UNIT 3 SYLLOGISM

Contents

3.0 OBJECTIVES

In this unit an attempt is made:

- to introduce to you salient features of syllogism, which forms an important part of classical or Aristotelian Syllogism.
- to integrate traditional analysis with modern analysis. In doing so, some vital differences between these analyses are brought to the fore.

3.1 INTRODUCTION

Syllogism is the most important part of Aristotle's logic. It is a kind of mediate inference in which conclusion follows from two premises. We consider two kinds of syllogism, viz., conditional and unconditional. Further, under conditional, there are two divisions: mixed and pure. We can consider conditional syllogism at a later stage. In this unit, we shall confine ourselves to unconditional syllogism or categorical syllogism.

3.2 THE STRUCTURE OF CATEGORICAL SYLLOGISM

For the time being, let us assume that syllogism means valid categorical syllogism unless otherwise qualified. Syllogism consists of two premises and a conclusion. Thus, we have three prepositions and only three terms. An argument is not syllogistic at all unless it conforms to this structure. Since the number of propositions and terms is three, it is quite obvious that every term occurs twice. Consider an example for a syllogistic argument.

1st premise: All humans are stupid.

2^{nd} premise: All sages are human.

Conclusion: Therefore all sages are stupid.

A term, which is common to the premises (human), is called *middle* (M). Predicate of the conclusion (stupid) is called *major* (P) and subject of the conclusion (sages) is called *minor* (S). While major has maximum extension, minor has minimum extension. The middle term is so called because its extension varies between the limits set by minor and major. The premise in which major occurs is called *major premise* and the premise in which minor occurs is called *minor premise*.

Though in this argument the first premise is major and the second is minor there is no rule which stipulates that this must be the order. Not only can minor premise be written first, but also the conclusion can as well be the first statement. The only restriction is that if an argument starts with premises, always 'therefore' or its synonym must precede the conclusion and if the conclusion is the starting point, then 'because' or its synonym must be immediately follow the conclusion. Aristotle argued that our inference proceeds from minor term to major term through middle term. Therefore in the absence of middle term, it is impossible to proceed from minor to major. Aristotle is also a pioneer who discovered predicate logic. He restricted syllogism to subject-predicate logic and, naturally he did not give credence to other forms of proposition like relational prepositions. Most of what Aristotle said on syllogism holds good only when we consider predicate logic (see below, block 4, unit 4).

3.3 AXIOMS OF SYLLOGISM

There are two types of axioms: axioms of quantity and axioms of quality. Rules under these axioms are merely stated because there is no proof to these rules.

A. Axioms of Quantity:

A_1: The middle must be distributed at least once in the premise.

A_2: A term, which is undistributed in the premise, must remain undistributed in the conclusion. A term, which is distributed in the conclusion, should compulsorily be distributed in the premise.

B. Axioms of quality:

B_1: Two negative premises do not yield any conclusion.

B_2: Affirmative premises yield only affirmative conclusion.

B_3: Negative premise (there can be only one negative premise) yields only negative conclusion.

Three corollaries follow from these rules. They are as follows: -

1. The number of terms distributed in the conclusion must be one less than the number of terms distributed in the premises. It is very easy to explain this corollary. The number of terms in the conclusion itself is one less than the number of terms in the premises and M which is compulsorily distributed in the premises is not a part of the conclusion.

2. Two particular premises do not yield any conclusion. Only one particular premise is permissible.

3. Particular premise yield only particular conclusion. [The reader is advised to prove these corollaries with the help of Axioms of quality and quantity.]

3.4 FIGURES AND MOODS

In the conclusion, S and P have fixed positions but this is not the case with M. There are four ways in which M can occupy two places. These four ways are called four figures, i.e., the position of M determines the figure of argument. These figures are as follows: -

	I	II	III	IV
Major Premise:	M-P	P-M	M-P	P-M
Minor Premise:	S-M	S-M	M-S	M-S
Conclusion:	S-P	S-P	S-P	S-P

From this scheme it is clear that neither P nor S determines the figure of syllogism. History has recorded that Aristotle accepted only first three figures. The origin of the fourth figure is disputed. While Quine said that Theophrastus, a student of Aristotle, invented the fourth figure, Stebbing said that it was Gallen who invented the fourth figure. This dispute is not very significant. But what Aristotle says on the first figure is significant.

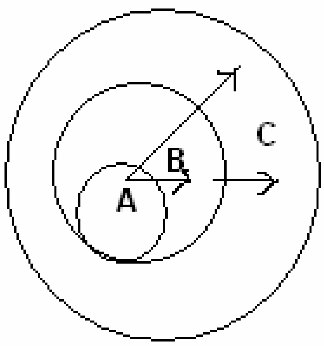
Aristotle regarded the first figure as most ‘scientific’. It is likely that by ‘scientific’ he meant ‘satisfactory’. One of the reasons, which Aristotle has adduced, is that both mathematics and physical sciences establish laws in the form of the first figure. Second reason is that reasoned conclusion or reasoned fact is generally found in the first figure. Aristotle believed that only universal affirmative conclusion can provide complete knowledge and universal affirmative conclusion is possible only in the first figure. Aristotle quotes the fundamental principle of syllogism. ‘One kind of syllogism serves to prove that A inheres in C by showing that A inheres in B and B in C’. This principle can be expressed in this form:

Minor: A inheres in B

Major: B inheres in C

Conclusion: ∴ A inheres in C

Evidently, this argument satisfies transitive relation. This is made clear with the help of this diagram:



Let us mention four examples, which correspond to four figures.

FIGURE I

	M P	
Major Premise:	All Artists are Poets.	AAP
	S M	
Minor Premise:	All Musicians are Artists.	MAA
Conclusion:	∴ All Musicians are Poets.	MAP

FIGURE II

	P M	
Major Premise:	All saints are pious.	SAP
	S M	
Minor Premise:	No criminals are pious.	CEP
Conclusion:	∴ No criminals are saints.	CES

FIGURE III

	M P	
Major Premise:	All great works are worthy of study.	GAW
	M S	
Minor Premise:	All great works are epics.	GAE
Conclusion:	∴ Some epics are worthy of study.	EIW

FIGURE IV

	P M	
Major Premise:	No soldiers are traitors.	SET
	M S	
Minor Premise:	All traitors are sinners.	TAS
Conclusion:	∴ Some sinners are not soldiers.	SOS

We have to consider figures in conjunction with moods. Mood is determined by quality and quantity propositions, which constitute syllogism. Since there are four kinds of categorical proposition and there are three places where they can be arranged in any manner, there are sixty-four different combinations in any given figure. Since there are four figures, in all, two hundred and fifty six ways of arranging categorical propositions are possible. These are exactly what we mean by moods. However, out of two hundred and fifty-six, two hundred and forty-five moods can be shown to be invalid by applying the rules and corollaries. So we have only eleven moods. There is no figure in which all eleven moods are valid. In any given figure only six moods are valid. They are as follows:

I.	AAA,	$\boxed{\text{AAI}}$	AII	EAE	$\boxed{\text{EAO}}$	EIO
II.	AEE	$\boxed{\text{AEO}}$	EAE	$\boxed{\text{EAO}}$	EIO	AOO
III.	$\boxed{\text{AAI}}$	AII	IAI	$\boxed{\text{EAO}}$	EIO	OAO
IV.	$\boxed{\text{AAI}}$	IAI	AEE	$\boxed{\text{AEO}}$	$\boxed{\text{EAO}}$	EIO

In all these cases, first letter stands for major premise, second for minor and third for conclusion. Moods are boxed in two ways. Moods within thick boxes are called strengthened moods, and moods within thin boxes are called weakened moods. It is important to know the difference between these two. *When two universal premises can yield only particular conclusion, then such moods are called strengthened moods. On the other hand, if we deduce particular conclusion from two universal premises, when it is logically possible to deduce a universal* *conclusion, then such moods are called weakened moods*. When we recall that from universal premises alone particular conclusion cannot be drawn, both strengthened and weakened moods become invalid. Thus, the number of valid moods reduces to fifteen. In this scheme, we notice that EIO is valid in all the figures.

Though EIO is valid in all figures, it is one mood in one figure and some other in another figure. Likewise, AEE is valid in the second and the fourth figures. But it is one mood in the second figure and different mood in the fourth figure. In the thirteenth century, one logician by name Pope John XXI, invented a technique to reduce arguments from other figures to the first figure. This technique is known as mnemonic verses. Accordingly, each mood, excluding weakened moods, was given a special name:

I.	Fig:	AAA	BARBARA	III.	Fig:	AAI	DARAPTI
		EAE	CELARENT			IAI	DISAMIS
		AII	DARII			AII	DATISI
		EIO	FERIO			EAO	FELAPTON
						OAO	BOCARDO
						EIO	FERISON
II.	Fig:	EAE	CESARE	IV.	Fig:	AAI	BRAMANTIP
		AEE	CAMESTRES			AEE	CAMENES
		EIO	FESTINO			IAI	DIMARIS
		AOO	BAROCO			EAO	FESAPO
						EIO	FRESISON

Syllogism can be tested using rules and corollaries. These are also known as general rules. There is one more method of testing syllogism. Every figure is determined by special rules. These are called special rules because they apply only to particular figure. These special rules also depend directly upon the axioms of quantity and quality. Therefore special rules can be proved. While doing so we shall follow the method of *reductio ad absurdum* because, it is a simple method.

I. Special rules of the first figure: M – P

S – M

S – P

1. Minor must be affirmative:

   Proof :

   1. Let minor be negative.
   2. Conclusion must be negative. (From B_3 and 1)
   3. Conclusion distributes P. (From 2)
   4. Major should distribute P. (From A_2 and 3)
   5. Major must be negative. (From A_2 and 4)
   6. Negative minor implies negative major.
   7. Two premises cannot be negative (B_1)
   8. ∴ Minor must be affirmative. q.e.d.

2. Major must be universal:

   Proof:

   1. Let Major be particular.
   2. Major undistributes M. (From 1)
   3. Minor should distribute M. (From A_1 and 1)
   4. Minor should be affirmative. (First special rule)
   5. Minor has to undistributed M.
   6. Major should distribute M. (From A_1)
   7. Major must be universal. q.e.d.

Using these two special rules, valid moods can be distinguished from invalid moods.

II. **Special rules of the Second figure**: P – M

S – M

S – P

1. Only one premise must be negative:

   Proof:

   1. Let both premises be affirmative.
   2. M is undistributed in affirmative statements.
   3. (1) and (2) together contradict $A_{1.}$
   4. One premise must be negative. q.e.d.

2. Major should be universal:

   Proof:

   1. Let Major be particular.
   2. Major undistributes P. (from 1)
   3. Conclusion must be universal. (From B_3 and first special rule).
   4. Conclusion distributes P.
   5. (2) and (4) together contradict A_2.
   6. Major should distribute P.
   7. Major must be universal.

III. **Special rules of the Third figure**: M – P

M – S

S – P

1. Minor must be affirmative.
2. Conclusion must be particular.

(The reader is advised to try to prove these two rules).

IV. **Special rules of the Fourth figure**: P – M

M – S

S – P

1. If Major is affirmative, then minor must be universal.

   Proof:

   1. Let minor be particular when major is affirmative.
   2. Major undistributes M.
   3. Minor also undistributes M. (From 1)
   4. (2) and (3) together contradict $A_{1.}$
   5. Minor should distribute M.
   6. Minor must be universal.

2. If any premise is negative, major must be universal.

   Proof:

   1. Let major be particular, when one premise is negative.
   2. Negative premise yields negative conclusion. (B_3)
   3. Negative conclusion distributes P.
   4. Major should distribute P. (From 3 and A_2)
   5. Major must be universal.
   6. (1) and (5) contradict one another.
   7. Major must be universal. q.e.d.

3. If minor is affirmative, then, conclusion must be particular.

   Proof:

   1. Let conclusion be universal with affirmative minor.
   2. Universal conclusion distributes S.
   3. Minor should distribute S. (From A_2 and 2)
   4. Affirmative minor undistributed S.
   5. (3) and (4) contradict one another.
   6. Conclusion should undistribute S.
   7. Conclusion must be particular.

3.5 FALLACIES

There are three important fallacies associated with categorical syllogism. They are fallacies of undistributed middle, illicit major and illicit minor. One example for each fallacy with explanation will suffice.

	P M	
Major Premise:	All inscriptions are contents of historical study.	IAC
	S M	
Minor Premise:	All ancient coins are contents of historical study.	AAC
Conclusion:	∴ All ancient coins are inscriptions.	AAI

Ans: This argument is in the second figure. According to one special rule of the second figure, only one premise must be negative. Since this rule is violated M is undistributed in both the premises.

∴ The argument commits the fallacy of undistributed middle.

While mentioning the rule violated we can also say that according to one axiom of quantity, M should be distributed at least once. When this rule is violated this fallacy is committed.

	M P	
Major Premise:	All sailors are strong.	SAS
	M S	
Minor Premise:	All sailors are men.	SAM
	S P	
Conclusion:	∴ All men are Strong.	MAS

Ans: This argument is in the third figure. According to one special rule of the third figure, the conclusion must be particular. Since this rule is violated, the argument commits the fallacy of illicit minor. [The reader is advised to identify the second type of explanation.]

	P M	
Major Premise:	Some rich people are merchants.	RIM
	M S	
Minor Premise:	No merchants are educated.	MEE
Conclusion:	∴ Some educated persons are not rich.	EOR

Ans: This argument is in the fourth figure. According to one special rule of the fourth figure, when a premise is negative major must be universal. This rule is violated by the argument and it commits the fallacy of illicit major. [The reader is advised to identify the second type of explanation.]

In any deductive argument certain elements are constant. In syllogism, for example, quality and quantity and position of terms determine the structure of the argument. Keeping the structure constant if any term is replaced by any other term, the end result remains the same. Therefore the student can construct as many examples as he or she wants. The method of identifying the fallacy remains the same, if the structure remains the same.

3.6 REDUCTION OF ARGUMENTS

Reducing arguments from other figures to the first figure is one of the techniques developed by Aristotle to test the validity of arguments. It is because Aristotle held that the first figure is the perfect one; all others are imperfect. After reduction, if the argument is valid in the first figure, then it means that the original argument in any other figure is valid. This technique is quite mechanical. So, we are only required to know what exactly is the method involved. We will learn this only by practice.

II Figure

II Figure CESARE		I Figure CELARENT
P E M	→ Conversion→	M E P
S A M		S A M
S E P		S E P
No politicians are poets.	→ Conversion →	No poets are politicians.
All girls are poets.		All girls are poets.
∴No girls are politicians.		∴No girls are politicians.

In CESARE 'S' after 'E' indicates simple conversion. It shows that 'E' (major premise) must undergo simple conversion.

II Figure

II Figure CAMESTRES	I Figure CELARENT
P A M	M E S
S E M → conversion M E S	P A M
∴S E P	∴P E S conversion→S E P

'S' and 'T' after 'E' shows that 'E' (minor premise) should undergo simple conversion and both premises be transposed. 'S' after second 'E' shows that this 'E' (conclusion) should undergo simple conversion. [The student is advised to construct argument for this and subsequent reductions.]

II Figure

II Figure FESTINO		I Figure FERIO
P E M	→ Conversion →	M E P
S I M		S I M
S O P		S O P

FESTINO becomes FERIO when major premise undergoes simple conversion. The kind of reduction of the above mentioned moods is known as direct reduction. BAROCO becomes FERIO through the process of indirect reduction. Indirect reduction includes, in addition to conversion, obversion also.

II Figure

II Figure BAROCO		I Figure FERIO
P A M → obversion P E $\overline{M}$	→ Conversion →	$\overline{M}$ E P
S O M → obversion S I $\overline{M}$		S I $\overline{M}$
S O P		S O P

There is no need to consider weakened moods separately when the technique involved is reduction. What is required is replacement of universal by its corresponding subaltern.

III Figure

III Figure		I Figure
DARAPTI		DARII
M A P		M A P
M A S	→ Conversion→	S I M
S I P		S I P
DATISI		DARII
M A P		M A P
M I S	→ Conversion→	S I M
S I P		S I P
FELAPTON		FERIO
M E P	→ Conversion→	M E P
M A S		S I M
S O P		S O P

'P' which follows 'A' in DARAPTI and FELAPTON shows that conversion per accidens applies to 'A'.

FERISON			FERIO
M E P			M E P
M I S		→ Conversion→	S I M
S O P			S O P
DISAMIS			DARII
M I P	M A S		M A S
M A S	M I P	→ Conversion →	P I M
S I P			P I S
			↓ Conversion
			S I P

While the reduction of the above-mentioned moods is direct, next one is indirect.

BOCARDO						
M O P	→ Obversion →	M I $\bar{P}$	→ Conversion →	$\bar{P}$ I M		M A S
M A S		M AS		M A S		$\bar{P}$ I M
S O P				P I S		$\bar{P}$ IS
						↓Conversion
						S I $\bar{P}$
						↓Obversion
						S O P

When BOCARDO undergoes reduction, conversion, obversion and transposition are required to complete the process. Here OAO becomes AII. Further, when we consider obverted conclusion of AII, we obtain AIO. This is a paradox.

	IV Figure
IV Figure	I Figure
BRAMANTIP	Weakened Mood
P A M	M A S
M A S	P A M
S I P	P A S → Conversion →S I P

'S' after 'E' and 'P' after 'A' in FE

CAMENES	CELARENT
P A M	M E S
MES	PAM
S E P	S E P

DIMARIS	DARII
P I M	M A S
M A S	P I M
S I P	S I P

FESAPO		FERIO
P E M	→ Conversion→	M E P
M A S	→ Conversion→	S I M
SOP		SOP

As usual 'S' stands for simple conversion of 'E' (Major Premise) and 'P' stands for conversion per accedens of 'A' (Minor premise). This process is similar to first and third moods of III figure.

FRESISON		FERIO
P E M	→ Conversion→	M E P
M I S	→ Conversion→	S I M
S O P		S O P

A close observation of the above reductions reveals that they are to be performed according to certain parameters. The moods in the first figure are Barbara, Celarent, Darii and Ferio. Their initial consonants are arbitrarily found. For other figures, the initial consonants indicate to which of the first, the figure is to be reduced. Accordingly, Fesapo in the 4th figure is to be reduced to Ferio. Other consonants occurring in second, third and fourth figures' mnemonics indicate the operation that must be performed on the proposition indicated by the preceding vowel in order to reduce the syllogism to a first-figure syllogism. Certain 'keys' are the following. 's' indicates simple conversion; 'p' indicates conversion per accidens (by limitation); 'm' indicates the interchanging of the premises; 'k' indicates obversion; 'c' refers to the process that the syllogism is to be reduced indirectly. Meaningless letters in mnemonic terms are 'r', 't', 'l', 'n', and noninitial 'b' and 'd'.

From reduction technique one point becomes clear. Originally, there were twenty-four valid moods. Later weakened and strengthened moods were eliminated on the ground that particular proposition (existential quantifier) cannot be deduced from universal propositions (universal quantifier) alone, and the number was reduced to fifteen. Now after reduction to first figure the number came down to four. Strawson argues that reduction technique is superior to axiomatic technique to which he referred in the beginning of his work 'Introduction to Logical Theory'. He regards the moods as inference-patterns. He argues that the path of reduction should be an inverted pyramid. At one particular point of time Strawson maintains that in addition to equivalence relation, we require opposition relation also to effect reduction.

3.7 ANTILOGISM OR INCONSISTENT TRIAD

This technique was developed by one lady by name, Christine Ladd-Franklin (1847-1930). This technique applies only to fifteen moods. The method is very simple. Consider Venn's results for all propositions. Replace the conclusion by its contradiction. This arrangement constitutes antilogism. If the corresponding argument should be valid, then antilogism should conform to certain structure. It must possess two equations and one inequation. A term must be common to equations. It should be positive in one equation and negative in another. Remaining two terms appear in inequation. Consider one example for a valid argument.

	Venn's Results	**Antilogism**
All Indians are Asians.	$I\bar{A} = Ø$	$I\bar{A} = Ø$
All Hindus are Indians.	$H\bar{I} = Ø$	$H\bar{I} = Ø$
∴ All Hindus are Asians.	$H\bar{A} = Ø$	$H\bar{A}$ '" Ø

In this case, antilogism satisfies all the requirements. I is common to equations; in one equation it is positive and in another negative. There is only one inequation. Remaining terms appear in inequation. In all cases, this is the method to be followed. If any one of these characteristics is absent in antilogism, then the corresponding mood is invalid.

Now, for remaining fourteen moods antilogism can be easily constructed.

1 Fig.

1) CELARENT

Contradiction

M E P		$MP = Ø$
S A M		$S\bar{M} = Ø$
S E P →	SIP	$SP \neq Ø$

2) DARII

M A P		$M\bar{P} = Ø$
S I M		$SM \neq Ø$
S I P →	SEP	$SP = Ø$

3) FERIO

M E P		$MP = \emptyset$
S I M		$SM \neq \emptyset$
S O P →	SAP	$S\overline{P} = \emptyset$

II Fig.

4) CESARE

P E M		$PM = \emptyset$
S A M		$S\overline{M} = \emptyset$
S E P →	SIP	$SP \neq \emptyset$

5) CAMESTRES

P A M		$P\overline{M} = \emptyset$
S E M		$SM = \emptyset$
S E P →	SIP	$SP \neq \emptyset$

6) FESTINO

P E M		$PM = \emptyset$
S I M		$SM \neq \emptyset$
S O P →	SAP	$S\overline{P} = \emptyset$

7) BAROCO

P A M		$P\overline{M} = \emptyset$
S O M		$S\overline{M} \neq \emptyset$
S O P →	SAP	$S\overline{P} = \emptyset$

III Fig.

8) DISAMIS

M I P		$MP \neq \emptyset$
M A S		$M\overline{S} = \emptyset$
S I P →	SEP	$SP = \emptyset$

9) DATISI

M A P		$M\overline{P} = \emptyset$
M I S		$MS \neq \emptyset$
S I P $\rightarrow$	SEP	$SP = \emptyset$

10) BOCARDO

M O P		$M\overline{P} \neq \emptyset$
M A S		$M\overline{S} = \emptyset$
S O P $\rightarrow$	SAP	$S\overline{P} \neq \emptyset$

11) FERISON

M E P		$MP = \emptyset$
M I S		$MS \neq \emptyset$
S O P $\rightarrow$	SAP	$S\overline{P} = \emptyset$

IV Fig.

12) CAMENES

P A M		$P\overline{M} = \emptyset$
M E S		$MS = \emptyset$
S E P $\rightarrow$	SIP	$SP \neq \emptyset$

13) DIMARIS

P I M		$PM \neq \emptyset$
M A S		$M\overline{S} = \emptyset$
S I P $\rightarrow$	SEP	$SP = \emptyset$

14) FRESISON

P E M		$PM = \emptyset$
M I S		$MS \neq \emptyset$
S O P $\rightarrow$	SAP	$S\overline{P} = \emptyset$

We will see why a strengthened mood is invalid.

III Fig.

DARAPTI

M A P		$M\overline{P} = \emptyset$
M A S		$M\overline{S} = \emptyset$
S I P $\rightarrow$	SEP	$SP = \emptyset$

In this antilogism there is no inequation. Hence corresponding mood is invalid. Now consider a weakened mood.

II Fig.

Weakened Mood:

P A M		$P\overline{M} = \varnothing$
S E M		$SM = \varnothing$
S O P →	SAP	$S\overline{M} = \varnothing$

Again, in this antilogism, there is no inequation. Hence, corresponding is invalid. Same method applies to any other invalid mood.

3.8 VENN DIAGRAM TECHNIQUE

Let us extend our knowledge of Venn diagram to the testing of arguments. If two terms yield four product classes, then three terms should yield eight product classes according to the formula $2^x = n$, where x stands for the number of terms and n stands for the number of product classes. Since syllogism consists of three terms, we have eight product classes. There is a certain method to construct Venn's diagram when eight product classes are involved. At least one segment must be common to all the three circles which represent three terms. Further, when three circles are considered in combination of two circles at a time, every such combination must produce a unique intersection. When care is taken to meet these requirements, we can easily discern eight segments corresponding to eight product classes. Let us begin with a valid mood to list these product classes and identify corresponding segments in the diagram. It may be noted that the structure of Venn's diagram is constant for all arguments. The difference consists only in what we mark and where we mark.

I Fig.

BARBARA	Venn Diagram
p_1: M A P	$M\overline{P} = \varnothing$
p_2: S A M	$S\overline{M} = \varnothing$
q: ∴ S A P	$S\overline{P} = \varnothing$

The product classes are as follows: -

SMP

$\overline{SMP}$

$SM\overline{P}$

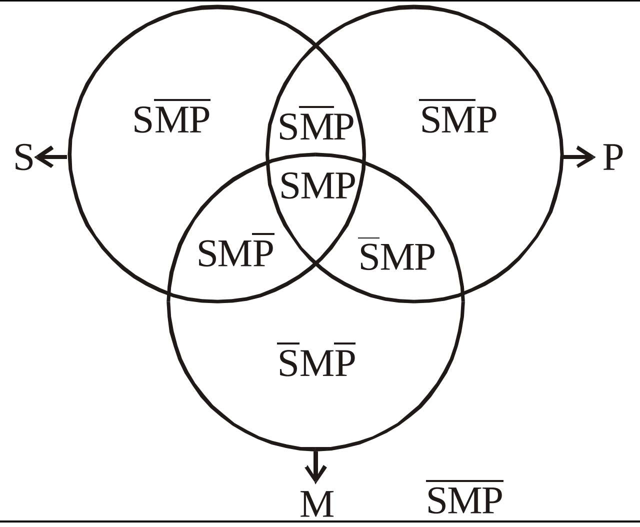
$S\overline{MP}$

$\overline{S}\,\overline{M}P$

$\overline{S}MP$

$\overline{S}M\overline{P}$

$S\overline{M}P$



While listing product classes, sufficient care should be taken to ensure that no product class is repeated. It is always advisable to make a list of product classes with diagrams and mark classes accurately to avoid confusion.

Now let us use diagram to represent the propositions. While doing so null sets are shaded and non-null sets are starred. We should also note that product of null set and non-null set is a null set. It is like saying that 4 x 0 = 0. But the union, i.e., addition of a non-null set and null set is a non-null set. Remember 4 + 0 = 4.

Since M $\bar{P}$ is a null set not only SM, but also M is a null set. It does not mean that there are two null sets. There is only one null set. S is also a null set. Therefore not only the product of S & P, but also S and is a null set. It only means that all nullsets are identical. It is in this sense that there is only one nullset. Now we shall shade relevant subsets, which are nullsets.

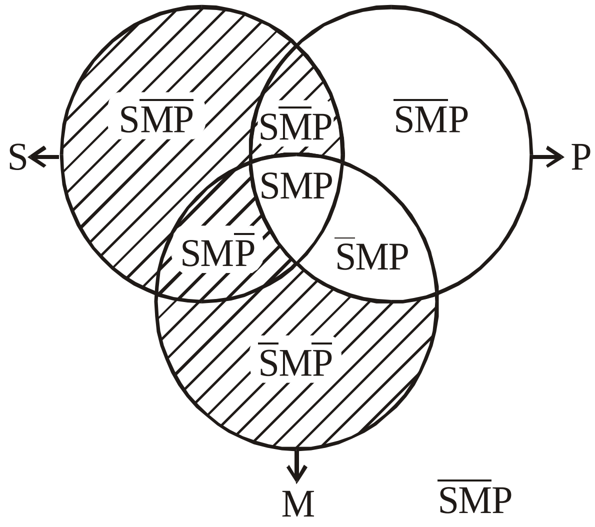
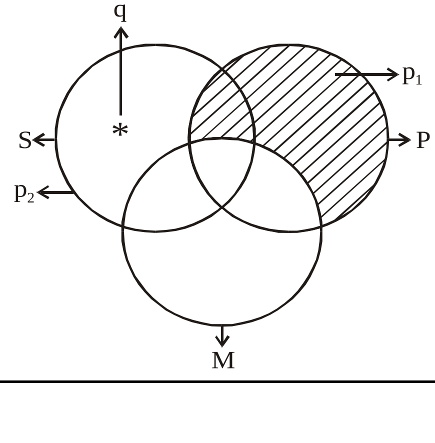


Fig. 2.

p_1 and p_2 show that: $\bar{S}$ M $\bar{P}$ = SM= S= SP = Ø. Conclusion shows that S also is a null set. We did not specially shade S. Shading M and S included naturally the shading of S segment. This is what actually happens in the case of valid arguments. Marking of premises naturally includes conclusion. It is not marked separately. If we adopt Venn diagram technique, then this important condition should be borne in mind. Secondly, when any premise is particular, the segment, which corresponds to the universal premise, should be shaded first. This is the initial step to be followed. Now we shall consider remaining moods. [In all cases all product classes should be identified by the student even if there is no need. This is a good exercise.]

BAROCO

p1: All P are M.	$P\bar{M} = Ø$
p2: Some S are not M.	$S\bar{M} \neq Ø$
q: Some S are not P.	$S \neq Ø$

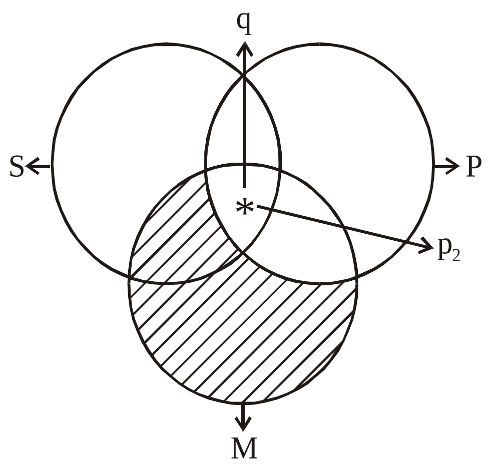


p1: All M are P. $M\overline{P} = \varnothing$

p2: Some M are S. $MS \neq \varnothing$

---

q: ∴ Some S are P. $SP \neq \varnothing$



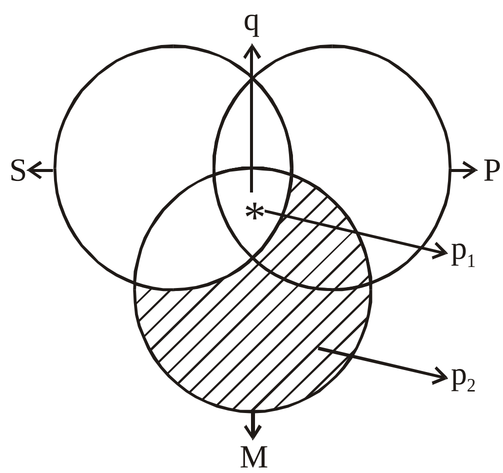
DISAMIS

p1: Some M are P. $MP \neq \varnothing$

p2: All M are S. $M\overline{S} = \varnothing$

---

q: ∴ Some S are P. $SP \neq \varnothing$



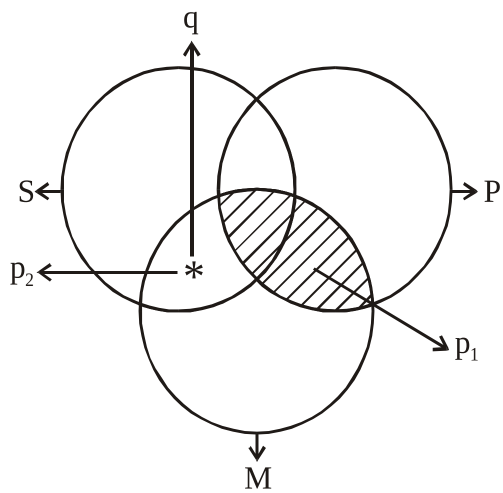
FERISON

p1: No M are P. $MP = \varnothing$

p2: Some M are S. $MS \neq \varnothing$

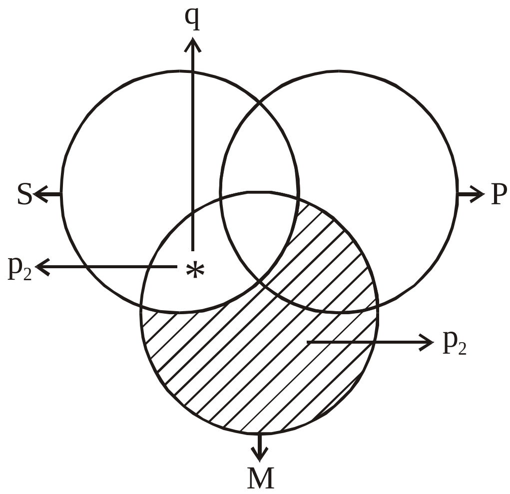
---

q: Some S are not P. $S\overline{P} \neq \varnothing$



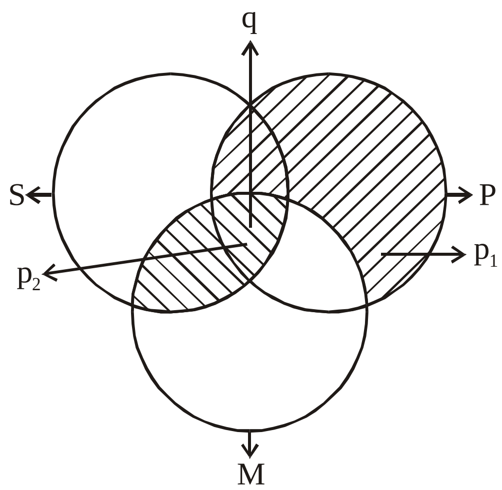
BOCARDO

p1: Some M are not P.	$M\bar{P} \neq \varnothing$
p2: All M are S.	$M\bar{S} = \varnothing$
q: ∴ Some S are not P.	$S \neq \varnothing$



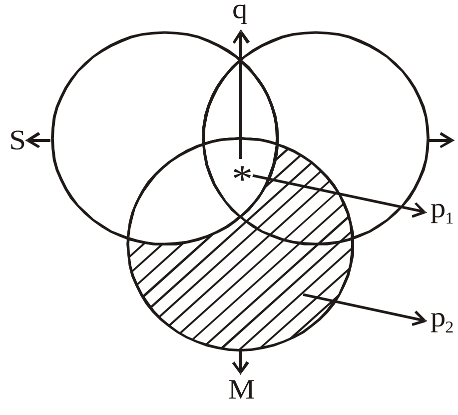
CAMENES

p1: All P are not M.	$P\bar{M} = \varnothing$
p2: No M are S.	$M\ S = \varnothing$
q: No S are not P.	$S\ P = \varnothing$



DIMARIS

p1: Some P are M.	$P\ M \neq \varnothing$
p2: All M are S.	$M\bar{S} = \varnothing$
q: ∴ Some S are P.	$S\ P \neq \varnothing$



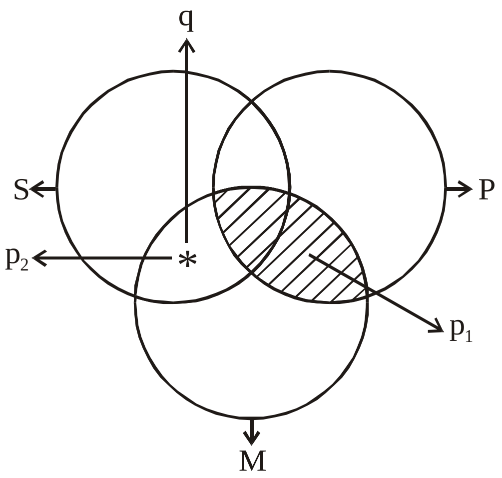
FRESISON

p1: No P are M. $PM = \emptyset$

p2: Some M are S. $MS \neq \emptyset$

---

q: Some S are not P. $S\overline{P} \neq \emptyset$



Using Venn's diagram, let us examine, again weakened and strengthened moods.

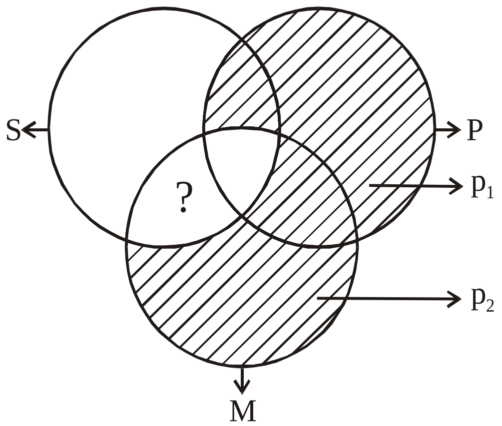
BRAMANTIP

p1: All P are M. $P\overline{M} = \emptyset$

p2: All M are S. $M\overline{S} = \emptyset$

---

q: Some S are P. $SP \neq \emptyset$



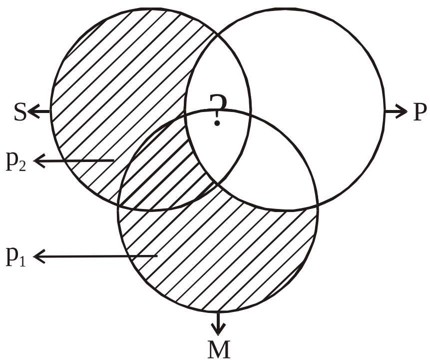
No information on S M $\overline{P}$ and SMP is available after the premises are diagrammed. Therefore BRAMANTIP is invalid. Now consider a weakened mood.

AAI

p1: M A P. $M\overline{P} = \emptyset$

p2: S A M. $S\overline{M} = \emptyset$

q: ∴ S I P. $SP \neq \emptyset$



In this case also no information is available on S $\overline{M}$ P and S M P after the premises are diagrammed. Hence AAI is invalid.

Using this technique the students can test other valid moods.

Check Your Progress I

Note: a) Use the space provided for your answer.

b) Check your answers with those provided at the end of the unit.

1) State the rule which is common to conversion and syllogism.

....

2) Mention the figure which is valid in all figures.

....

....

3) Mention the figure which is invalid in all the figures.

....

3.9 LET US SUM UP

Syllogism is an important form of inference in traditional logic. The structure of syllogism determines the rules and in turn quality, quantity and position of terms determine the structure of syllogism. There are five techniques to test the validity of arguments. Conditions of validity differ from traditional analysis to modern analysis.

There are three important fallacies in this category.

3.10 KEY WORDS

Paradox: A paradox is a statement or group of statements that leads to a contradiction or a situation which defies intuition or common experience.

3.11 FURTHER READINGS AND REFERENCES

Alexander, P. *An Introduction to Logic & The Criticism of arguments*. London: Unwin University, 1969.

Copi, I.M. *Introduction to Logic*. New Delhi: Prentice Hall India, 9th Ed., 1995.

Joseph, H.W.B. *An Introduction to Logic*. Oxford: 1906.

Nandan, M.R. *A Textbook of Logic.* New Delhi: S.Chand & Co, 1985.

Stebbing,Susan. *A Modern Introduction to Logic.* London: 1933

Stoll, R. *Set Theory and Logic*. New Delhi: Eurasia publishing House, 1967.

Strawson, P.F. *Introduction To Logical Theory*. London: Methuen, 1967.

3.12 ANSWERS TO CHECK YOUR PROGRESS

Check Your Progress I

1. The rule which is common to conversion and syllogism is: ‘term which is undistributed in the premise must remain undistributed in the conclusion’.

2. EIO is the only mood which is valid in all the figures.

3. IEO is invalid in all the figures.