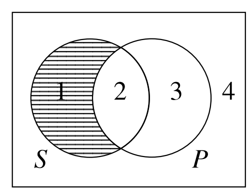


Chapter 4: Categorical Statements — Venn Diagrams & The Square of Opposition VII

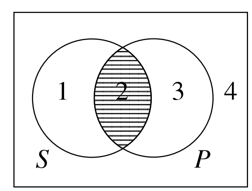
- Exercise from above: prove that "Nothing is an *S*" implies *both* **A** *and* **E**.



"Nothing is an *S*"



(**A**) All *S* are *P*.



(**E**) No *S* are *P*.

- The top diagram contains the information in *both* bottom diagrams.

Chapter 4: Categorical Statements — Conversion, Obversion & Contraposition I

- Conversion, Obversion, and Contraposition are three important operations or transformations that can be performed on categorical statements.
- The Converse of a categorical statement is obtained by switching its subject and predicate terms. This switching process is called Conversion.

Proposition	Name	Converse
All *A* are *B*.	**A**	All *B* are *A*.
No *A* are *B*.	**E**	No *B* are *A*.
Some *A* are *B*.	**I**	Some *B* are *A*.
Some *A* are not *B*.	**O**	Some *B* are not *A*.

- Some statements are *equivalent to* (*i.e., have the same Venn Diagram as*) their converses. Some statements are *not* equivalent to their converses.
- **E** and **I** claims are equivalent to their converses, whereas **A** and **O** claims are *not* equivalent to their converses. Let's *prove* this with Venn Diagrams.

Chapter 4: Categorical Statements — Conversion, Obversion & Contraposition II

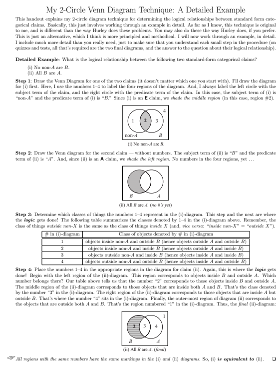
- The complement of a term "*X*" is written "non-*X*", and it denotes the class of things *not* contained in the *X*-class. Do not confuse "not" and "non-". "not" is part of the *copula* "are not", but "non-" is part of a *term* "non-*X*" ("non-*X*" can be either the subject term or the predicate term of a categorical statement).
- The Obverse of a categorical statement is obtained by: (1) switching the quality (but *not* the quantity!) of the statement, and (2) replacing the predicate term with its complement. This 2-step process is called Obversion.

Proposition	Name	Obverse
All *A* are *B*.	**A**	No *A* are non-*B*.
No *A* are *B*.	**E**	All *A* are non-*B*.
Some *A* are *B*.	**I**	Some *A* are not non-*B*.
Some *A* are not *B*.	**O**	Some *A* are non-*B*.

- *All* categorical statements are logically equivalent to their obverses. Let's *prove* this for each of the four categorical claims, using Venn Diagrams.

Chapter 4: Categorical Statements — Conversion, Obversion & Contraposition II.1

- At this point, we need to be more careful with our Venn Diagram Method! So far, we have not seen any Venn Diagrams with complemented terms in them.
- Let's do an example to see how we must handle this new case.
- Here, I will go over the handout on my 2-Circle Venn Diagram Method.



Chapter 4: Categorical Statements — Conversion, Obversion & Contraposition III

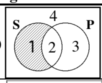
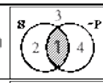
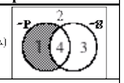
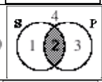
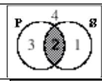
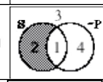
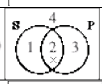
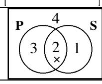
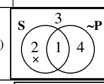
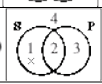
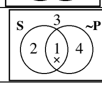
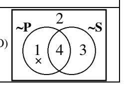
- The Contrapositive of a categorical statement is obtained by: (1) *converting* the statement, and (2) replacing both the subject term and the predicate term with their complements. This 2-step process is called Contraposition.

Proposition	Name	Contrapositive
All *A* are *B*.	**A**	All non-*B* are non-*A*.
No *A* are *B*.	**E**	No non-*B* are non-*A*.
Some *A* are *B*.	**I**	Some non-*B* are non-*A*.
Some *A* are not *B*.	**O**	Some non-*B* are not non-*A*.

- Some statements are *equivalent to* (*i.e., have the same Venn Diagram as*) their contrapositives. Some statements are *not* equivalent to their contrapositives.
- **A** and **O** claims are equivalent to their contrapositives, whereas **E** and **I** claims are *not* equivalent to their contrapositives. Let's *prove* this with Venn's.

Chapter 4: Categorical Statements — Conversion, Obversion & Contraposition IV

Proposition	**Converse**	**Obverse**	**Contrapositive**
(**A**) All *A* are *B*.	All *B* are *A*. (≠)	No *A* are non-*B*. (=)	All non-*B* are non-*A*. (=)
(**E**) No *A* are *B*.	No *B* are *A*. (=)	All *A* are non-*B*. (=)	No non-*B* are non-*A*. (≠)
(**I**) Some *A* are *B*.	Some *B* are *A*. (=)	Some *A* are not non-*B*. (=)	Some non-*B* are non-*A*. (≠)
(**O**) Some *A* are not *B*.	Some *B* are not *A*. (≠)	Some *A* are non-*B*. (=)	Some non-*B* are not non-*A*. (=)

Categorical Claim	Converse	Obverse	Contrapositive
(A) 	All P are S	Obverse(A) 	Contrapositive(A) 
(E) 	Converse(E) 	Obverse(E) 	No non–P are non–S
(I) 	Converse(I) 	Obverse(I) 	Some non–P are non–S
(O) 	Some P are not S	Obverse(O) 	Contrapositive(O) 

Chapter 4: Categorical Statements — Translation from English Overview

- Many English claims can be translated faithfully into one of the four standard form categorical claims. There are 10 things to look out for.
  * Terms Without Nouns
  * Nonstandard Verbs
  * Singular Propositions
  * Adverbs and Pronouns
  * Unexpressed Quantifiers
  * Nonstandard Quantifiers
  * Conditional Statements
  * Exclusive Propositions
  * "The Only"
  * Exceptive Pronouns
- You do not need to remember the names of these 10 watchwords, but you'll need to know how to translate English sentences which involve them.

Chapter 4: Categorical Statements — Translation from English I

- Terms Without Nouns: The subject and predicate terms of a categorical proposition must contain either a plural noun or a pronoun that serves to denote the class indicated by the term.
- Nouns and pronouns denote classes, while adjectives (and participles) connote attributes or properties. We must replace mere adjectives with noun phrases.
- Examples:
  - "Some roses are red." Here, the subject term is a noun and properly denotes a class of things (i.e., roses). But, the predicate term is a mere adjective and does not denote a class. How do we fix this?
  - "All tigers are carnivorous." Again, the subject term is a noun and properly denotes a class of things (*i.e.*, tigers). But, the predicate term is a mere adjective and does not denote a class. How do we fix this?

Chapter 4: Categorical Statements — Translation from English II

- Nonstandard Verbs: The only copulas that are allowed in standard form are "are" and "are not." Statements in English often use other forms of the verb "to be." These need to be translated into standard form.
- Examples:
  - "Some college students will become educated." How do we translate this into something of the standard form "Some college students are _______"?
  - "Some dogs would rather bark than bite." How do we translate this into something of the standard form "Some dogs are _______"?
- Sometimes the verb "to be" does not occur at all, as in:
  - "Some birds fly south for the winter." How do we translate this into something of the standard form "Some birds are _______"?
  - "All ducks swim." How do we translate this into something of the standard form "All ducks are _______"?