

## Philosophy 57 — Day 7

- Quiz #2 Today (Chapter 3 — “Fallacy Matching”)
- On to Chapter 4 — Categorical Logic
  - The Language of Categorical Logic
  - Categorical Statements (four kinds)
  - Their Grammar (also called syntax)
  - Their Meaning (also called semantics)
  - Using Venn Diagrams to Picture Categorical Statements



## Chapter 4: Categorical Statements — Overview & Definition

- I will not be covering sections 4.5 or 4.6. These sections are concerned with the traditional (ancient), Aristotelian perspective on categorical claims.
- Moreover, I will only be discussing the modern, Boolean perspective on categorical claims. This excludes some stuff from section 4.3 as well.
- Our goal in 4 & 5 is to learn how to analyze categorical *arguments* (*syllogisms*). First, we need categorical *statements* (their building blocks).
- Here are two examples of categorical statements in ordinary language:
  - \* Light rays travel at a fixed speed.
  - \* Not all convicted murderers get the death penalty.
- A **categorical statement** (or **proposition**) relates two classes or categories, denoted by the **subject term** (*S*) and the **predicate term** (*P*). Categorical statements assert that either all or part of *S* is included in (excluded from) *P*.
- What are *S* and *P* in the above two categorical statements?



## Chapter 4: Categorical Statements — Forms & Components

- Categorical statements come in four **standard forms** (we’ll discuss *translating* categorical claims from English into standard form at the end of the chapter):
  - \* All *S* are *P*.
  - \* No *S* are *P*.
  - \* Some *S* are *P*.
  - \* Some *S* are not *P*.
- The words “all”, “no” and “some” are called **quantifiers** because they specify *how much of S* is included in (or excluded from) *P*.
- The words “are” and “are not” are called the **copula**, because they link (or “couple”) the subject term with the predicate term.
- Consider the following example of a standard form categorical statement:
  - \* All members of the American Medical Association are persons holding degrees from recognized academic institutions.
- What are its quantifier, subject term, predicate term, and copula?



## Chapter 4: Categorical Statements — Quality, Quantity & Distribution I

- |                                  |   |
|----------------------------------|---|
| All <i>S</i> are <i>P</i> .      | Every member of the <i>S</i> class is a member of the <i>P</i> class. In other words, the <i>S</i> class is <i>contained in</i> the <i>P</i> class. |
| No <i>S</i> are <i>P</i> .       | No member of the <i>S</i> class is a member of the <i>P</i> class. In other words, the <i>S</i> class is <i>excluded from</i> the <i>P</i> class.   |
| Some <i>S</i> are <i>P</i> .     | At least one member of the <i>S</i> class is a member of the <i>P</i> class.  |
| Some <i>S</i> are not <i>P</i> . | At least one member of the <i>S</i> class is <i>not</i> a member of the <i>P</i> class.   |
- The **quality** of a categorical claim is either **affirmative** or **negative**, depending on whether it *affirms* or *denies* class membership.
    - \* “All *S* are *P*” and “Some *S* are *P*” have *affirmative* quality.
    - \* “No *S* are *P*” and “Some *S* are not *P*” have *negative* quality.
  - The **quantity** of a categorical claim is either **universal** or **particular**, depending on whether it makes a claim about *every* member or just *some* member of *S*.
    - \* “All *S* are *P*” and “No *S* are *P*” are *universal*.
    - \* “Some *S* are *P*” and “Some *S* are not *P*” are *particular*.



**Chapter 4: Categorical Statements — Quality, Quantity & Distribution II**

- **Meaning Note:** “Some *S* are *P*” does *not* imply “Some *S* are not *P*.”
- It is customary to give the single letter names “**A**”, “**E**”, “**I**”, and “**O**” to the four kinds of standard form categorical claims (first four vowels).

Proposition	Letter Name	Quantity	Quality
All <i>S</i> are <i>P</i> .	<b>A</b>	Universal	Affirmative
No <i>S</i> are <i>P</i> .	<b>E</b>	Universal	Negative
Some <i>S</i> are <i>P</i> .	<b>I</b>	Particular	Affirmative
Some <i>S</i> are not <i>P</i> .	<b>O</b>	Particular	Negative

- Unlike quality and quantity, which are attributes of entire categorical statements, **distribution** is a property of a *term* in a categorical statement.
- A term *X* is **distributed** in a categorical statement if the statement asserts something about *every* member of the class *X* (otherwise, *X* is *undistributed*).
- For instance, in the categorical statement (**A**) “All *S* are *P*”, the term *S* is distributed, but the term *P* is *undistributed* (*why?*). What about **E**, **I**, **O** claims?



**Chapter 4: Categorical Statements — Quality, Quantity & Distribution III**

- To determine whether terms are distributed in claims, it helps to visualize what the claims assert about *S* and *P* using Venn Diagrams.
- In an **E** claim, “No *S* are *P*”, an assertion is made about every member of the class *S* (*i.e.*, that every member of the class *S* is *outside of* the class *P*).
- But, **E** claims *also* assert something about every member of the class *P* (*i.e.*, that every member of the class *P* is *outside of* the class *S*).
- So, *both S and P* are distributed in an **E** claim “No *S* are *P*”.
- In an **I** claim, “Some *S* are *P*”, an assertion is made about *at least one* member of *S* and *at least one* member of *P*. But, *no* assertion is made about *every* member of either class. So, *neither S nor P* is distributed in an **I** claim.
- In an **O** claim, “Some *S* are not *P*”, an assertion is made about *at least one* member of *S*, but *not* about *every* member of *S*. So, *S* is *undistributed* in **O**.
- But, *P* is distributed in an **O** claim. *Why?* Use a Venn Diagram here.



**Chapter 4: Categorical Statements — Quality, Quantity & Distribution IV**

Proposition	Name	Quantity	Quality	<i>S</i>	<i>P</i>
All <i>S</i> are <i>P</i> .	<b>A</b>	Universal	Affirmative	Distributed	Undistributed
No <i>S</i> are <i>P</i> .	<b>E</b>	Universal	Negative	Distributed	Distributed
Some <i>S</i> are <i>P</i> .	<b>I</b>	Particular	Affirmative	Undistributed	Undistributed
Some <i>S</i> are not <i>P</i> .	<b>O</b>	Particular	Negative	Undistributed	Distributed

- It may help to simply *memorize* the cases of distribution. The text offers two mnemonic devices for remembering the above facts about distribution.

**Mnemonic #1. Unprepared Students Never Pass.**

Universals distribute Subjects. Negatives distribute Predicates.

**Mnemonic #2. Any Student Earning B’s Is Not On Probation.**

**A** distributes Subject. **E** distributes Both.

**I** distributes Neither. **O** distributes Predicate.

- I prefer to *deduce* these using Venn Diagrams and the *definition of distribution*. **In Logic, answers can always be deduced from basic definitions.**



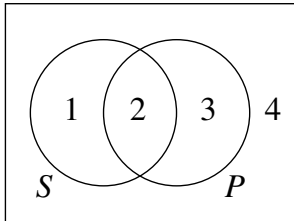
**Chapter 4: Categorical Statements — Venn Diagrams & The Square of Opposition I**

- Ultimately, we will use Venn Diagrams to test categorical *arguments* (*sylogisms*) for validity and invalidity. First, we need to learn how to represent categorical *statements* using Venn Diagrams.
- We will always operate from the *modern, Boolean* standpoint. You can ignore the stuff in the book about the traditional, Aristotelian standpoint.
- The standard from categorical statements can be understood as follows:
  - (**A**) All *S* are *P*. = No members of *S* are *outside P*.
  - (**E**) No *S* are *P*. = No members of *S* are *inside P*.
  - (**I**) Some *S* are *P*. = At least one *S* exists, and that *S* is a *P*.
  - (**O**) Some *S* are not *P*. = At least one *S* exists, and that *S* is not a *P*.
- **Note:** **A** and **E** do *not* imply that any *S*’s *exist!* This is the modern, Boolean standpoint. On the Aristotelian view, **A** and **E** *do* imply that some *S*’s exist.
- Consider “All unicorns are one-horned animals” (Boolean vs Aristotelian).



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

- To represent categorical statements using Venn Diagrams, we draw a box containing two overlapping circles. The box stands for “all things”, and the two circles stand for the *S* and *P* classes in the claim being represented.



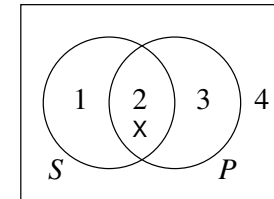
The box stands for the class of “all things”.

- It is helpful to think about which class of things are contained in each of 1–4.
- 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*.

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

- Next, we adopt the following two Venn Diagram conventions.
  - If a region (*i.e.*, 1–4) is *empty*, we use *shading (hashing)* to indicate this.
  - If a region contains *at least one thing*, we use an “X” to indicate this.
- For instance, recall that the **I** claim “Some *S* are *P*” asserts that *at least one S exists, and that S is inside of P*. How would we draw a Venn Diagram for **I**?

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

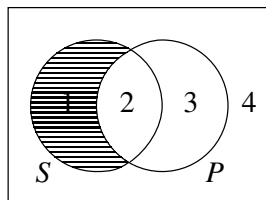


- “Some *S* are *P*” does **not** imply “Some *S* are not *P*”. The fact that there is something in region 2 does **not** imply that there is anything in region 1.
- What about the other three standard form categorical claims?

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

- A** and **E** claims will both involve *shading (hashing)* regions.

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



- Let’s draw the **E** and **O** diagrams together on the board.
- Consider the following simple Categorical argument (“**immediate inference**”):
 

Some trade spies are not masters at bribery.  
Therefore, it is false that all trade spies are masters at bribery.
- Let’s use Venn diagrams to prove that this argument is *valid*. First, we must express the argument using *standard form* categorical statements. Then, we will draw Venn Diagrams of the premise and the conclusion.