

Logical Deductions

Logical Deduction is reasoning which constructs or evaluates deductive arguments. Deductive arguments are attempts to show that a conclusion necessarily follows from a set of premises or hypotheses. A deductive argument is valid if the conclusion does follow necessarily from the premises, i.e., the conclusion must be true provided that the premises are true. A deductive argument is sound if it is valid and its premises are true. Deductive arguments are valid or invalid, sound or unsound. Deductive reasoning is a method of gaining knowledge. An example of a deductive argument:

All men are mortal
Socrates is a man
Therefore, Socrates is mortal

The first premise states that all objects classified as "men" have the attribute "mortal". The second premise states that "Socrates" is classified as a man \square a member of the set "men". The conclusion states that "Socrates" must be mortal because he inherits this attribute from his classification as a man.

Rules for deriving conclusion from two given premises:

1. The conclusion does not contain the middle term.

Example.

Statements:

1. All men are girls.
2. Some girls are students.

Conclusions:

1. All girls are men.
2. Some girls are not students.

Since both the conclusions 1 and 2 contain the middle term 'girls', so neither of them can follow.

2. No term can be distributed in the conclusion unless it is distributed in the premises.

Example.

Statements:

1. Some dogs are goats.
2. All goats are cows.

Conclusions:

1. All cows are goats.
2. Some dogs are cows.

Statement 1 is an I-type proposition which distributes neither the subject nor the predicate.

Statement 2 is an A type proposition which distributes the subject i.e. 'goats' only.

Conclusion 1 is an A-type proposition which distributes the subject 'cow' only since the term 'cows' is distributed in conclusion 1 without being distributed in the premises, so conclusion 1 cannot follow.

3. The middle term (M) should be distributed at least once in the premises. Otherwise, the conclusion cannot follow.

For the middle term to be distributed in a premise.

- (i) M must be the subject if premise is an A proposition.
- (ii) M must be subject or predicate if premise is an E proposition.
- (iii) M must be predicate if premise is an O proposition.

Note that in an I proposition, which distributes neither the subject nor the predicate, the middle term cannot be distributed.

Example.

Statements:

1. All fans are watches.
2. Some watches are black.

Conclusions:

1. All watches are fans.
2. Some fans are black.

In the premises, the middle term is 'watches'. Clearly, it is not distributed in the first premise which is an A proposition as it does not form its subject. Also, it is not distributed in the second premise which is an I proposition. Since the middle term is not distributed even once in the premises, so no conclusion follows.

4. No conclusion follows

(a) if both the premises are particular

Example.

Statements:

1. Some books are pens.
2. Some pens are erasers.

Conclusions:

1. All books are erasers.
2. Some erasers are books.

Since both the premises are particular, so no definite conclusion follows.

(b) if both the premises are negative.

Example.

Statements:

1. No flower is mango.
2. No mango is cherry.

Conclusions:

1. No flower is cherry.
2. Some cherries are mangoes. Since both the premises are negative, neither conclusion follows.

(c) if the major premise is particular and the minor premise is negative.

Example.

Statements:

1. Some dogs are bulls.
2. No tigers are dogs.

Conclusions:

1. No dogs are tigers.
2. Some bulls are tigers.

Here, the first premise containing the middle term 'dogs' as the subject is the major premise and the second premise containing the middle term 'dogs' as the predicate is the minor premise. Since the major premise is particular and the minor premise is negative, so no conclusion follows.

5. If the middle term is distributed twice, the conclusion cannot be universal.

Example.

Statements:

1. All fans are chairs.
2. No tables are fans.

Conclusions:

1. No tables are chairs.
2. Some tables are chairs.

Here, the first premise is an A proposition and so, the middle term 'fans' forming the subject is distributed. The second premise is an E proposition and so, the middle term 'fans' forming the predicate is distributed. Since the middle term is distributed twice, so the conclusion cannot be universal.

6. If one premise is negative, the conclusion must be negative.

Example.

Statements:

1. All grasses are trees.
2. No tree is shrub.

Conclusions:

1. No grasses are shrubs.
2. Some shrubs are grasses.

Since one premise is negative, the conclusion must be negative. So, conclusion 2 cannot follow.

7. If one premise is particular, the conclusion must be particular.

Example.

Statements:

1. Some boys are thieves.
2. All thieves are dacoits.

Conclusions:

1. Some boys are dacoits.
2. All dacoits are boys.

Since one premise is particular, the conclusion must be particular. So, conclusion 2 cannot follow.

8. If both the premises are affirmative, the conclusion must be affirmative.

Example.

Statements:

1. All women are mothers.
2. All mothers are sisters.

Conclusions:

1. All women are sisters.
2. Some women are not sisters.

Since both the premises are affirmative, the conclusion must be affirmative. So, conclusion 2 cannot follow.

9. If both the premises are universal, the conclusion must be universal.

When more than two conclusions are given:

Find out which of the conclusions logically follow from the given premises, More than one conclusion may also follow. In such questions, first the given statements are analysed. If the middle term is not disturbed even once, no conclusion follows. Thus the middle term must be distributed at least once. To derive the correct conclusions, we usually take the help of the Venn Diagram.

Also no conclusion follows in the following cases:

- (i) If both the premises are particular
- (ii) If both the premises are negative

Example

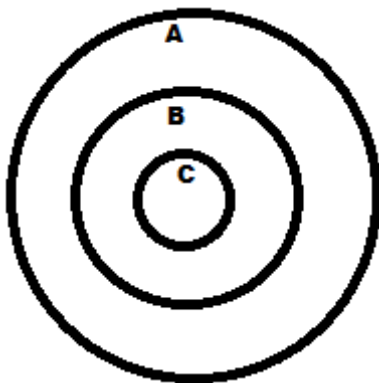
Statements:

1. All books are cakes
2. All cakes are apples

Conclusions:

- Some cakes are books
- No cake is book
- Some apples are books
- All apples are books

- A) Only 1 follows
- B) Only either 1 or 2 follows
- C) Only 1 and 3 follow
- D) Only either 3 or 4 follows
- E) None follows



For the given statements, the Venn Diagram is as shown where B indicates books, C indicates cakes and A indicates apples.

Now, since B has a common area with C, so 1 follows while 2 does not. Also, B has a common area with A but does not entirely lie with A. So 3 follows while 4 does not.

Thus, only I and III follow. Hence, the answer is (c).

Directions (1-2): In each question below are given two statements followed by two conclusions numbered I and II. You have to take the given two statements to be true even if they seem to be at variance from commonly known facts. Read the conclusion and then decide which of the given conclusions logically follows from the two given statements, disregarding commonly known facts.

Give answer:

- (A) If only conclusion I follows
- (B) If only conclusion II follows

(C) If either I or II follows

(D) If neither I nor II follows and

(E) If both I and II follow.

Statements: All tubes are handles. All cups are handles.

Conclusions:

1. All cups are tubes.
2. Some handles are not cups.

- A) Only conclusion I follows
- B) Only conclusion II follows
- C) Either I or II follows
- D) Neither I nor II follows
- E) Both I and II follow

2. Statements: No magazine is cap. All caps are cameras.

Conclusions:

1. No camera is magazine.
2. Some cameras are magazines.

- A) Only conclusion I follows
- B) Only conclusion II follows
- C) Either I or II follows
- D) Neither I nor II follows
- E) Both I and II follow

Direction (3-5) : In each of the questions below are given three statements followed by three conclusions numbered I, II and III, You have to take the given statements to be true even if they seem to be at variance from the commonly known facts. Read all the conclusions and then decide which of the given conclusions logically follows from the given statements disregarding commonly known facts.

3. Statements: Some pens are books. All schools are books. Some colleges are schools.

Conclusions:

1. Some colleges are pens.
2. Some pens are schools.
3. Some colleges are books

1. Only I and II follow
2. Only II and III follow
3. Only I and III follow
4. All follow
5. None of these

4. Statements: Some blades are hammers. Some hammers are knives. Some knives are axes.

Conclusions:

1. Some axes are hammers.
2. Some knives are blades.
3. Some axes are blades.

1. None follows
2. Only I follows
3. Only II follows
4. Only III follows
5. None of these

5. Statements: Some mountains are hillocks. Some mountains are rivers. Some mountains are valleys.

Conclusions:

1. All mountains are either hillocks or rivers or valleys.
2. No valley is river.
3. Some river are valleys.
 - A. None follows
 - B. Only I follows
 - C. Only either II or III follows
 - D. Only III follows
 - E. None of these

Answer & Explanations:

1. D. Both the premises are A type propositions. So, in either, the middle term 'handles' forming the predicate is not distributed. Since the middle term is not distributed even once in the premises, no definite conclusion follows.

2. C. As discussed above, the conclusion must be particular negative and should not contain the middle term. So, it follows that 'Some cameras are not magazines'. However, I and II involve only the extreme terms and form a complementary pair. Thus, either I or II follows.

3. E. Some pens are books. All schools are books.

Since the middle term 'books' is not distributed even once in the premises, so no definite conclusion follows.

Some colleges are schools. All schools are books.

Since one premise is particular, the conclusion must be particular and should not contain the middle term.

So, it follows that 'Some colleges are books'. Thus, III follows.

Some pens are books. Some colleges are books.

Since both the premises are particular, no definite conclusion can be drawn.

Hence, only III follows.

4. A. Since each combination of premises has two particular premises, so no definite conclusion follows.

5. C. Since each combination of premises shall contain two particular premises, no definite conclusion can be drawn. However, II and III are statements involving the extreme terms of the last two premises and form a complementary pair. Thus, either II or III follows.