Components of the Syllogism

I. Lesson

You may have heard something along the lines of the following argument in the past:

(1) All men are mortal.
(2) Socrates is a man.
(3) Therefore, Socrates is mortal.

These lines are an example of a type of deductive reasoning that is known as a *syllogism.* We defined "syllogism" earlier, but we can also describe them as follows:

- **Syllogism**: a type of argument that deduces a **conclusion** on the basis of two **premises** which share three distinct terms. These terms are known as the **minor term**, the **middle term,** and the **major term**

You may have seen syllogisms used before in everyday life, but never known how to describe how they work or been able to distinguish their features from those of other types of arguments. In this lesson, we aim to give you the terminology to do exactly that. Today's lesson will focus on the components of a syllogism.

In any syllogism, there are three distinct terms: the **minor term**, the **major term**, and the **middle term**.

- **Minor Term:** the subject of the conclusion. In the above example, the **minor term** is 'Socrates'.
- **Major Term**: the predicate of the conclusion. In the above example, the **major term** is 'mortal'.

These terms constitute the conclusion of the syllogism; they are the terms in the premises about which we are making the inference.

A note on the terminology: the adjectives of 'minor' and 'major' do not describe any relative significance of the terms or their roles in the argument. The major term is not more significant than the minor term in any manner -- they are distinguished only by their placements in the conclusion.

- **Middle Term**: the shared term that connects the two premises and enables us to draw the conclusion. In the above example, the **middle term** is 'man'.

The **middle term** is the term that does the bulk of the inferential work in the syllogism. If the middle term was not shared between the two premises in the above syllogism, then the argument would not

produce any valid conclusion relating the minor term to the major term. For example, consider replacing 'men' in the first premise with 'cats':

(1) All cats are mortal
(2) Socrates is a man.
(3) Therefore, Socrates is mortal.

Although, certainly, the conclusion is actually true -- Socrates was mortal! -- the argument used to deduce the conclusion is far from valid. Without a shared middle term to connect the two premises, the two premises are irrelevant to each other.

In any syllogism, there are three statements which are composed of the above terms. We have referred to them above as the premises and the conclusion, but some of them have specific titles as well. These three statements are called the **minor premise**, **major premise**, and **conclusion**.

- **Minor Premise**: the premise that contains the minor term. It can be the first *or* second premise. In the above example, the **minor premise** is "Socrates is a man" (although we could have equivalently written it in the first place)

- **Major Premise**: the premise that contains the major term. It can also be the first or second premise. In the above example, the **major premise** is "All men are mortal" (although, like with the minor premise, we could have equivalently written in the second place)

- **Conclusion** (this stays the same)**:** the final statement of the syllogism. The **conclusion** combines the term that is unique to the minor premise to the term that is unique to the major premise. The middle term is never present in the **conclusion**. In the above example, the **conclusion** is "Socrates is mortal".

Therefore, we can conclude that the middle term can be shared in one of four ways. These ways determine what logicians call the *figure* of a syllogism.

(1) it can be the subject of the major premise and the predicate of the minor premise (called "first figure")

(2) it can be the predicate of both premises (called "second figure")

(3) it can be the subject of both premises (called "third figure"), or

(4) it can be the predicate of the major premise and the subject of the minor premise (called "fourth figure")

Understanding the figure of a syllogism and how to determine it is important, because through it we can realize that *switching* the *order* of the premises of a syllogism will not change its figure. Neither will

it change the content of each premise. Thus, we can conclude that the premises of a syllogism have no *required* order. We can switch them around and still have a syllogism with all the same relevant properties: validity/invalidity, types of categorical propositions, soundness/unsoundness, term clarity/vagueness, etc.

I. Examples

1. All birds are animals.
   All animals are alive.
   Therefore, all birds are alive.

- This syllogism is both valid and sound.
- The **premises** are "All birds are animals" and "All animals are alive."
- The **conclusion** is "All birds are alive."
- The **minor term** is "birds."
- The **major term** is "alive."
- The **middle term** is "animal."
- The **minor premise** is "All birds are animals." Note that this is the second premise of the syllogism, whereas in the original example the minor premise was the first premise.
- The **major premise** is "All animals are alive." Note that this is the first premise of the syllogism, whereas in the original example the major premise was the second premise.

2. Everything that's salty is good for cooking.
   Sand is salty.
   Therefore, Sand is good for cooking.

- This syllogism is valid. However, it is not sound, because its first premise is untrue (since it is clearly *not* the case that all salty things are good for cooking!)
- The **premises** are "Everything that's salty is good for cooking" and "Sand is salty."
- The **conclusion** is "Sand is good for cooking."
- The **minor term** is "sand."
- The **major term** is "good for cooking."
- The **middle term** is "salty" or "things that are salty."
- The **minor premise** is "Sand is salty."
- The **major premise** is "Everything that's salty is good for cooking."

3. Amy hates all critters.
   A thing that hates critters is a thing that hates cockroaches.

So, Amy hates cockroaches.

The syllogism above doesn't have the same format as the ones above; however, it can easily be reformulated to match the other syllogisms. To review, look at the earlier lesson, *Propositions and their Parts*. This yields the following equivalent syllogism:

Amy *is a thing that hates* all critters.
A thing that hates critters is a thing that hates cockroaches.
So, Amy is *a thing that hates* cockroaches.

- This syllogism is both valid and sound.
- The **premises** are "Amy is a thing that hates all critters" and "A thing that hates all critters is a thing that hates cockroaches"
- The **conclusion** is "So Amy must be a thing that hates all critters."
- The **minor term** is "Amy."
- The **major term** is "a thing that hates cockroaches."
- The **middle term** is "a thing that hates all critters."
- The **minor premise** is "Amy is a thing that hates all critters."
- The **major premise** is "A thing that hates all critters is a thing that hates cockroaches"

Activity: Consider the syllogism below. Is the syllogism valid? Is it sound? Place a #1 next to the first premise, a #2 next to the second premise, and a C next to the conclusion. Draw a circle around the minor term. Draw a square around the major term. Underline the middle term. Put one star next to the minor premise. Put two stars next to the major premise. When you're done, compare your answers with a partner.

All Swans are beautiful.
I love all beautiful things.
I love swans.

III. Exercises

Exercise 1

Determine whether the following statements are true or false. Justify your answer.

i. The first premise of a syllogism is known as the major premise. The second premise is known as the minor premise.

ii. A syllogism can be valid even if one of its premises is false.

iii. (Assuming all terms are clear and unambiguous) The conclusion of valid syllogism can be false even if both of its premises are true.

Exercise 2

Fill in the blanks for the following five syllogisms. Remember to not include *quantifiers* in terms.

i. No mammals are toads. All monkeys are mammals. No monkeys are toads.	**Premises:** **Conclusion:** **Minor Term:** **Major Term:** **Middle Term:** **Minor Premise:** **Major Premise:**
ii. All houseplants require watering. This fern is a houseplant. This fern requires watering. *Hint:* reformulate the first premise and conclusion using the verb "to be" (look at example 3 above to see how this reformulation can be done)	**Premises:** **Conclusion:** **Minor Term:** **Major Term:** **Middle Term:** **Minor Premise:** **Major Premise:**
iii. No lawyers are children. Some immature people are lawyers. Not all immature people are children.	**Premises:** **Conclusion:** **Minor Term:** **Major Term:** **Middle Term:** **Minor Premise:** **Major Premise:**

iv. All children are sometimes grouchy. Amy is a child. Amy is sometimes grouchy.	**Premises:** **Conclusion:** **Minor Term:** **Major Term:** **Middle Term:** **Minor Premise:** **Major Premise:**
v. All elephants have tusks. Some animals are elephants. Some animals have tusks. *Hint:* reformulate the first premise and conclusion using the verb "to be" (look at example 3 above to see how this reformulation can be done)	**Premises:** **Conclusion:** **Minor Term:** **Major Term:** **Middle Term:** **Minor Premise:** **Major Premise:**

Exercise 3

Come up with three of your own syllogisms and fill in the blanks as above.

IV. Conclusion

Out of everything Aristotle achieved in the field of logic, he is perhaps best known for his work on syllogisms. The reasons are clear: not only are these kinds of arguments present almost everywhere, but they are a key way for us to make inferences and gain new information about the world.

V. Lesson Goals

At the end of this lesson, students will be able to:

- Differentiate between validity and soundness when it comes to syllogisms
- Explain the different components of a syllogism's structure, including the middle term, major term, minor term, major premise, and minor premise
- Distinguish between something being the first premise and its being the major premise of a syllogism, as well as between something being the second premise and its being the minor premise of a syllogism

- Come up with their own examples of simple syllogisms

Answer Key

Exercise 1:

i. False. Which premise is the major or the minor premise depends on whether it contains the subject or the predicate of the conclusion, *not* on whether it comes first or second in the progression of the syllogism.

ii. True. Validity depends on correct structure, *not* on the truth or falsity of the premises.

iii. False. The truth or falsity of the conclusion depends on the truth or falsity of the premises in a valid syllogism. (Assuming all terms are clear and unambiguous)

Exercise 2:

Fill in the blanks for the following five syllogisms:

i. No mammals are toads. All monkeys are mammals. No monkeys are toads.	**Premises:** "No mammals are toads;" "All monkeys are mammals" **Conclusion:** "No monkeys are toads" **Minor Term:** "monkey" **Major Term:** "toad" **Middle Term:** "mammal" **Minor Premise:** "All monkeys are mammals" **Major Premise:** "No mammals are toads"
ii. All houseplants require watering. This fern is a houseplant. This fern requires watering. *Can be reformulated as:* All houseplants *are* things that require watering. This fern is a houseplant. This fern *is* a thing that requires watering.	**Premises:** "All houseplants are things that require watering"; "This fern is a houseplant" **Conclusion:** "This fern is a thing that requires watering" **Minor Term:** "This fern" **Major Term:** "a thing/things that require watering" **Middle Term:** "houseplant" **Major Premise:** "All houseplants are things that

	require watering” **Minor Premise:** “This fern is a houseplant”
iii. No lawyers are children. Some immature people are lawyers. Not all immature people are children.	**Premises:** “No lawyers are children;” “Some immature people are lawyers” **Conclusion:** “Not all immature people are children” **Minor Term:** “immature people” **Major Term:** “children” **Middle Term:** “lawyer” **Minor Premise:** “Some immature people are lawyers” **Major Premise:** “No lawyers are children”
iv. All children are sometimes grouchy. Amy is a child. Amy is sometimes grouchy.	**Premises:** “All children are sometimes grouchy;” “Amy is a child” **Conclusion:** “Amy is sometimes grouchy” **Minor Term:** “Amy” **Major Term:** “sometimes grouchy” **Middle Term:** “child” **Minor Premise:** “Amy is a child” **Major Premise:** “All children are sometimes grouchy”
v. All elephants have tusks. Some animals are elephants. Some animals have tusks. *Can be reformulated as:* All elephants *are* things that have tusks. Some animals are elephants. Some animals *are* things that have tusks.	**Premises:** “All elephants are things that have tusks”; “Some animals are elephants” **Conclusion:** “Some animals are things that have

	tusks” **Minor Term:** “animal” **Major Term:** “things that have tusks” **Middle Term:** “elephant” **Minor Premise:** “Some animals are elephants” **Major Premise:** “All elephants are things that have tusks”

Exercise 3:

Answers will vary.