UNIT 1: STANDARD FORM OF CATEGORICAL SYLLOGISM

UNIT STRUCTURE

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1.1 LEARNING OBJECTIVES

After going through unit, you will be able to:

- define standard form of categorical syllogism
- explain the structure of categorical syllogism
- discuss what is mood
- describe what is figure
- illustrate the Venn diagram technique for testing syllogism.

1.2 INTRODUCTION

This unit introduces to you standard form of categorical syllogism. It includes the definition as well as the structure of the categorical syllogism. Apart from this, you get the concepts like mood, figure of syllogism and the Venn diagram technique for testing syllogism.

A standard form of categorical syllogism is a deductive argument which contains two categorical propositions. And from two categorical propositions taken jointly conclusion is drawn. As for instance:

All Philosophers are rationalists.

All mathematicians are philosophers.

∴ All mathematicians are rationalists.

This is an example of standard form categorical syllogism.

1.3 STANDARD FORM CATEGORICAL SYLLOGISM

A syllogism is a kind of deductive argument in which a conclusion is drawn from two premises taken jointly. A categorical syllogism is a deductive argument consisting only of categorical propositions.

1.3.1 Structure of Categorical Syllogism

A categorical syllogism contains three terms, each of which occur in the two premises from which the conclusion follows. A standard form categorical syllogism consists of standard form categorical propositions. Its premises and conclusion are all standard form categorical propositions. The three terms of the standard form categorical propositions occur twice in the syllogism. The three terms are called the major term, the minor term and the middle terms respectively. The term that occurs as the predicate of the conclusion is called the major term of the conclusion is called the major term of the syllogism, and the term that occurs as the subject term of the conclusion is called the minor term of the syllogism. The term that occurs in both the premises but not in the conclusion is called the middle term. An example of the standard form categorical syllogism is given below–

All Greeks are humans.

All Athenians are Greeks.

∴ All Athenians are humans.

The term 'humans' is the predicate of the conclusion and thus it is the major term of the syllogism. 'Athenians' is the subject of the conclusion and as such it is called the minor term. The term 'Greek' occurs in both the premises and as such it is the middle term of the syllogism.

The premise 'All Greeks are humans' is the major premise because the major term 'human' occurs in this premise. The premise 'All Athenians are Greeks' is the minor premise since the minor term 'Athenians' occur in this premise.

In the standard form of categorical syllogism, the major premise is stated first, the minor premise the second and the conclusion last. Major premise and the minor premise are not defined in terms of their position but in terms of their possession of major term and minor term respectively.

The standard form of categorical syllogism is said to have a form. The form of standard form of categorical syllogism is determined by the form of the premises and the conclusion it contains. There are three letters that indicate the form of the syllogism. The first letter represents the term of the major premise, the second letter represents the form of the minor premise and the third letter represents the form of the conclusion. For example, the syllogism–

All Greeks are humans.

All Athenians are Greeks.

∴ All Athenians are humans.

Consists of major premise which is an A proposition, minor premise which is also an A proposition and the conclusion which is an A proposition.

1.4 MOOD: WHAT IT IS

The mood of a standard form of categorical proposition is determined by the forms of the standard form of categorical propositions it contains. Since the above syllogism contain all A propositions i.e., both the premises and the conclusion are A propositions, therefore, the mood of the syllogism is AAA.

However, the mood of a standard form of categorical syllogism does not wholly or completely determine its form. Two syllogisms may have the same mood but may differ in form. Let us take two syllogisms and see that they have the same mood but differ in form.

1) All philosophers are intellectuals.
Some scientists are intellectuals.
∴ Some scientists are philosophers.

2) All scientists are philosophers.
Some scientists are mathematicians.
∴ Some mathematicians are philosophers.

In both the syllogisms major premise are universal affirmative i.e., A propositions, minor premises are particular affirmative i.e., I propositions and the conclusions are particular affirmative propositions i.e., I propositions. Therefore, the syllogisms are of mood 'All'. But their form is different. In order to show how these two syllogisms differ in forms, we have to replace the terms of the propositions i.e., the major terms, minor terms and the middle terms by the letters P, S, and M respectively. The forms of the two syllogisms are as follows-

1) All P is M
some S is M
∴ Some S is P

2) All M is P
Some M is S
∴ Some S is P

Their difference lies in the fact that the position of the middle term is different in the two syllogisms. In the first, the middle term is the predicate in both the premises where as in the second the middle term is the subject in both the premises. Thus, it is seen that these two syllogisms inspite of having the same mood are different in form.

The mood of a syllogism can not completely define the form of a syllogism. The form of a syllogism may be completely described by stating its mood and figure.

1.5 FIGURE: WHAT IT IS

Figure indicates the position of the middle term in the syllogism. Now as we know that middle term is that term which occurs in both the premises. Depending on the position of the middle term in the premises, we have four

different figures. Those syllogisms may have. The middle term may be the subject of the major premise and predicate term of the minor premise or it may be the predicate term of both the premises or it may be the subject term of both the premises or it may be the predicate term of major premise and the subject term of minor premise. These different possible positions of the middle term constitute the first, second, third and fourth figures respectively. The four figures are schematized in the following array–

M – P	P M	M – P	P – M
S – M	S M	M – S	M – S
– P	∴ S M	∴ M – S	∴ M – S
First figure	Second figure	Third figure	Fourth figure

Thus, the mood and the figure together constitute the form of the standard form categorical syllogisms.

There are four kinds of propositions– A.E.I and O. A syllogism has got two premises. Hence we may have sixteen possible moods in each figure. Again there are four figures so we have 16 x 4 = 64 possible moods in all the four figures. Again each of the 64 combinations may have four forms. Thus, in this sense there are 64 x 4 = 256 moods in all the four figures. Out of these 256 moods some are valid and some are invalid.



CHECK YOUR PROGRESS

Q.1: What is standard form of categorical syllogism?

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Q.2: What are the three terms occur in 'Standard form of categorical syllogism'?

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Q.3: What is mood?

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Q.4: How many figures in syllogism?

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Q.5: Fill in the blanks:

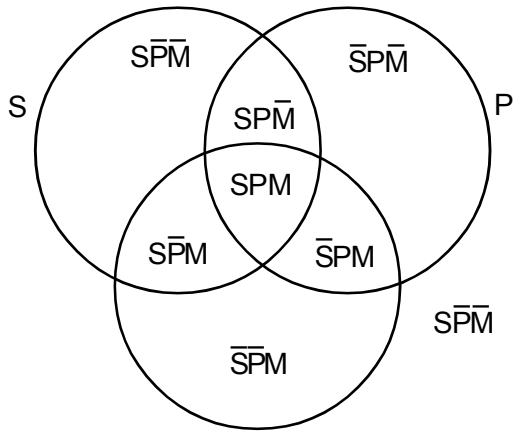
a) A categorical syllogism contain ..... terms.

b) Figure indicates the position of the ..... term.

c) ..... and ..... constitute the standard form of categorical syllogism.

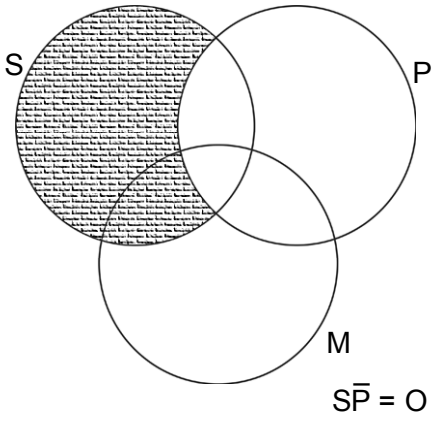
1.6 VENN DIAGRAM TECHNIQUE FOR TESTING SYLLOGISM

This section explains the Venn diagram technique to diagram the standard form of categorical propositions. In order to diagram the standard form of categorical syllogism, it is necessary to take three circles for three terms i.e., major, minor, and middle term. Three circles, abbreviated as S, P and M representing minor term, major term and middle term respectively, are drawn in such a way that they overlap. We first draw the two over lapping circles i.e., circle S and the circle P and then we draw the third circle 'M' overlapping the first two circles as shown in the diagram below. The diagram of three overlapping circle give the diagram of eight class. They are: $S\bar{P}\bar{M}$, $SP\bar{M}$, $\bar{S}P\bar{M}$, $S\bar{P}M$, SPM, $\bar{S}PM$, $\bar{S}\bar{P}M$, $\bar{S}\bar{P}\bar{M}$.

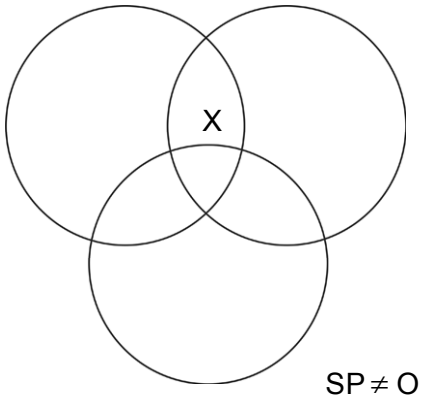


This diagram can be interpreted in terms of various classes. For example, we can take the letter 'S' for the class of all 'scientists', the letter 'P' for the class of all 'philosophers' and the letter M for the class of all mathematicians. Now the part $S\bar{P}\bar{M}$ in the diagram represents the class of all scientists who are neither philosophers nor mathematicians i.e., it is the

product of three class-scientists and non philosophers and non mathematicians. $SP\bar{M}$ is the product of the class scientists and philosophers and non mathematicians. $S\bar{P}M$ is class which is the product of scientists and mathematicians and philosophers. The part SPM represents the class of all those people who are scientists and at the same time philosophers and mathematicians. $\bar{S}PM$ is the product of all people who are both philosophers and mathematicians but not scientists. $\bar{S}P\bar{M}$ is product of the class philosophers with the complement of the class scientists and mathematicians. $\bar{S}\bar{P}\bar{M}$ is the class of all those who are non scientists, non philosophers but mathematicians. It is the product of the class mathematicians with the complement of the two classes scientists and philosophers. The part $\bar{S}\bar{P}\bar{M}$ is the product of the class non scientists, non philosophers and non mathematicians. It is the class of all those people who are neither scientists, nor philosophers nor mathematicians. By shading out or by inserting an 'X' we can diagram any standard form categorical propositions whose terms are S, P and M. For example to diagram the proposition "All S are P" ($S\bar{P} = O$) we have to shade out all of S that is not contained in P as shown in below. To diagram the proposition some S are P ($SP \neq O$) we have to put an X in the overlapping part of the circle S and P.



$S\bar{P} = O$



$SP \neq O$

The general technique of using Venn Diagrams to lest the validity of any standard form of categorical syllogisms are the following:

1) In a standard form of categorical syllogism we have 3 terms represented by S, P and M. Three circles represent three terms i.e., S, P and M. First we draw three over lapping circles and they are labeled as S, P

and M respectively. The circle S stands for minor forms, the circle P stands for minor term and the circle M stands for middle term.

2) We diagram both the premises. If one premise is universal and the other premise is particular then it is necessary to diagram the universal premise first and then to diagram the particular premise.

3) It is to be noted that we need not diagram the conclusion. Rather, we must inspect the diagram to see whether or not the diagram of the premises contains in it the diagrams of the conclusion. If the diagram of the premises contain the diagram of the conclusion then, the given syllogism is valid; if it does not, the syllogism is invalid. In other words, the syllogism is valid if and only if the two premises imply or entail the conclusion. The premises must say what is said by the conclusion. The diagram of the premises of a valid argument should be sufficient enough to include the diagram of the conclusion such that no further marking of the circles is needed.

Let us apply the Venn Diagram technique to test the validity of the following syllogism.

All mathematicians are philosophers.

All scientists are mathematicians.

$\therefore$ All scientists are philosophers.

This syllogism consists of all A propositions. It is of the form AAA. Now we symbolize the syllogism in the following way–

$M \cap \sim P = \wedge$ or $M\bar{P} = O$

$S \cap \sim M = \wedge$ or $S\bar{M} = O$

$\therefore\ S \cap \sim P = \wedge$ or $\therefore\ S\bar{P} = O$

Now let us apply the Venn diagram technique. We draw the following figures.

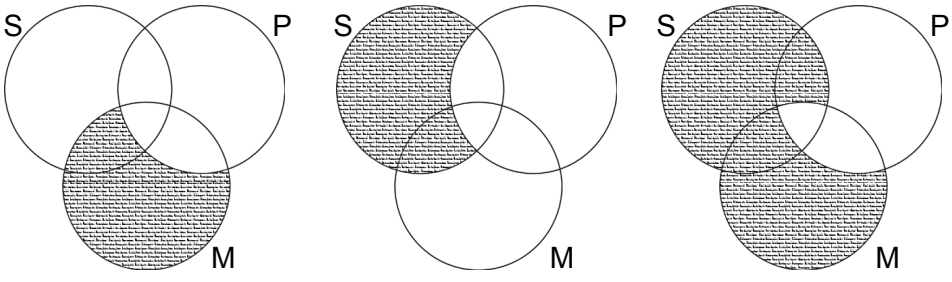


Figure I represents the diagram of the premise $M\bar{P} = O$. $M\bar{P}$ consists of two classes i.e. $M\bar{P}\bar{R}$ and $MS\bar{P}$. These two parts are shaded horizontally to indicate that $M\bar{P} = O$. Like wise figure II represents the diagram of the premise $S\bar{M} = O$. $S\bar{M}$ consists of two parts, that is, $S\bar{P}\bar{M}$ and $SP\bar{M}$. These two parts are horizontally shaded to represent the diagram of the premise $S\bar{M} = O$. The conclusion of the syllogism is $S\bar{P} = O$. The diagram of the conclusion i.e., $S\bar{P} = 0$ demands that the parts $S\bar{P}M$ and $SM\bar{P}$ must be shaded as $S\bar{P} = O$. The diagram of the two premises contain in them the diagram of the premises. Therefore, the given syllogism is valid.

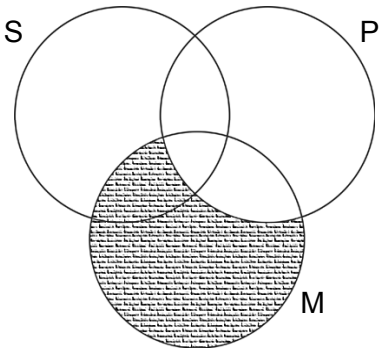
Let us lake another example of syllogistic reasoning:

$M\bar{P} = O$

$MS \neq O$

$\therefore$ $SP \neq O$

The following is the diagram of the above syllogism.



To diagram the premise $M\bar{P} = O$, the part or the area $SM\bar{P}$ and $S\bar{M}\bar{P}$ are shaded. The diagram of the premise $MS \neq O$ consists of two parts i.e., $S\bar{P}M$ and SPM. Since the part $SM\bar{P}$ is already shaded and only the part SMP is left therefore the diagram of the premise $MS \neq O$ is given by inserting an X to the overlapping pant of, S P and M and so there is an X in the region SP. Thus, the diagram of the premises diagram the conclusion or we can say that the diagram of the premises contain in them the diagram of the conclusion and hence the diagram is valid.

Let us take another example.

All scientists are mathematicians.

Some philosophers are mathematicians.

$\therefore$ Some philosophers are scientists.

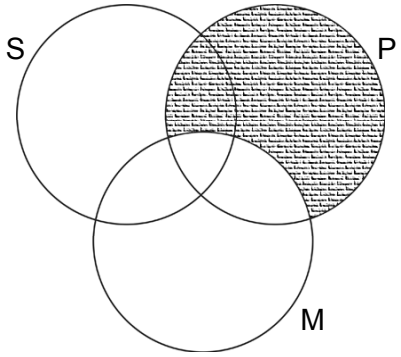
First we symbolize the syllogism in the following way by means of set notation:

$P\bar{M} = O$

$S\bar{M} \neq O$

$SP \neq O$

Now we diagram these two premises by drawing three overlapping circles in the following way as shown in the figure below –



We diagram the premise $P\bar{M} = O$ by shadding the part $SP\bar{M}$ and $S\bar{P}\bar{M}$. The premise $SM \neq O$ says that the part or the area $SM\bar{P}$ or the part SMP is non empty. Since it says that any one of the two parts is non empty therefore we insert an X in the overlapping part of the circle S and M. The conclusion $SP \neq O$ demands that the overlapping part of the circle S and P must be inserted with an X.

Since there is no X in the overlapping part of the circle S and P, therefore, it follows that the diagram of the conclusion does not follow from the diagram of the premises. As the diagram of the premises does not entail the diagram of the premises therefore the given syllogism is invalid.



CHECK YOUR PROGRESS

Q.6: What is Venn diagram technique?

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1.7 LET US SUM UP

- A standard form of categorical syllogism consists of standard form categorical propositions.
- The form of a standard form of categorical syllogism is determined by its mood and figure.
- To test the validity of standard form of categorical syllogism three overlapping circles are drawn. We diagram both the premises but not the conclusion. The diagram of the premises must entail in it the diagram of the conclusion. An argument is valid if and only if the diagram of the conclusion follow from the diagram of the premises.



1.8 FURTHER READING

1) Bason and O'connom; *Introduction to Symbolic Logic*.
2) Copi, M. Irving; *Introduction to Logic* (Sixth edition).
3) Copi, M. Irving; *Symbolic Logic* (Fifth edition).



1.9 ANSWERS TO CHECK YOUR PROGRESS

Ans. to Q. No. 1: A standard form of categorical proposition is deductive argument which consists of two categorical propositions out of which the conclusion is drawn.

Ans. to Q. No. 2: Middle term, Minor term and Major term

Ans. to Q. No. 3: Four figures.

Ans. to Q. No. 4: Four figures

Ans. to Q. No. 5: a) Three terms, b) Middle term, c) Figure and Mood

Ans. to Q. No. 6: It is a technique of testing the validity of standard form of categorical prepositions with diagrams.



1.10 MODEL QUESTIONS

A) Very short questions:

Q.1: Define the concept of figure in syllogism.

Q.2: What is mood?

Q.3: What do you mean by categorical syllogism?

Q.4: What is venn diagram?

Q.5: What do you mean by standard form of categorical syllogism?

Q.6: What are the figures of syllogism?

Q.7: Give an example of standard form of categorical syllogism.

B) Short questions: (Answer each question in about 150 words)

Q.1: What is standard form of categorical syllogism? Briefly explain.

Q.2: Briefly explain the concept of Mood.

Q.3: What do you mean by the concept of Mood? Explain in brief.

Q.4: Writes short notes on:

a) Standard form of categorical syllogism

b) Figure

c) Venn diagram technique

Q.5: Briefly explain the structure of categorical syllogism.

C) Long questions: (Answer each question in about 300-500 words)

Q.1: What is standard form of categorical syllogism? Explain the structure of categorical syllogism.

Q.2: Explain the concept of mood in syllogism.

Q.3: What is figure? Do the concepts of mood and figure play an important role to determine the form of a syllogism? Discuss

Q.4: What is Venn diagram technique? Discuss this technique for testing syllogism? With suitable examples.

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