Business Logic

Lecture 10: Deductive Reasoning Part 2

Lecturer: Fidela R. Balajadia

Associate Professor 2

University of the Assumption, Philippines

Lecture Learning Objectives:

At the end of the lecture, you will be able to:

1. Explain the two kinds of arguments
2. Understand the SYMBOLS A, E, I, AND O
3. Distinguish the different types of categorical propositions.
4. Identify the premise and conclusion of a standard form categorical proposition.
5. Explain the mood and figure of a syllogism
6. Understand the distribution of the predicate term
7. Test the validity of the syllogism using Venn Diagram.

Deductive Reasoning

TWO KINDS OF GOOD ARGUMENTS

Logicians recognize **two kinds of good arguments**: A **good "deductive" argument** and a **good "inductive" argument**. Before we explain these arguments, we should point out that the distinction between the two is second nature to instructors of critical thinking, and it is easy for them (and for us) to sometimes forget that it is new to many people. In addition, within the past few pages we have already brought up several new ideas, including "critical thinking, "claim," "argument," "premise," "conclusion," "issue," and more. This is quite a load, so don't worry if you don't understand the distinction immediately.

Deductive Arguments

The **first type of good argument**, a **good deductive argument** , is said to be "valid," which means it isn't possible for the premises to be true and the conclusion false. Take this argument about one of our former students:

Premise: Josh Fulcher lives in Alaska.
Conclusion: Therefore, Josh Fulcher lives in the United States.

This is a valid argument because it isn't possible for Josh Fulcher to live in Alaska and not live in the United States. One more example:

Premise: Josh Fulcher is taller than his wife, and his wife is taller than his son.
Conclusion: Therefore, Josh Fulcher is taller than his son.

This, too, is a valid argument, because it isn't possible for that premise to be true and the conclusion to be false.

To put all this differently, the premises of a good deductive argument, assuming they are true, prove or demonstrate the conclusion.

Inductive Arguments

The premises of the other type of good argument, a **good inductive argument** , don't prove or demonstrate the conclusion. They support it. This means that, assuming they are true, they raise the probability that the conclusion is true.

Premise: Fulcher lives in Alaska.
Conclusion: Therefore, he uses mosquito repellent.

Fulcher's living in Alaska makes it more probable that Fulcher uses mosquito repellent.
And:

Premise: People who live in Butte City already spend a lot of time in the sun.
Conclusion: Therefore, a tanning salon won't do well there.

The premise of this argument (assuming it is true) raises the probability that the conclusion is true; thus, it supports the conclusion.

The more support the premises of an argument provide for a conclusion, the stronger the argument is said to be.

Deductive Arguments

Categorical logic is logic based on the relations of inclusion and exclusion among classes (or "categories") as stated in categorical claims. Its methods date back to the time of Aristotle, and it was the principal form that logic took among most knowledgeable people for more than two thousand years. During that time, all kinds of bells and whistles were added to the basic theory, especially by monks and other scholars during the medieval period. So as not to weigh you down with unnecessary baggage, we'll just set forth the basics of the subject in what follows.

Studying categorical and truth-functional logic can teach us to become more careful and precise in our own thinking. Getting comfortable with this type of thinking can be helpful in general, but for those who will someday apply to law school, medical school, or graduate school, it has the added advantage that many admission exams for such programs deal with the kinds of reasoning discussed in this lecture.

Let's start by looking at the four basic kinds of claims on which categorical Logic is based.

A **categorical claim** says something about classes (or "categories") of things. Our interest lies in categorical claims of certain standard forms. A **standard form categorical claim** is a claim that results from putting names or descriptions of classes into the blanks of the following structures:

(note: these are also known as propositions **A** – Universal Affirmative, **E**- Universal Negative, **I**- Particular affirmative, **O**- Particular Negative)

A: All ________ are _________ .
(Example: All Presbyterians are Christians.)
E: No _________ are _________ .
(Example: No Muslims are Christians.)
I: Some ________ are ________.
(Example: Some Christians are Arabs.)
O: Some ________ are not _________ .
(Example: Some Muslims are not Sunnis.)

The phrases that go in the blanks are **terms;** the one that goes into the first blank is the **subject term** of the claim, and the one that goes into the second blank is the **predicate term**. Thus, "Christians" is the predicate term of the first example above and the subject term of the third example. In many of the examples and explanations that follow, we'll use the letters S and P (for "subject" and "predicate") to stand for terms in categorical claims. And we'll talk about the subject and predicate classes, which are just the classes that the terms refer to.

But first, a caution: Only nouns and noun phrases will work as terms. An adjective alone, such as "red," won't do. "All fire engines are red" does not produce a standard-form categorical claim, because "red" is not a noun or noun phrase. To see that it is not, try switching the places of the terms: "All red are fire engines." This doesn't make sense, right? But "red vehicles" (or even "red things") will do because "All red vehicles are fire engines" makes sense (even though it's false).

Looking back at the standard-form structures just given, notice that each one has a letter to its left. These are the traditional names of the four types of standard-form categorical claims. The claim "All Presbyterians are Christians "is an A-claim, and so are "All idolators are heathens," "All people born between 1946 and 1964 are baby boomers," and any other claim of the form "All S are P." The same is true for the other three letters and the other three kinds of claims.

THE SYMBOLS A, E, I, AND O

Viewing propositions on the basis of both quality and quantity, they are designated as A, E, I, and O. The four letters are derived from the Latin words ***affirmo***, which means "I affirm," and ***nego***, which means "I deny". A, E, I, and O have the following connotations: A and I (the first two vowels of affirmo) signify affirmative propositions--A is either a universal or a singular, and I a particular; E and O (from the vowels of nego) signify negative propositions--E is either a universal on a singular; and O is a particular. This is shown in Table 1.

	Affirmative	Negative
Universal and singular	A	E
Particular	I	O

The following are models for each kind of proposition:

A

1. All Christians are believers.
2. All men are beings-for-death.
3. Whoever is inside this room is welcome.
4. Pendatum is a revered Muslim leader.
5. A cow is an animal.

E:

1. No bird has five legs.
2. No Ilongo is an Ilocano.
3. A tomato is not a potato.
4. No vitamin is a poison.
5. I am not a senator

I:

1. Some biologists are chemists.
2. Several Muslims are good human relationists.
3. A few dogs were seen in the plaza.
4. Many women are selfish.
5. Majority of the people of Cotabato province favor the Mt. Apo Geothermal Project.

0:

1. Most Chinese are not natives of Midsayap.
2. A few carabaos were not recovered by the Población 7 CAFGU.
3. Not everyone who says to me: "Lord, Lord" shall enter the kingdom of heaven.
4. Not all carabaos are black.
5. All lovers can't see.

THE DISTRIBUTION OF THE PREDICATE TERM

When we speak of the distribution of the predicate term, we mean the extension or quantity that the predicate possesses on account of its relation to the subject in a certain proposition. The predicate may be taken universally (distributed) or particularly (undistributed).

To determine the extension or quantity of the predicate term, we need to take a look at the copula. The rule of the thumb is:

a) In an affirmative proposition, the predicate is always taken particularly.

b) In a negative proposition, the predicate is always taken universally.

The justification for the rule of thumb becomes clear once we consider how the subject and predicate are related in affirmative and negative propositions.

In an affirmative statement, what is formally asserted is that P is in the comprehension of S, and that S is contained in the extension of P. If S is in P, P must have an extension wider than that of S. But, as we all know, in an affirmative proposition, S and P are identified and in order to make this identification, we must limit the extension of P. Thus, in an affirmative proposition, the predicate is taken particularly. It becomes evident that only part of the extension of P is identified with S.

In the proposition, "All Manobos are Filipinos," the predicate term "Filipinos" is a particular term, that is, only a certain portion of the extension of "Filipinos" is identified with the subject "Manobos."

Venn Diagrams

Each of the standard forms has its own graphic illustration in a Venn diagram, as shown in Figure 1 through 4 . Named after British logician John Venn, these diagrams exactly represent the four standard-form categorical claim types. In the diagrams, the circles represent the classes named by the terms, shaded areas represent areas that are empty, and areas containing Xs represent areas that are not empty—that contain at least one item. An area that is blank is one that the claim says nothing about; it may be occupied, or it may be empty.

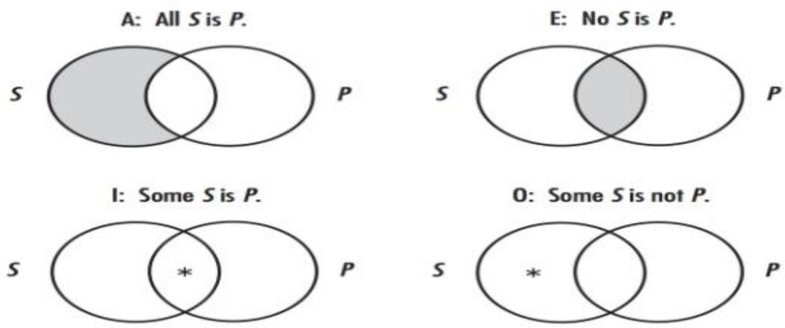


Figure 1-4
Moore & Parker (2008)

Notice that in the diagram for the A-claim, the area that would contain any members of the S class that were not members of the P class is shaded—that is, it is empty. Thus, that diagram represents the claim “All S are P,” since there is no S left that isn’t P. Similarly, in the diagram for the E-claim, the area where S and P overlap is empty; any S that is also a P has been eliminated. Hence: “No S are P.

For our purposes in this lecture, the word “some” means “at least one.” So, the **third diagram** represents the fact that at least one S is a P, and the X in the area where the two classes overlap shows that at least one thing inhabits this area.

Finally, the last diagram shows an X in the area of the S circle that is outside the P circle, representing the existence of at least one S that is not a P. We’ll try to keep technical jargon to a minimum, but here’s some terminology we’ll need: The **two claim types** that include one class or part of one class within another, the A-claims and I-claims, are **affirmative claims**; the two that exclude one class or part of one class from another, the E-claims and O-claims, are **negative claims**.

Although there are only four standard form claim types, it’s remarkable how versatile they are. A large portion of what we want to say can be rewritten, or “translated,” into one or another of them. Because this task is sometimes easier said than done, we’d best spend a little while making sure we understand how to do it. And we warn you in advance: A lot of standard-form translations are not very pretty—but it’s accuracy we seek here, not style.

Correct thinking is the aim of logic and thinking primarily consists of reasoning. As a consequence, it is the function of logic to look into the various types of argumentation and the rules or laws which govern their consistency, since consistency is the very essence of correct inferential thinking. As mentioned earlier, the **two-chief division of**

argumentation are <u>deduction</u> and <u>induction</u>. **Argumentation** is made up of terms and propositions of **two main types namely**:

1. **Categorical propositions** which make a direct assertion (hence it is also called **assertoric**) of agreement or disagreement between subject and predicate; and

2. **Hypothetical propositions** which express the dependence of one affirmation or denial on another affirmation or denial.

NATURE OF THE SYLLOGISM

The word syllogism comes from the Greek words "**syn legein**" which mean 'connected thought'. It is defined as an argumentation in which, from two judgments that contain a common idea and at least one of which is universal, a third judgment, distinct from either of the former, follows with necessity.

Whether we are conscious of it or not, many of our arguments actually fall into syllogistic patterns. Thus, a careful investigation of syllogism is still relevant and has a utilitarian value at present, although the study of syllogism dates back to Aristotle.

The fundamental arrangement of the syllogism consists, therefore, of **two premises and a conclusion.** One of the premises contains a comparison of the major term (P) with the middle term (M), and the other contains the comparison of the minor term (S) with the middle term (M). The conclusion expresses the agreement or disagreement between the minor term (S) and the major term (P). The syllogism is considered a categorical syllogism when the premises are categorical propositions. <u>Here are **two typical examples:**</u>

All M are P;	All birds have wings;
Atqui, All S are M;	Atqui, all eagles are birds;
Ergo, All S are P.	Ergo, all eagles have wings.
No M are P:	No birds are quadrupeds;
Atqui, All S are M;	Atqui, all eagles are birds;
Ergo, No S are P.	Ergo, no eagles are quadrupeds.

These simple categorical syllogisms show us the nature of the syllogism as just defined, namely, the pronouncement of agreement or disagreement between the minor (S) and the major (P) terms in the conclusion, due to their identity or non-identity with the compared middle term (M) in the major and minor premises. In the first instance, we obtained an affirmative conclusion and in the latter instance, a negative one.

If we examine the general axiom or principle which governs syllogism, we find it expressed in what is labelled as Dictum de omni et nullo-the Law of All and None:

> Dictum de omni dicitur de singulis.
> Dictum de nullo negatur de singulis.

This axiom can be interpreted as follows: "What is affirmed of a logical whole may be affirmed of a logical part of what whole; and what is denied of a logical whole may be denied of a logical part of that whole." This axiom sounds a bit mystifying, but the meaning is really quite simple. The middle term in the major premise is a 'logical whole' and the entire comprehension of the major term is affirmed of the middle term; and since the minor term is but a 'logical part' belonging to the extension of the middle term, therefore, the entire comprehension of the major term must be also affirmed of the minor term. Similarly, what is denied of the logical whole must be also denied of the logical part.

BASIC STRUCTURE OF THE CATEGORICAL SYLLOGISM.

While the simple categorical syllogism is the most important elementary type of syllogism, its structure must be thoroughly understood.

In a syllogism, the **first proposition** is the major premise; the **second proposition** is the minor premise; and the **third proposition** is the conclusion.

1. ***Major Term***. The **major term** is the predicate of the conclusion. It must occur in the conclusion and in one of the premises, specifically in the major premise. It is conveniently displayed graphically by a rectangle.

2. ***Minor Term***. The minor term is the subject of the conclusion and must occur in the conclusion and in the minor premise. The **minor premise** which contains the minor term is often introduced by the adversative conjunction "Atqui" (but) since in argumentation and debate it introduces a turn of thought contrary to the expectations of an opponent. The minor term is displayed more graphically by an ellipse.

3. ***Middle Term***. The middle term is the "bridge," the "connecting link" between the major and the minor terms. It occurs in each of the premises but not in the conclusion. As opposed to the middle term, the minor and the major terms are called **EXTREMES**. The middle term is displayed more graphically by the following symbol.

The structure or form of the syllogism can be displayed in the following manner:

All Ilongos are industrious;
Atqui, all Antiquenos are Ilongos;
Ergo, All Antiquenos are industrious.

The relationship of the terms of a syllogism towards one another and, concomitantly, the validity of a syllogism, can be demonstrated more clearly through the use of diagrams.

EIGHT GENERAL SYLLOGISTIC LAWS OR CANONS

From the very nature of the categorical syllogism, logicians have developed Eight General Laws or Canons governing every type of categorical syllogism, and must be rigidly observed, otherwise, the consistency of the argumentation will be demolished, and the conclusion will suffer from falsity or will not follow with logical force from the premises.

In order to master these laws, the following mnemonic lines have been devised:

The terms are only three, to this attend;
Nor let the consequent a term extend.
Conclusion ne'er the middle term admit;
At least one premise must distribute it.
Two negatives no consequent can show;
From affirmative no negation flow.
A universal premise you'll provide;
And let conclusions take the weaker side.

Translated into the **Eight General Laws or Canons**, we now have the following.

1. Only three terms must exist in the syllogism;

2. Neither the major nor the minor term may be a universal term in the conclusion, if it was treated as a particular term in the premises;

3. The middle term may not appear in the conclusion;

4. The middle term must be used at least once distributively, i.e., as a universal term, in the premises;

5. If both premises are affirmative, the conclusion must also be affirmative.

6. Both premises may not be negative; one at least must be affirmative.

7. No conclusion can be drawn from two particular premises; at least, one must be a universal proposition:

8. The conclusion takes the weaker side, that is, (a) if one of the premises is negative, the conclusion must be negative; and (b) if one of the premises is particular, the conclusion must also be particular.

CATEGORICAL SYLLOGISMS

A **syllogism** is a two-premise deductive argument. A **categorical syllogism** (in standard form) is a syllogism whose every claim is a standard-form categorical claim and in which three terms each occur exactly twice in exactly two of the claims. Study the following example:

All Americans are consumers.
Some consumers are not Democrats.
Therefore, some Americans are not Democrats.

Notice how each of the three terms "Americans," "consumers," and "Democrats" occurs exactly twice in exactly two different claims. The terms of a syllogism are sometimes given the following labels:

Major term: the term that occurs as the predicate term of the syllogism's conclusion
Minor term: the term that occurs as the subject term of the syllogism's conclusion
Middle term: the term that occurs in both of the premises but not at all in the conclusion

The most frequently used symbols for these three terms are P for major term, S for minor term, and M for middle term. We use these symbols throughout to simplify the discussion.

In a categorical syllogism, each of the premises states a relationship between the middle term and one of the other terms . If both premises do their jobs correctly—that is, if the proper connections between S and P are established via the middle term, M—then the relationship between S and P stated by the conclusion will have to follow—that is, the argument is valid.

In case you're not clear about the concept of validity, remember: An argument is valid if, and only if, it is not possible for its premises to be true while its conclusion is false. This is just another way of saying that, were the premises of a valid argument true (whether or not they are in fact true), then the truth of the conclusion would be guaranteed. In a moment, we'll begin developing the first of two methods for assessing the validity of syllogisms.

First, though, let's look at some candidates for syllogisms. In fact, only one of the following qualifies as a categorical syllogism. Can you identify which one? What is wrong with the other two?

1. All cats are mammals.

Not all cats are domestic.
Therefore, not all mammals are domestic.

2. All valid arguments are good arguments.
Some valid arguments are boring arguments.
Therefore, some good arguments are boring arguments.

3. Some people on the committee are not students.
All people on the committee are local people.
Therefore, some local people are nonstudents.

We hope it was fairly obvious that the second argument is the only proper syllogism. The **first example** has a couple of things wrong with it: Neither the second premise nor the conclusion is in standard form—no standard-form categorical claim begins with the word "not"—and the predicate term must be a noun or noun phrase. The **second premise** can be translated into "Some cats are not domestic creatures" and the conclusion into "Some mammals are not domestic creatures," and the result is a syllogism. The **third argument** is okay up to the conclusion, which contains a term that does not occur anywhere in the premises: "nonstudents." However, because "nonstudents" is the complement of "students," this argument can be turned into a proper syllogism by obverting the conclusion, producing "Some local people are not students."

Once you're able to recognize syllogisms, it's time to learn how to determine their validity. We'll turn now to our method, the Venn diagram test.

Categorical Syllogisms are two-premise arguments consisting of categorical statements with exactly three class terms: the subject and predicate term of the conclusion (these are, respectively, the *minor* and *major* terms of the syllogism) and a third term (the *middle* term) which occurs in both premises. In addition, the major and minor terms must each occur exactly once in a premise. For example, the following argument from the beginning of the lecture is a categorical syllogism:

Some four-legged creatures are gnus.
All gnus are herbivores.

- ❖ Some four-legged creatures are herbivores.

In this syllogism, the major term is "herbivores", the minor term is "four legged creatures", and the middle term is "gnus".

We test for the validity of categorical syllogisms with Venn diagrams. The diagram of a syllogistic form uses three overlapping circles to represent the three terms in the premises. The circles are labeled (in any order) with letters standing for these terms. For the above syllogism, we use *H* for “herbivores”, *F* for “four-legged creatures”, and *G* for “gnus” to obtain the following:

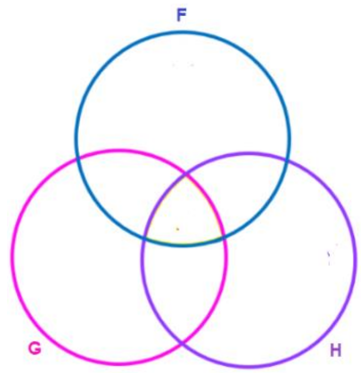


FIGURE 5-12

> **Note !**
>
> **The Venn diagram for a categorical syllogism must include a three-cornered middle region to represent the things common to all three sets.**

We diagram one premise at a time. The resulting diagram may then be used to test form for validity in the same way we tested immediate inferences: if the diagram of the premises is the same as the diagram of the conclusion, then the form is valid; if not, the form is invalid.

Example 1. Use a Venn diagram to test the validity of the following categorical syllogism:

No ***F*** are ***G****.*
All ***G*** are ***H****.*
❖ No ***F*** are ***H****.*

The first premise asserts that the sets *F* and *G* share no members, and so we shade the lens-shaped area shared by the *F* and *G* circles. The second premise says that *G* is a subset of *H*, and so we shade the crescent part of the *G* circle opposite *H.*

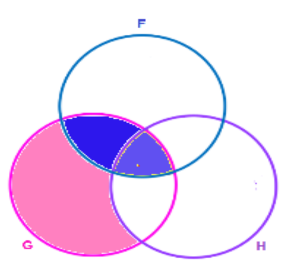


FIGURE 5-13

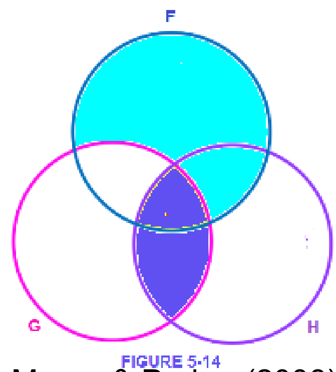
Moore & Parker (2008)

We have no information about the region of overlap between the *F* and *H* circles, which is consistent with the premises that there are *Fs* which are in *H* but no in *G.* If there is such an *F*, then the conclusion :No *F* are *H"* is false. And so, the conclusion may be false while the premises are true. Thus, this form is invalid.

Example 2. Use a Venn diagram to test the validity of the following categorical syllogism:

All ***F*** are ***G****.*
No ***G*** are ***H****.*
❖ No ***F*** are ***H****.*

Via the same approach as above, we produce the following Venn diagram for the two premises:



Moore & Parker (2008)

These premises shade the lens-shaped area shared by the *F* and *H* circles, showing that the conclusion “No *F* are *H”* must be true when the premises are true. Therefore, the form is valid.

The Venn Diagram Method of Testing for Validity

Diagramming a syllogism requires three overlapping circles, one representing each class named by a term in the argument. To be systematic, in our diagrams we put the minor term on the left, the major term on the right, and the middle term in the middle but lowered a bit. We will diagram the following syllogism step by step:

No Republicans are collectivists.
All socialists are collectivists.
Therefore, no socialists are Republicans.

In this **example**, “socialists” is the minor term, “Republicans” is the major term, and “collectivists” is the middle term. See diagram for the three circles required, labeled appropriately.

We fill in this diagram by diagramming the premises of the argument just as we diagrammed the A-, E-, I-, and O-claims earlier. The premises in the foregoing example are diagrammed like this:

First: No Republicans are collectivists (Figure 5). Notice that in this figure we have shaded the entire area where the Republican and collectivist circles overlap.
Second: All socialists are collectivists . Because diagramming the premises resulted in the shading of the entire area where the socialist and Republican circles overlap, and because that is exactly what we would do to diagram the syllogism's conclusion, we can conclude that the syllogism is valid. In general, a syllogism is valid if and only if diagramming the premises automatically produces a correct diagram of the conclusion. * (The one exception is discussed later.)

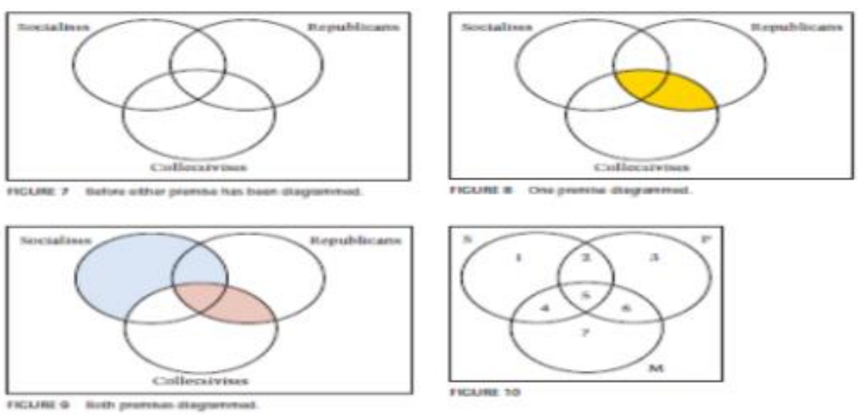


Figure 8-11
Moore & Parker (2008)

When one of the premises of a syllogism is an I- or O-premise, there can be a problem about where to put the required X. The following example presents such a problem (see Figure 10 for the diagram). Note in the diagram that we have numbered the different areas in order to refer to them easily.

Some S are not M.
All P are M.
Some S are not P.
(The horizontal line separates the premises from the conclusion.) An X in either area 1 or area 2 of Figure 10 makes the claim "Some S are not M" true, because an inhabitant of either area is an S but not an M. How do we determine which area should get the X? In some cases, the decision can be made for us: When one premise is an A- or E-premise and the other is an I- or O-premise, diagram the A- or E-premise first. (Always shade

before putting in Xs.) Refer to Figure 11 to see what happens with the current example when we follow this rule.

Once the A-claim has been diagrammed, there is no longer a choice about where to put the X— it has to go in area 1. Hence, the completed diagram for this argument looks like Figure 12. And from this diagram, we can read the conclusion “Some S are not P,” which tells us that the argument is valid.

A syllogism like this one still leaves us in doubt about where to put the X, even after we have diagrammed the A-premise (Figure 13): Should the X go in area 4 or 5? When such a question remains unresolved, here is the rule to follow: An X that can go in either of two areas goes on the line separating the areas, as in Figure 14 .

In essence, an X on a line indicates that the X belongs in one or the other of the two areas, maybe both, but we don’t know which. When the time comes to see whether the diagram yields the conclusion, we look to see whether there is an X entirely within the appropriate area. In the current example, we would need an X entirely within the area where S and P overlap; because there is no such X, the argument is invalid. An X partly within the appropriate area fails to establish the conclusion.

Please notice this about Venn diagrams: When both premises of a syllogism are A- or E-claims and the conclusion is an I- or O-claim, diagramming the premises cannot possibly yield a diagram of the conclusion (because A- and E-claims produce only shading, and I- and O-claims require an X to be read from the diagram). In such a case, remember our assumption that every class we are dealing with has at least one member. This assumption justifies our looking at the diagram and determining whether any circle has all but one of its areas shaded out. If any circle has only one area remaining unshaded, an X should be put in that area. This is the case because any member of that class has to be in that remaining area. Sometimes placing the X in this way will enable us to read the conclusion, in which case the argument is valid (on the assumption that the relevant class is not empty); sometimes placing the X will not enable us to read the conclusion, in which case the argument is invalid, with or without any assumptions about the existence of a member within the class.

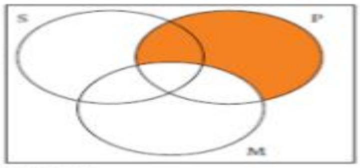


FIGURE 11

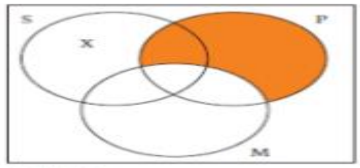


FIGURE 12

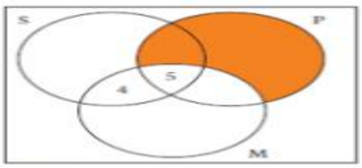


FIGURE 13

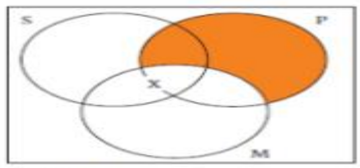


FIGURE 14

Exercise 1 : Venn Diagram
Write out each of the following syllogistic forms, using S and P as the subject and predicate terms of the conclusion, and M as the middle term.
Then test the validity of each syllogistic form using a Venn diagram.

Example
1. AEE -1

SOLUTION
We are told that this syllogism is in the first figure, and therefore the middle term, M, is the subject term of the major premise and the predicate term of the minor premise. The conclusion of the syllogism is an E proposition and therefore reads: No S is P. The first (major) premise (which contains the predicate term of the conclusion) is an A proposition, and therefore reads: All M is P. The second (minor) premise (which contains the subject term of the conclusion) is an E proposition and therefore reads: No S is M. This syllogism therefore reads as follows:

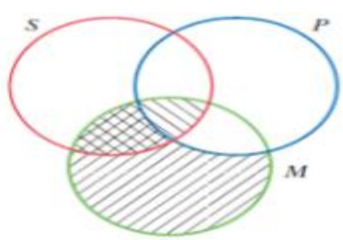


Figure 10

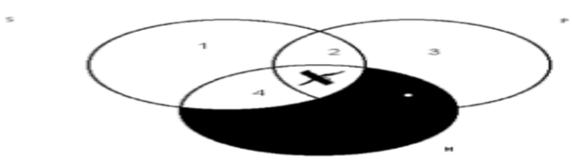
All M is P.
No S is M.
Therefore, no S is P.

Tested by means of a Venn diagram, as in Figure 10, this syllogism is shown to be invalid, it is reflected in the diagram that there is an S which is P that is not shaded, and this contradicts the conclusion that no S is P.

2. EIO–2
3. OAO–3
4. AOO–4
5. EIO–4
6. OAO–2
7. AOO–1
8. EAE–3
9. EIO–3
10. IAI–4
11. AOO–3
12. EAE–1
13. IAI–1
14. OAO–4
15. EIO–1

Exercise 2. Put each of the following syllogisms into standard form, name its mood and figure, and test its validity using a Venn diagram:
*1. Some reformers are fanatics, so some idealists are fanatics, because all reformers are idealists.

Solution: Some reformers are fanatics. Some M are P because all reformers are idealists All M are S, so some idealists are fanatics. So, Some S are P



This argument is valid since Some S is P is reflected on the diagram, and no S which is P is shaded.

2. Some philosophers are mathematicians; hence some scientists are philosophers, because all scientists are mathematicians.

3. Some neurotics are not parasites, but all criminals are parasites; it follows that some neurotics are not criminals.

4. All underwater craft are submarines; therefore, no submarines are pleasure vessels, because no pleasure vessels are underwater craft.

5. No criminals were pioneers, for all criminals are unsavory persons, and no pioneers were unsavory persons.

6. No musicians are astronauts; all musicians are baseball fans; consequently, no astronauts are baseball fans.

REFERENCES:

Introduction to Logic
Irving Copi
Carl Cohen
Kenneth McMahon
14th edition, Pearson Education Limited, 2014

Logic for Filipinos 3rd Edition
Prisciliano Bauzon, National Bookstore 2013

Logic
Nolt, Rohatyn and Varzi McGraw Hill 2012

Introduction To Logic
Harry Gensler
2nd Edition New York: Routledge, 2010

Critical Thinking
Noel Moore & Richard Parker
9th ed. McGraw-Hill, 2008

Elements of Logic: An Integrative Approach
Christopher Ryan Maboloc and Atty. Edgar Pascua II, Rex Bookstore Inc. 2008