Date: 11th March 2021

VIRTUAL COACHING CLASSES
ORGANISED BY BOS (ACADEMIC), ICAI

FOUNDATION LEVEL
PAPER 3: BUSINESS MATHEMATICS, LOGICAL REASONING & STATISTICS

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Introduction

- A **syllogism** (Greek: συλλογισμός, *syllogismos*, 'conclusion, inference') is a kind of logical argument that applies deductive reasoning to arrive at a conclusion based on two or more propositions that are asserted or assumed to be true.
- Within logic, various types of arguments, premises, and conclusions can be formed.
- A **syllogism** is a method of reasoning by drawing a conclusion from two premises.
- All men are mortal.
  Socrates is a man.
  Therefore, Socrates is mortal.

INTRODUCTION

- Syllogism is a ‘Greek’ word that means **inference or deduction.**
- As such inferences are based on logic, then these inferences are called logical deduction.
- These deductions are based on **propositions (premise).**
- Different types of questions covered in this chapter are as follows:
- **Two Statements and Two Conclusions**
- ‘Syllogism’ checks **basic aptitude and ability** of a candidate to **derive inferences from given statements** using **step by step methods of solving problems**

- The **law of syllogism** is also known as **reasoning by transitivity**. It is similar to the transitive property of equality, which says
- If a = b
- and if b = c
- then a = c

- "All A are B," and "No A are B" are termed *universal* propositions;
- "Some A are B" and "Some A are not B" are termed *particular* propositions.
- **Major premise** shares something with a second, **minor premise**, which in turn leads to a **conclusion**

- **Major premise**: All humans are mortal.
- **Minor premise**: All Greeks are humans.
- **Conclusion**: All Greeks are mortal.

- **Major premise**: All mortals die.
- **Minor premise**: All men are mortals.
- **Conclusion**: All men die.

- **Major premise**: All M are P.
- **Minor premise**: All S are M.
- **Conclusion**: All S are P.
- ***Deductive argument***
- Some pigs have wings.

  All winged things sing.

  Conclusion : Therefore, some pigs sing.

- All circles are squares.
- All squares are triangles.
- **Conclusion :** Therefore all circles are triangles.

All fruits are vegetables.

apple is a fruit.

Conclusion : Therefore apple is a vegetable.

Deductive Reasoning

- If I study each subject 1 hr a night, then I will get good marks *(if p then q)*
- If I get good marks, then I will get into good colleges *(if q then r)*
- If I study each subject 1 hr a night, then I will get into good colleges *(if p then r)*

All athletes work out in the gym.

James Bonds is an athlete.

Therefore, James Bonds works out in the gym.

All students eat pizza.

Suresh is a student.

Therefore, Suresh eats pizza.

Definition= Proposition

- In all the sentences mentioned above, a **relation** is established between **subject** and **predicate** with the help of **quantifier** and **copula.**
- Now, we can define proposition as under:
- A **proposition** or **premise** is grammatical sentence comprising of four components.
- **Quantifier** • **Subject** • **Copula** • **Predicate**

Analysis

(i)

All	**Rats**	**are**	**Cats**
Quantifier	Subject	Copula	Predicate

(ii)

No	**Rat**	**is**	**Cat**
Quantifier	Subject	Copula	Predicate

(iii)

Some	**Rats**	**are**	**Cats**
Quantifier	Subject	Copula	Predicate

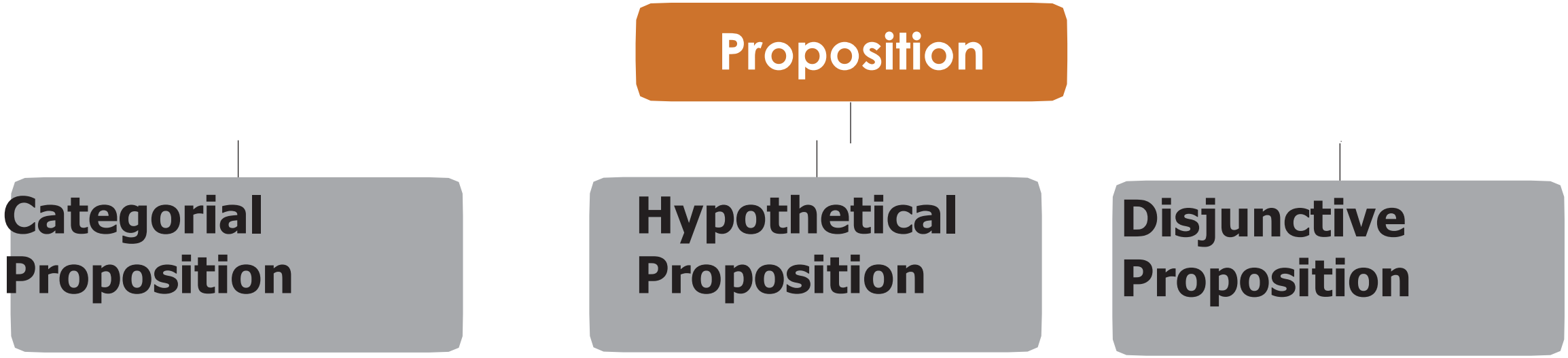
(iv)

Some	**Rats**	**are not**	**Cats**
Quantifier	Subject	Copula	Predicate

Components of Proposition

- **Quantifier** – The words ‘All’ ‘No’ and ‘Some’ are called quantifiers as they specify a quantity. **Keep in mind that ‘All’ and ‘No’ are universal quantifiers** because they refer to each and every object of a certain set.
- **‘Some**’ is a **particular quantifier** as it refers to at least one existing object in a certain set.
- **Subject** – Subject is the **part of the sentence something is said about.** It is denoted by S.
- **Copula** – It is that part of a proposition that denotes the **relation between subject and predicate.**
- **Predicate** – It is that part of a proposition which is affirmed detail about that subject.

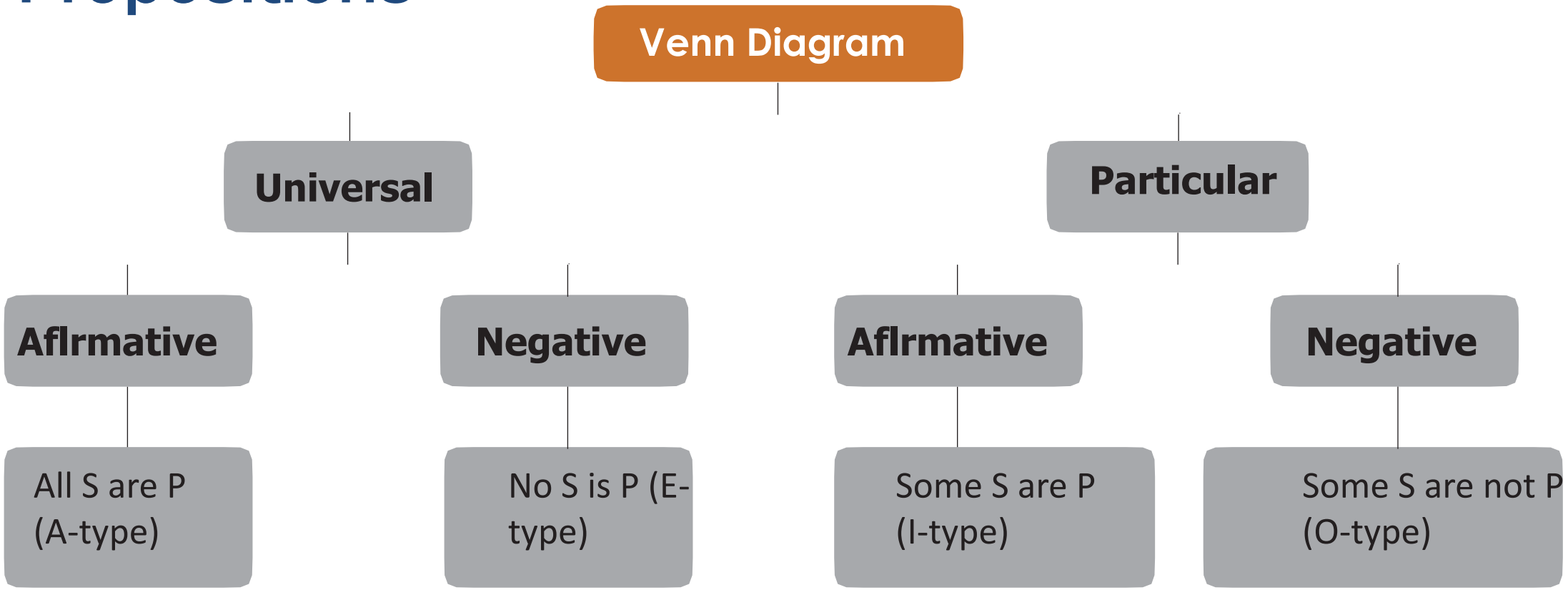
Classification of Proposition



- **1. Categorical Proposition:** In categorical proposition, there exists a **relationship between the subject and the predicate without any condition.**
- It means predicate is either **affirmation or denial of the subject unconditionally.**
- **Example:**
- I. All cups are pens.
  - *No boy is girl.*

- **2. Hypothetical Proposition:** In a hypothetical proposition, relationship between subject and predicate is asserted conditionally.
- **Example:** I. **If it rains**, he will not come.
  - ***If he comes**, I will accompany him.*
- **3. Disjunctive Proposition:** In a disjunctive proposition, the **assertion is of alteration**.
- **Example:** I. Either he is sincere **or** he is loyal.
  - *Either he is educated **or** he is scholar.*

Venn Diagram Representation of Two Propositions



Analysis

- Following things are very much clear:
- Universal propositions, Either
  - ***completely include*** *the subject (A-type) or*
  - ***completely exclude*** *the subject (E-type)*
- Particular propositions, Either
  - ***partly include*** *the subject (I-type) or*
  - ***partly exclude t****he subject (O-type)*

Hidden Propositions

A-Type Propositions

- *All positive propositions beginning with **'every' and 'any' are A type propositions.***

- **Example:**
  - Every cat is dog Þ All dogs are cats
  - Each of students of class has passed Þ
  - All students of class X have passed
  - Anyone can do this job Þ
  - All can do this job

Important relations

All negative sentences beginning with 'no one', 'not a single' etc., are E-type propositions.

- Example:
  - Not a single student could answer the question.
- None can cross the English channel
- *A positive sentence with a particular person as its subject is always an A-type proposition.*
- A sentence with a definite exception is A type.
- A negative sentence with a very definite exception is also of E-type proposition

- *When an **Interrogative sentence** is used to make an assertion, this **could be reduced to an E-type proposition**. example:*
- ***Is there any person who can scale Mount Everest?***
- ***Þ None can climb Mount Everest.***

■ A negative sentence with a particular person as its subject is E-type proposition

I-Type Propositions

- Positive propositions beginning with words such as **'most', 'a few' 'mostly', 'generally', 'almost', 'frequently', and 'often' are to be reduced to the I-type propositions.**
- **Example:**
  - *Almost all the Vegetables have been sold.*
  - *Þ* ***Some*** *vegetables have been sold.*
  - *Most of the students will qualify in the test.*
  - *Þ* ***Some*** *of the students will qualify in the test.*
  - *Boys are frequently physically weak*
  - *Þ* ***Some boys*** *are physically weak.*

- **Negative propositions** beginning with words such as **‘few’ ‘seldom’, ‘hardly’, ‘rarely’, ‘little’** etc. **are to be reduced to the I-type propositions.**
- (a) Seldom writers do not take rest.
- Þ **Some writers take rest.**
- (b) Few politicians do not tell a lie.
- Þ **Some** politicians **tell a lie.**
- (c) Rarely Scientists do not get a good job
- Þ **Some Scientists get a good job.**
- **Positive propositions** with starting words such as **‘few’, ‘seldom’, ‘hardly’, ‘scarcely’, ‘rarely’, ‘little’, etc.**, are to be reduced to the **O-type propositions.**

- A **positive sentence** with an exception which is not definite, is **reduced to an I-type proposition.**
- All **negative propositions** beginning with words such as '**all**', '**every**', '**any**', '**each**' **etc. are to be reduced to O-type propositions.**
- (a) All Psychos are not guilty.
- Þ **Some Physchos are not guilty.**
- (b) All that glitters is not gold.
- Þ **Some glittering objects are not gold.**
- (c) Everyone is not Scientist
- Þ **Some are not Scientist.**

- **Exclusive Propositions**
- Such propositions start with ‘only’, ‘alone’, ‘none but’, ‘none else but’ etc., and they can be reduced to either A or E or I-type.
- **Example:**
- **Only** Post-graduates are officers.
- None below Post-graduate is officer. (E-type)
- All officers are Post-graduates. (A-type)
- Some Post-graduates are officers (I-type)

Types of Inferences

- Inferences drawn from statements can be **of 2 types:**
- **A. Immediate Inference:** When an inference is drawn from a single statement, then that inference is known as an immediate inference.
- **Example: Statement:** All books are pens.
- **Conclusion:** Some pens are books.
- In the above example, a **conclusion is drawn from a single statement and does not require the second statement to be referred**, hence the inference is called an **immediate inference.**

- **B. Mediate Inference** In mediate inference, conclusion is drawn from **2 given statements.**
- **Example: Statements:**
- All cats are dogs. All dogs are black.
- **Conclusion:** All cats are black.
- In the above example, **conclusion is drawn from the two statements or in other words, both** the statements are required to draw the conclusion. Hence, the above conclusion is known as **mediate inference.**

Method to Draw Immediate Inferences

- We are to study two methods, **A. implications and B.conversion.**
- **1) A-Type: All boys are blue. (A-type to I-type)**
- From the above A-type proposition, it is very 'clear that if all boys are blue, then **some boys will definitely be blue** because some is a part of all. **(through implication).**
- **2) E-Type: No cars are buses. (E-type** to **O-type)**
- If no' cars are buses, it clearly means : **some cars are not buses..**
- **3) I-Type: Some chairs are tables.**
- 'From the above I-type proposition, **we cannot draw any valid conclusion (through implication).**

- **4). O-Type: Some A are not B.**
- From the above O-type proposition, we can not draw any valid inference (**through implication**). On first look, **it appears that if some A are not B, then conclusion that some A are B must be true but the possibility of this conclusion being true can be over ruled** with the help of example:
- **Case I** A = {a, b, c} and B = {d, e, f}
- **Case II** A = {a, b, c} and B ={b, c, d}
- Now, in case I, none of the element of set A is the element of set B. Hence, **conclusion "Some A are B" cannot be valid.** However, in case II, elements b and c are common to both sets A and B.
- Hence, **here conclusion "Some A are B" is valid.** But for any conclusion to be true, **it should be true for all the cases**.
- **Hence, conclusion "Some A are B" is not a valid conclusion drawn from an O-type proposition.**

Rules

- No + No = No conclusion
- Some Not/ Some not reserved + Anything = No conclusion
- If all A are B then we can say – Some B are Not A is a possibility
- If Some B are not A then we can say – All A are B is a possibility
- If some A are B then we can say All A are B is a possibility. All B are A is a possibility.
- All Û Some not reserved
- Some Þ All
- No conclusion = Any possibility is true

Example 1:

- **Statement:**
- Some boys are student. **I-type proposition**
- All students are Engineers. **A-type propositions**
- **Conclusions:**

I. All Engineers are students.

II. Some boys are Engineers.

a) Only I follows

b) Only II follows

c) Both I and II follow

d) Neither I nor II follows

Solution-b

Example 2: may exclude

- **Statements:**
  - *All Lotus are flowers. (A type)*
  - *No Lily is a Lotus. (E type)*
- **Conclusions:**
- No Lily is a flower
- Some Lilies are flowers.

a) Only I follows

b) Only II follows

c) Either I or II follows

d) Neither I nor II follows

Solution: (c)

- **Example 3:**
- **Statements**
- I All A's are C's (A Type)
- II All D's are C's (A Type)
- **Conclusion**
- I All D's are C's
- II Some D's are not A's
  a) *Only I follows*
  b) *Only II follows*
  c) *Both I and II follows*
  d) *None follows*
- **Solution: (a)**

- **Example 4:**
- **Statements:** All balls are bats. All bats are stumps.
- The sentences are already aligned. From the above given Table, **A + A = A**. Hence the conclusion is of type-A whose subject is the subject of the first proposition and the predicate is the predicate of the second proposition?
- So the conclusion is ***All balls are Stumps***.

- **Example 5:**
- **Statements:** All Professors are readers. All Professors are writers.
- This pair is **not properly aligned** because the subject of both the sentences is ‘Professors’.
- Since both the **sentences are of type-A**, we may convert any of them. So the aligned pair is **Some readers are Professors.**
- All Professors are writers.
- Here the conclusion will be of type - I because **I + A = I.**
- The conclusion is ***Some readers are writers.***

THANK YOU