

Deductive Reasoning

Categorical Logic

Chapter Objectives

Statements and Clauses

You will be able to

- define subject term, predicate term, copula, quantifier, quantity, and quality.
- memorize the four standard-form categorical statements.

Translations and Standard Form

You will be able to

- translate ordinary statements into standard categorical form.
- translate singular statements into standard form.

Diagramming Categorical Statements

You will be able to

- construct a Venn diagram for any categorical statement.
- memorize the Venn diagrams for the four standard-form categorical statements.
- use Venn diagrams to tell if two statements are, or are not, equivalent.

Assessing Categorical Statements

You will be able to

- understand the structure of categorical syllogisms.
- check the validity of a categorical argument by drawing Venn diagrams.

Chapter Summary

In categorical reasoning the statements, or claims of interest, are **categorical statements**—those that make simple assertions about categories, or classes, of things. Every categorical statement has a **subject term** and a **predicate term**. There are four standard forms of categorical statements:

1. **universal affirmative** (“All dogs are mammals”);
2. **universal negative** (“No dogs are mammals”);
3. **particular affirmative** (“Some dogs are mammals”); and
4. **particular negative** (“Some dogs are not mammals”).

Categorical statements must be translated into **standard form** before you can work with them. Translating involves identifying terms, ensuring that they designate classes, and determining the quantifiers. Drawing **Venn diagrams** is a good way to visualize categorical statements and to tell whether one statement is equivalent to another.

A **categorical syllogism** is an argument consisting of three categorical statements (two premises and a conclusion) that are interlinked in a structured way. The syllogism consists of a subject term, a predicate term, and a **middle term**. The middle term appears once in each premise. The subject term appears in one premise and the conclusion, and the predicate term appears in the other premise and the conclusion. You can use Venn diagrams to represent categorical statements, showing how the terms are related.

The easiest way to check the validity of a categorical syllogism is to draw a three-circle Venn diagram—three overlapping circles with the relationship between terms graphically indicated. If, after diagramming each premise, the diagram reflects what is asserted in the conclusion, the argument is valid. If not, the argument is invalid.

Answers to Select Textbook Exercises

Please note: These answers are for some of the questions that were not answered in Appendix B of *The Power of Critical Thinking*, Fifth Canadian Edition.

Exercise 6.1

4. $S =$ airplanes; $P =$ jets; particular affirmative; **I**
6. $S =$ urbanites who wear lumberjack jackets and big bushy beards; $P =$ hipsters; universal affirmative; **A**
15. $S =$ protestors at the Occupy Wall Street protest; $P =$ poor people; particular negative; **O**

Exercise 6.2

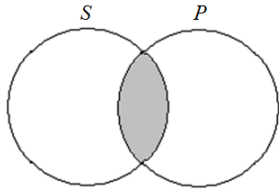
3. All hearts that beat beneath Scottish skies are brave hearts. **A**
7. Some people with pinched faces are persons who have poisonous hearts. **I**
15. No rap music songs are music popular among senior citizens. **E**

Exercise 6.3

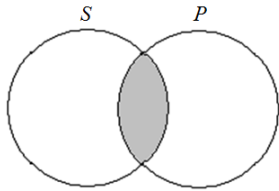
2. All political parties that gets at least 10 per cent of the vote in a general election are parties that should be considered major players in Canadian politics. **A**
9. Some people who are among us are people who will one day rise to greatness. **I**
19. Some birds are not non-flightless birds. (or “Some birds are flightless birds.”) **O**

Exercise 6.4

2. No man is an island. = No men are islands. S = men; P = islands.

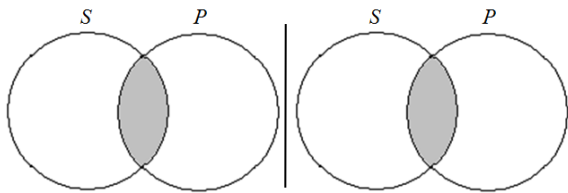


14. No stone was left unturned. = No stones are stones left unturned. S = stones; P = stones left unturned



Exercise 6.5

5. Equivalent



Exercise 6.6

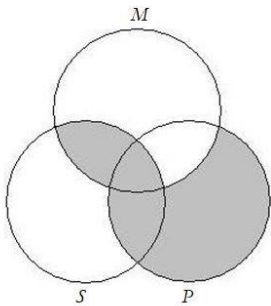
1. No essays are poems. Some blog entries are poems. So some blog entries are not essays.

S = Blog entries
 P = Essays
 M = Poems

No P are M .
 Some S are M .
 Therefore, some S are P .

Exercise 6.7

2. Valid



Exercise 6.8

2. All salty and high in fat foods are delicious foods. All Doritos are salty and high in fat foods. Therefore, All Doritos are delicious foods.

S = Doritos

P = Delicious foods

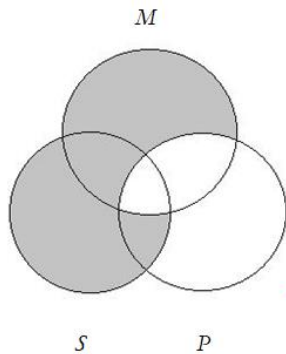
M = Salty and high in fat foods

All M are P

All S are M .

Therefore, all S are P .

Valid



Study Questions

1. What is categorical logic?
2. What is a categorical statement?
3. What are the four standard forms of categorical statements and what letters of the alphabet designate them?
4. What are the four main parts of a categorical statement?
5. What is a quantifier?
6. What does the term *quality* refer to in regard to categorical statements?
7. Why is translation an important skill in logic?
8. What is the first step in translating statements into standard form?
9. What term (subject or predicate) do the words “only” and “only if” precede in an A-statement?
10. In an A-statement, the words “the only” precede what term?
11. How can a singular statement be translated into standard form?

12. What are the quantifiers in the following statements?
 - a) “Every soldier is a warrior.”
 - b) “Kangaroos are good jumpers.”
13. What is the Venn diagram for an I-statement? For an A-statement?
14. What is the Venn diagram for “All S are non- P ”? What is the Venn diagram for “No P are S ”? Are these two statements equivalent?
15. What is a categorical syllogism?
16. What is the subject term in a categorical syllogism? The predicate term?
17. What is the procedure for checking the validity of a categorical syllogism?
17. If we reverse the position of S and P in each of the four basic forms of categorical statement (i.e., A, E, I, and O), in which of the four cases will we end up with a logically equivalent statement, and in which of the cases will we end up with a statement that is not equivalent? How do the Venn diagrams corresponding to the statements show this?
18. What three rules can be used for testing a categorical syllogism for validity without using a diagram?
19. Do we ever diagram the conclusion of a categorical syllogism, when using a Venn diagram to test it for validity? Why or why not?

Self-Assessment Quiz

Scroll down for answers.

Categorical Syllogisms for Analysis

Use the Venn diagram method to evaluate the following categorical syllogisms.

1. All rap musicians are poor singers. All poor singers are Virgos. Therefore, all rap musicians are Virgos.
2. Some princesses are royals. No royal is a commoner. Therefore, some commoners are not princesses.
3. Some Nova Scotians love eating lobster. No vegetarians love eating lobster. So, some Nova Scotians are not vegetarians.
4. All fruits are healthy for teenagers. Some foods that are healthy for teenagers are harmful to old men. So, some fruits are not healthy for old men.

5. Only Ryan Reynolds movies are funny. Some funny movies star Sandra Bullock. So, it is clear that some Ryan Reynolds movies star Sandra Bullock.
6. Connor McDavid is a hockey player. Some hockey players are all-stars. Therefore, Connor McDavid is an all-star.
7. All students who study hard can do well in this course. All students who do well in this course will be successful in their careers. So, all students who study hard will become successful in their careers.
8. Justin Trudeau is the current Prime Minister of Canada. The Prime Minister of Canada has a diplomatic passport. So, Justin Trudeau has a diplomatic passport.
9. People who travel widely develop cultural sensitivity. My mother does not travel widely. Therefore, she is not culturally sensitive.
10. My friends are not pot smokers. Chiara is my friend. Therefore, Chiara does not smoke pot.
11. Bananas are fruits. Some fruits do not contain high calories. So, some bananas do not contain high calories.
12. Every telescope is an instrument. Some instruments are not properly calibrated. So, some telescopes are not properly calibrated.
13. Most lighthouses are illuminated. Every illuminated building is visible. Thus, most lighthouses are visible.
14. Some octogenarians are grumpy folks. Some grumpy folks are old folks. Therefore, some octogenarians are old folks.
15. Many winter days are cold. No summer days are winter days. So no summer days are cold days.
16. Each city is a municipality. Every municipality is a township. Thus, all townships are cities.
17. All aqueducts are channels. Every channel is a waterway. Thus, each aqueduct is a waterway.
18. No mountains are foothills. But since no valleys are foothills, it follows that some valleys are mountains.
19. All fairies are guardian angels. Every guardian angel has a cloud castle. So, some fairies have cloud castles.
20. Every Kangaroo is a marsupial. Not a single whale is a marsupial, and thus, not a single whale is a Kangaroo.

Answers to Self-Assessment Quiz

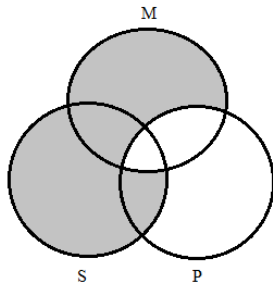
Passages for Evaluation

1. All rap musicians are poor singers. All poor singers are Virgos. Therefore, all rap musicians are Virgos.

S = Rap musicians
 P = Virgos
 M = Poor singers

All M are P .
All S are M .
Therefore, all S are P .

(Valid)

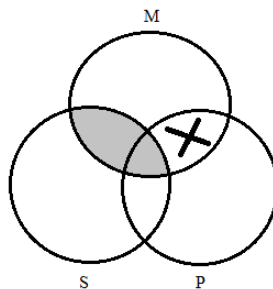


2. Some princesses are royals. No royal is a commoner. Therefore, some commoners are not princesses.

S = Commoners
 P = Princesses
 M = Royals

Some P are M .
No M are S .
Therefore, some S are not P .

Invalid

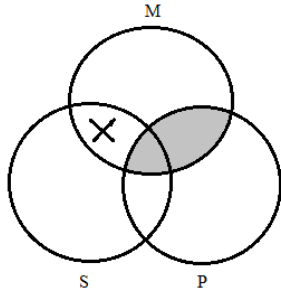


3. Some Nova Scotians love eating lobster. No vegetarians love eating lobster. So, some Nova Scotians are not vegetarians.

S = Nova Scotians
 P = Vegetarians
 M = People who love eating lobster

No P are M .
Some S are M .
Therefore, some S are not P .

Valid



4. All fruits are healthy for teenagers. Some foods that are healthy for teenagers are harmful to old men. So, some fruits are not healthy for old men.

S = Fruits

P = Foods that are healthy for old men

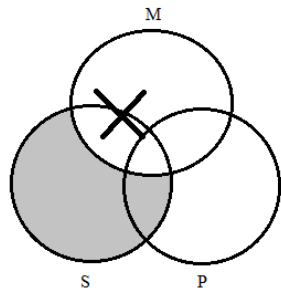
M = Foods that are healthy for teenagers

Some M are not P .

All S are M .

Therefore, some S are not P .

Invalid



5. Only Ryan Reynolds movies are funny. Some funny movies star Sandra Bullock. So, it is clear that some Ryan Reynolds movies star Sandra Bullock.

S = Movies with Ryan Reynolds

P = Movies starring Sandra Bullock

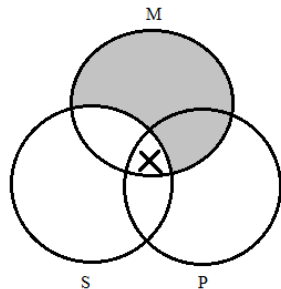
M = Funny movies

Some M are P .

All M are S .

Therefore, some S are P .

Valid

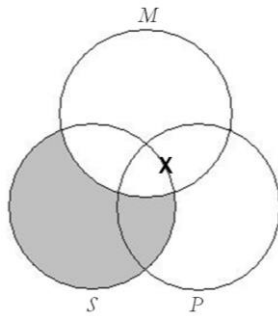


6. Connor McDavid is a hockey player. Some hockey players are all-stars. Therefore, Connor McDavid is an all-star.

S = Persons identical to Connor McDavid
 P = All-Stars
 M = Hockey Players

All S are M .
 Some M are P .
 So, all S are P .

Invalid

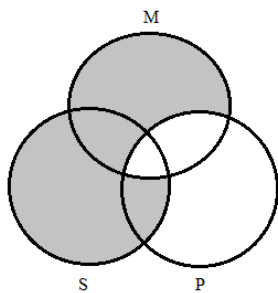


7. All students who study hard can do well in this course. All students who do well in this course will be successful in their careers. So, all students who study hard will become successful in their careers.

S = Students who study hard
 P = Students who will become successful
 in their careers
 M = Students who do well in this course

All M are P .
 All S are M .
 So, all S are P .

Valid

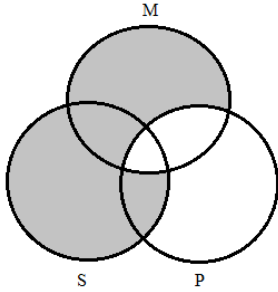


8. Justin Trudeau is the current Prime Minister of Canada. The Prime Minister of Canada has a diplomatic passport. So, Justin Trudeau has a diplomatic passport.

S = People identical to Justin Trudeau
 P = People with diplomatic passports
 M = People identical to the current PM of
 Canada

All M are P .
 All S are M .
 So, all S are P .

Valid

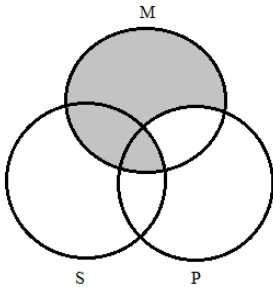


9. People who travel widely develop cultural sensitivity. My mother does not travel widely. Therefore, she is not culturally sensitive.

S = People identical to my mother
 P = Culturally sensitive people
 M = People who travel widely

All M are P .
 No S are M .
 No S are P .

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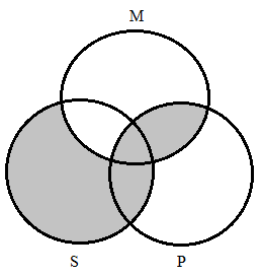


10. My friends are not pot smokers. Chiara is my friend. Therefore, Chiara does not smoke pot.

S = People identical to Chiara
 P = Pot smokers
 M = My friends

No M are P .
 All S are M .
 No S are P .

Valid

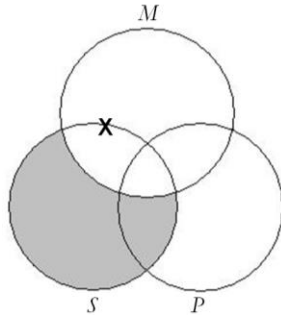


11. Bananas are fruits. Some fruits do not contain high calories. So, some bananas do not contain high calories.

S = Bananas
 P = Foods that contain high calories
 M = Fruits

Some M are not P .
 All S are M .
 So, some S are not P .

Invalid

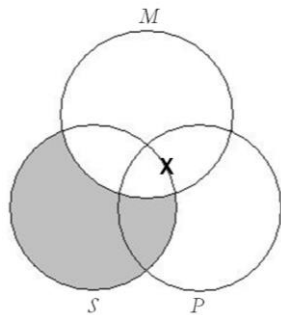


12. Every telescope is an instrument. Some instruments are not properly calibrated. So, some telescopes are not properly calibrated.

S = Telescopes
 P = Properly calibrated implements
 M = instruments

All S are M .
 Some M are P .
 So, some S are not P .

Invalid

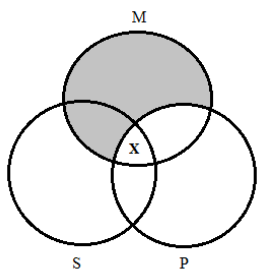


13. Most lighthouses are illuminated. Every illuminated building is visible. Thus, most lighthouses are visible.

S = Lighthouses
 P = visible things
 M = illuminated buildings

Some S are M .
 All M are P .
 Some S are P .

Valid

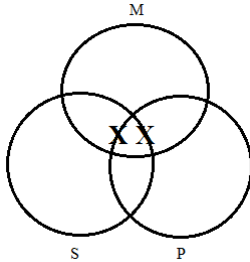


14. Some octogenarians are grumpy folks. Some grumpy folks are old folks. Therefore, some octogenarians are old folks.

S = Octogenarians
 P = Old folks
 M = Grumpy folks

Some S are M .
 Some M are P .
 Some S are P .

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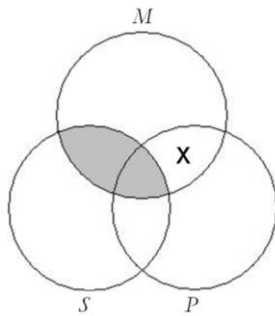


15. Many winter days are cold. No summer days are winter days. So, no summer days are cold days.

S = Summer days
 P = Cold days
 M = Winter days

Some M are P .
 No S are M .
 No S are P .

Invalid

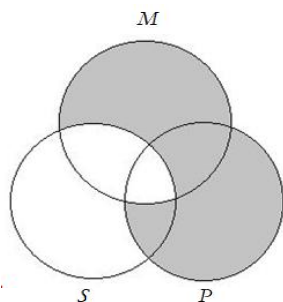


16. Each city is a municipality. Every municipality is a township. Thus, all townships are cities.

S = Townships
 P = Cities
 M = Municipalities

All P are M .
 All M are S .
 All S are P .

Invalid

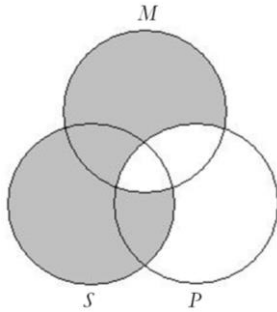


17. All aqueducts are channels. Every channel is a waterway. Thus, each aqueduct is a waterway.

S = Aqueducts
 P = Waterways
 M = Channels

All S are M .
All M are P .
All S are P .

Valid

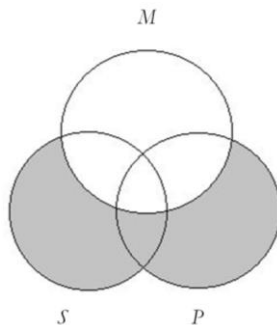


18. No mountains are foothills. But since no valleys are foothills, it follows that some valleys are mountains.

S = Valleys
 P = Mountains
 M = Foothills

No P are M .
No S are M .
So, some S are P .

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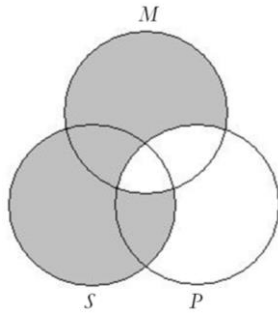


19. All fairies are guardian angels. Every guardian angel has a cloud castle. So, some fairies have cloud castles.

S = Fairies
 P = Owners of cloud castles
 M = Guardian angels

All S are M .
All M are P .
So, some S are P .

Invalid



20. Every Kangaroo is a marsupial. Not a single whale is a marsupial, and thus, not a single whale is a Kangaroo.

S = Whales
 P = Kangaroos
 M = Marsupials

All P are M .
 No S are M .
 Thus, no S are P .

Valid

