Chapter Six
Categorical Arguments

Categorical Arguments and Categorical Statements

- **Categorical arguments** are those that can be expressed with standard categorical statements.

- **Categorical statements** are statements about categories of things.
- A category is a **group of things with a shared characteristic**.

- Categorical statements thus say that **things of one group are or are not in some other group**.

Categorical Statements: An Example

- "Some apples are red"

Categories referred to:

- Things that are apples ---- G1
- Things that are red ---------G2

- The statement says that some of the things in G1 are also things in G2.
- Hence it has the form:
- Some G1 are G2

The Four Standard Categorical Statement Forms

UNIVERSAL AFFIRMATIVE (UA)

- **All G1 are G2**
- "All apples are red"

UNIVERSAL NEGATIVE (UN)

- **All G1 are not G2**
- "All apples are not red"
- Also: "No apples are red"

PARTICULAR AFFIRMATIVE (PA)

- **Some G1 are G2**
- "Some apples are red"

PARTICULAR NEGATIVE (PN)

- **Some G1 are not G2**
- "Some apples are not red"
- Also: "Not all apples are red"

The Four Parts of Categorical Statements

1. **Quantity**: Statement is universal or particular:

- **Universal**: It refers to **all things** in the class
- **Particular**: It refers to **some things** in the class

2. **Subject**: G1

3. **Quality**: Statement is affirmative or negative:

- **Affirmative**: Things in G1 **are** in G2
- **Negative:** Things in G1 **are not** in G2

4. **Predicate**: G2

Representing Categorical Statements: Venn Diagrams

Venn diagrams are devices used to **represent the meaning** of categorical statements.

- Venn diagrams use **circles to represent classes of things**.

- An **X inside a circle** means that there is something in that class.
- An **X in the overlapping area** between two circles represents a thing that belongs to both classes.
- An **X in the outside area** represents a thing that doesn't belong to either class.

- **Shaded areas are empty**: there is nothing in that area.

- **Blank areas** mean that **we don't know** whether there is something in that area or not.

Universal Affirmative Statements
All G1 are G2

- Every thing that is in G1 is also in G2
- If something is a G1, then it is in G2.

Example:

"**All** *college students* **are** *brilliant*"

Subject/G1 = (Things that are) College students

Predicate/G2 = Things that are brilliant

- If something is a college student, then that thing is brilliant.

Universal Affirmative Statements
All G1 are G2

The following are also Universal Affirmative Statements:

- “Toyotas have good mileage”

  Subject/G1= Toyotas; Predicate/G2 = Things that have good mileage

  “**All** *things that are Toyotas* **are** *things that have good mileage*”

- Compare: “College students are brilliant”

- “Only the strong will survive”

  Subject/G1 = Things that will survive; Predicate/G2 = Things that are strong

“**All** *things that will survive* **are** *things that are strong*”

- Compare: “Only brilliant people are college students”

Universal Negative Statements
All G1 are not G2

- Anything that is in G1 is not in G2
- If something is in G1, then it is not in G2.
- No thing in G1 is also on G2

Example:

"College students are not brilliant"

Subject/G1: College students

Predicate/G2: Brilliant things

- **All** (things that are) *college students* **are not (**things that are) *brilliant*
- If something is a college student, that thing is not brilliant

Universal Negative Statements
All G1 are not G2

- Universal Negative statements can also have the following form:

"Nobody is perfect"

Subject/G1: (Things that are) Human beings

Predicate/G2: Perfect things

- Nothing that is a person is a thing that is perfect
- **All** (things that are) *human beings* **are not (**things that are) *perfect*
- Compare: "No college student is brilliant"

Particular Affirmative Statements
Some G1 are G2

- At least one member of G1 is in G2
- There is something that is both in G1 and in G2

Example:
"Some college students are brilliant"
Subject/G1: College students
Predicate/G2: Brilliant things

- At least one thing is a college student and it is brilliant.
- **Some** (things that are) *college students* **are** (things that are) *brilliant*.

Particular Affirmative Statements
Some G1 are G2

The following are also examples of Particular Affirmative statements:

- Almost all college students are brilliant.
- Most college students are brilliant.
- Many college students are brilliant.
- A few college students are brilliant
- There is a college student that is brilliant.

They all mean that there is at least one thing in the first group that is also in the second group.

Particular Negative Statements
Some G1 are not G2

- At least one member of G1 is not in G2
- There is something that is in G1 and is not in G2

Example:
"Some college students are not brilliant"
Subject/G1: College students
Predicate/G2: Brilliant things

- At least one thing is a college student and it is not brilliant.
- **Some** (things that are) *college students* **are not** (things that are) *brilliant*.

Particular Negative Statements
Some G1 are not G2

Likewise, the following are examples of Particular Negative statements:

- Most college students are not brilliant.
- Many college students are not brilliant.
- A few college students are not brilliant
- There is a college student that is not brilliant.

They all mean that there is at least one thing in the first group that is **not** in the second group.

Consider especially the following case:

- “Not all college students are brilliant”

Categorical Arguments With One Premise

There are two main types of categorical arguments that have only one premise:

- Contradiction
- Conversion
- Contraposition
- Obversion

Contradiction

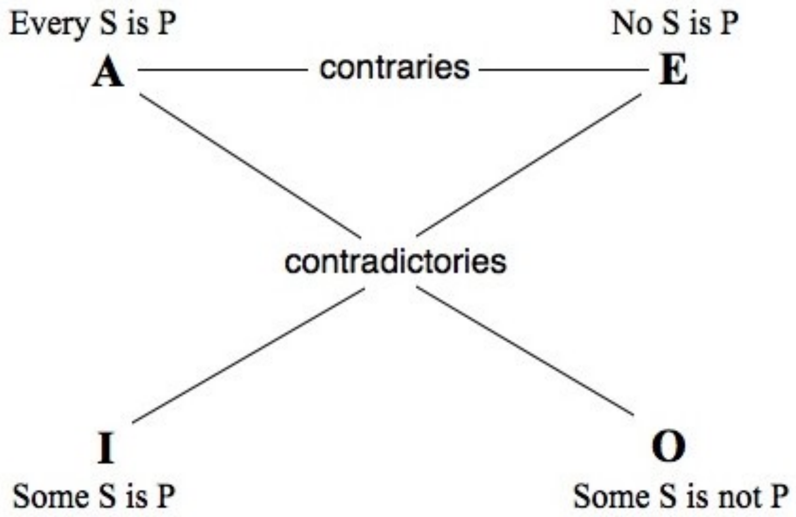
Contradictory statements or **contradictories** are pairs of statements that **cannot be both true and cannot be both false**.

- One of them has to be true, and the other one has to be false.

Contradictories have **opposed quantity and opposed quality**.

There are two pairs of contradictories:

- UA and PN
- UN and PA



Contradiction

Pairs of contradictories give raise to two valid forms:

(1) S1 is true
Therefore,
(2) Contradictory of S1 is false

(1) S1 is false
Therefore,
(2) Contradictory of S1 is true

[See a fully detailed list of contradictory forms on pp.201-202 and 236]

Examples:

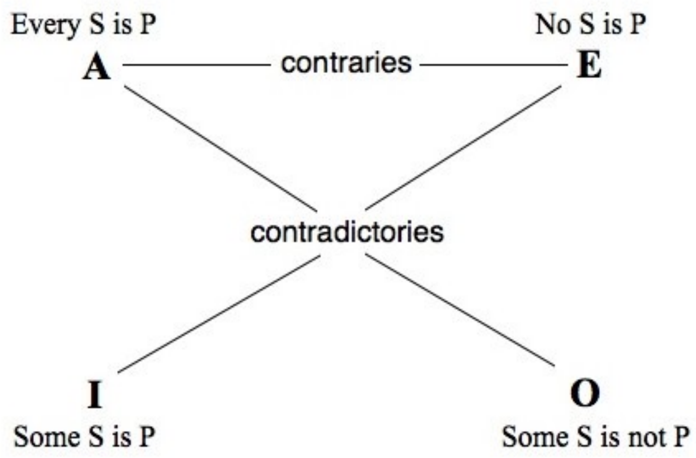
(1) All bunnies are mammals
Therefore,
(2) It is false that some bunnies are not mammals

(1) It is false that some bunnies are predators
Therefore,
(2) No bunnies are predators

Fallacy: Confusing a Contrary and a Contradictory

Contrary statements or **contraries** are pairs of statements that, like contradictories, **cannot be both true**.

But, unlike contradictories, **they can both be false**.



Because of this, it **is wrong to infer the truth of a statement from the falsity of its contrary**.
[But you can infer the falsity of a statement from the truth of its contrary]

Fallacy: Confusing a Contrary and a Contradictory

Examples:

(1) It is false that all bunnies are white.
Therefore,
(2) No bunnies are white.

> **WRONG: (2) doesn't follow**.
> It can be false that all bunnies are white, and it can also be false that no bunnies are white.

(1) All bunnies are rodents.
Therefore,
(2) It is false that no bunnies are rodents.

> **RIGHT**: If it is true that all bunnies are rodents, then it is false that no bunnies are rodents.

Conversion

The **converse** of a statement is a statement that **switches its subject and predicate**.

Example:

All ***bunnies*** are not ***predators***

Some ***bunnies*** are not ***white***

Converse statement:

All ***predators*** are not ***bunnies***

Some ***white things*** are not ***bunnies***.

Conversions are valid only in two cases:

UN statements:
(1) All G1 are not G2

Therefore,

(2) All G2 are not G1

PA statements:
(1) Some G1 are G2

Therefore,

(2) Some G2 are G1

Conversion: Examples

Valid (UN):

(1) All bunnies are not predators
Therefore,
(2) All predators are not bunnies

Valid (PA):

(1) Some bunnies are white
Therefore,
(2) Some white things are bunnies

Invalid (UA):

(1) All bunnies are rodents
Therefore,
(2) All rodents are bunnies

Invalid (PN):

(1) Some bunnies are not white
Therefore,
(2) Some white things are not bunnies

Technical Term: Distribution

Distribution is a **property of subject and predicate groups**.

A group is **distributed** when the statement says **something about all members of the group.**

- A group is **not distributed** when the statement doesn't say something about all members of the group.

Distributed groups:

- Subjects of universals

- Predicates of negatives

Non-distributed groups:

- Subjects of particulars

- Predicates of affirmatives

Technical Term: Distribution

<u>Distributed</u>:

Subjects of universals:

"All bunnies are rodents"
- **All members of the class of bunnies** are members of the class of rodents.

Predicates of negatives:

"Some bunnies are not white"
- **All members of the class of white things** are not some bunnies.

<u>Not distributed</u>:

Subjects of particulars:

"**Some bunnies** are messy"
- The statement doesn't say anything about the entire class of bunnies

Predicates of affirmatives:

"All bunnies are **rodents**"
- The statement doesn't say anything about the entire class of rodents
- At most, it says something about **some rodents** (says that they are bunnies)

Technical Term: Complement

The complement of a group is the **group of all things that are not in it**.

Example:	Complement:
Apples	Things that are not apples
Persons	Things that are not persons

Contraposition

The **contrapositive** of a statement is a statement that results from applying two operations to it:

1) **Switching** subject and predicate
2) **Replacing** subject and predicate with their **complements**.

Example:

"Some bunnies are cute"

Contrapositive:

"Some non-cute things are non-bunnies"

- Notice that you need to apply both steps to get the correct contrapositive.

"Some cute things are bunnies" – **WRONG**
- Not a contrapositive, but a converse.

Contraposition: Valid Forms

Contraposition gives raise to **valid argument forms** in two cases:

UA Statements:

(1) **All** G1 **are** G2
Therefore,
(2) **All** *non-G2* **are** *non-G1*

Example:

(1) **All** bunnies **are** mammals
Therefore,
(2) **All** *non-mammals* **are** *non-bunnies*

PN Statements:

(1) **Some** G1 **are** not G2
Therefore,
(2) **Some** *non-G2* **are** *non-G1*

Example:

(1) **Some** bunnies **are not** messy
Therefore,
(2) **Some** *non-messy things* **are not** *non-bunnies*

Contraposition: Invalid Forms

The following applications of Contraposition are **invalid**:

UN Statements:

(1) **All** G1 **are not** G2
Therefore,
(2) **All** *non-G2* **are not** *non-G1*

Example:

(1) **All** bunnies **are not** predators
Therefore,
(2) **All** *non-predators* **are not** *non-bunnies*

- Equivalent to:

All non-predators are bunnies

PA Statements:

(1) **Some** G1 **are** G2
Therefore,
(2) **Some** *non-G2* **are** *non-G1*

Example:

(1) **Some** bunnies **are** messy
Therefore,
(2) **Some** *non-messy things* **are** *non-bunnies*

Obversion

Like contraposition, **obversion** also consists of two steps:

1) **Change the quality** of the statement
2) Replace the **predicate with its complement**

Obversion is valid for all four categorical statements:

UA Statements
(1) All G1 **are** G2
Therefore,
(2) All G1 **are not** *non-G2*

UN Statements
(1) All G1 **are not** G2
Therefore,
(2) All G1 **are** *non-G2*

PA Statements
(1) Some G1 **are** G2
Therefore,
(2) Some G1 **are not** *non-G2*

PN Statements
(1) Some G1 **are not** G2
Therefore,
(2) Some G1 **are** *non-G2*

Obversion: Examples

Universal Affirmative:

(1) All bunnies **are** mammals
Therefore,
(2) All bunnies **are not** *non-mammals*.

Universal Negative:

(1) All bunnies **are not** predators
Therfore,
(2) All bunnies **are** *non-predators*

Particular Affirmative:

(1) Some bunnies **are** white
Therefore,
(2) Some bunnies **are not** *non-white*.

Particular Negative:

(1) Some bunnies **are not** white
Therefore,
(2) Some bunnies **are** *non-white*

Categorical Arguments With Two Premises:
Categorical Syllogisms

Categorical syllogisms are categorical arguments with three features:

1. They have precisely **three categorical statements** (two premises and a conclusion).
2. They mention precisely **three groups**.
3. Each group appears in **precisely two** of the three statements

Example:

(1) All *elastic arteries* are *capable of undergoing passive stretching*.
(2) All *aortas* are elastic arteries.
Therefore,
(3) All aortas are capable of undergoing passive stretching.

Evaluating Categorical Syllogisms: The Test Method

The test method for evaluating categorical syllogisms consists of four sub- tests:

1. The Equal Negatives Test
2. The Quantity Test
3. The Distributed Conclusion Test
4. The Distributed Middle Group Test

A categorical syllogism has to pass all four tests to be valid.

If it fails at least one of them, it is invalid.

1. The Equal Negatives Test

The **number of UN and PN statements** has to be the same in the premises and in the conclusion.

Example:

(1) All bunnies **are not** predators. - Premises contain one negation.
(2) Some predators have claws.
Therefore,
(3) All bunnies **are not** things with claws. - Conclusion contains one negation.

The argument passes the test.

1. The Equal Negatives Test

Arguments fail the Equal Negatives Test in three cases:

a) Both premises are negative

b) There is a negation in the premises, and the conclusion is affirmative

c) Both premises are affirmative, but conclusion is negative.

2. The Quantity Test

If **both premises are particular**, then **conclusion cannot be universal**.

If **both premises are universal**, then **conclusion cannot be particular**.

Example:

(1) **All** bunnies are not predators.
(2) **Some** predators have claws.
Therefore,
(3) **All** bunnies are not things with claws.

The argument passes the test.
Conclusion is universal, but there is a universal premise.

3. The Distributed Conclusion Test

Groups that are **distributed in the conclusion** must be **distributed in the premises** as well.

Example:

(1) All **bunnies** are not predators.
(2) Some predators **have claws**.
Therefore,
(3) All **bunnies** are not **things with claws**

"Bunnies" is distributed in the conclusion. But it is also distributed in premise 1. This is ok.
"Things with claws" is distributed in the conclusion. But it is not distributed in premise 2.

The argument fails the test.
Hence it is not a valid argument.

3. The Distributed Conclusion Test

The following argument passes the Distributed Conclusion test:

(1) All **bunnies** are not predators.
(2) Some predators **have claws**.
Therefore,
(3) Some **things with claws** are not **bunnies**

"Things with claws" is not distributed in the conclusion, so it doesn't have to be distributed in the premises.

"Bunnies" is distributed in the conclusion, but it is distributed in premise 1.

4. The Distributed Middle Group Test

The **middle group** (the group that is not in the conclusion) must be **distributed at least one time**.

Example:

(1) All bunnies are not **predators**.
(2) Some **predators** have claws.
Therefore,
(3) Some things with claws are not bunnies.

The argument passes the test.

The middle group is (things that are) predators.
It is distributed in premise 1.

Evaluating Categorical Syllogisms: The Venn Method

The Venn Method is an alternative way to test the validity of a categorical argument.

Categorical syllogisms can be represented with **Venn diagrams with three circles**.

A categorical syllogism has a valid form when **the Venn diagram of both premises already represents the conclusion**.

- In deductive arguments, the truth of the premises guarantees the truth of the conclusion.
- Thus, once premises are diagrammed, no extra diagramming is needed to represent the conclusion.

Evaluating Categorical Syllogisms: The Venn Method

- To use this method, you'll draw a Venn diagram with three circles.
- Universal premises should be diagrammed before particular premises.
- Shaded areas, blank areas and areas with an X are used just as they are used when representing single statements.
- Here, an X in the line that divides two areas indicates that there is at least one thing in at least one of these two areas.