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 $S$ are $P$. Every member of the $S$ class is a member of the $P$ class. In other words, the $S$ class is contained in the $P$ class.

No $S$ are $P$. No member of the $S$ class is a member of the $P$ class. In other words, the $S$ class is excluded from the $P$ class.

Some $S$ are $P$. At least one member of the $S$ class is a member of the $P$ class.

Some $S$ are not $P$. At least one member of the $S$ class is not a member of the $P$ 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).

<table>
<thead>
<tr>
<th>Proposition</th>
<th>Letter Name</th>
<th>Quantity</th>
<th>Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>All S are P.</td>
<td>A</td>
<td>Universal</td>
<td>Affirmative</td>
</tr>
<tr>
<td>No S are P.</td>
<td>E</td>
<td>Universal</td>
<td>Negative</td>
</tr>
<tr>
<td>Some S are P.</td>
<td>I</td>
<td>Particular</td>
<td>Affirmative</td>
</tr>
<tr>
<td>Some S are not P.</td>
<td>O</td>
<td>Particular</td>
<td>Negative</td>
</tr>
</tbody>
</table>

- 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

<table>
<thead>
<tr>
<th>Proposition</th>
<th>Name</th>
<th>Quantity</th>
<th>Quality</th>
<th>S</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>All $S$ are $P$.</td>
<td>A</td>
<td>Universal</td>
<td>Affirmative</td>
<td>Distributed</td>
<td>Undistributed</td>
</tr>
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<td>No $S$ are $P$.</td>
<td>E</td>
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<td>Distributed</td>
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<td>Distributed</td>
</tr>
</tbody>
</table>

- 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 (syllogisms) 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.

- 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 $P$.

The box stands for the class of “all things”.
Chapter 4: Categorical Statements — Venn Diagrams & The Square of Opposition III

- Next, we adopt the following two Venn Diagram conventions.
  1. If a region (i.e., 1–4) is empty, we use shading (hashing) to indicate this.
  2. 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?

$$\text{(I) Some } S \text{ are } P.$$ 

- “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.