**MPYE 001: Logic**

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**1. Explain the general characteristics of dilemma. Discuss the methods used for avoiding dilemma.**

A **dilemma** or "**double proposition**" is defined a problem offering two unrelated possibilities, neither of which is unambiguously acceptable or preferable. It consists of three prepositions of which two are premises and the third is a conclusion. One of the premises is a conjunction of two hypothetical preposition and the other is disjunctive. The dilemma is a common form of argument in ordinary language.

In many cases, dilemmatic arguments are based on assumptions which are not correct. Hence, the use of dilemma is restricted. In case of facing a dilemma, it is better to avoid, rather than refute. Refuting would be an avoiding tendency.

1. **Escaping between the horns**:

We refutes a given dilemma by showing that the alternatives given in the minor premise are not exhaustive and there is a third alternative which goes in favour of the opponent. It could be inability to decide which of two things to do because either could have bad results.

1. **Taking the dilemma by horns**: Attempts are to be made to contradict the hypothetical prepositions, which are conjoined in this method. It is pointed out that either one or both consequent or both the consequents do not follow from their antecedents. The hypothetical proposition is contradicted when antecedent and negation of consequent are accepted. Hence, the dilemma is wrong and the conclusion cannot be established. Since the major premise is a conjunction of two hypothetical propositions, the method of refutation is more complex.
2. **Rebuttal of dilemma**: It appears to be the contradiction of dilemma. But, actually, it is not. In all these cases, the dilemma becomes a potent weapon to mislead the opponent in debate. Therefore none of these methods amounts to the contradiction of opponent’s view. Dilemma can be rebutted by constructing another counter dilemma whose conclusion is opposed to the original conclusion.

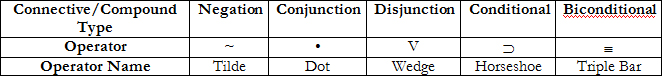
**2. Give a detailed account of Negation, Conjunction, and Disjunction form of compound propositions with sufficient examples.**

Several classes of proposition constitute arguments. There are no boundaries to the complexity of arguments. Propositional logic is the study of how complex statements are assembled and disassembled, as well as how we can replace one statement with another that is logically equivalent to it. Modern Login realises three kinds of proposition; Simple, Compound and General.

Simple sentences are equivalent to the ones as simple in grammar. A simple statement does not contain another statement as a component. A simple statement contains one clause only and singular term in place of subject.

Eg: Tea is good

Compound sentences contain two or more components. The components of compound sentences may be simple or may themselves be compound. The multiple components of compound sentences are connected through a sentential connectives, or logical notations. These logical notations are negation, conjunction, and disjunction, conditional (or implication) and bi conditional.

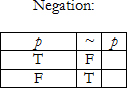


Propositions are replaced by lower case letters like p, q, r, etc. or simply p1, p2, p3, etc.

**NEGATION**:

Negation is a compound preposition in a unique case, as it is quite simple only. This refers to the negativity of a sentence. Negation tells us, “It is **not** the case that…”. It is a pointer to the exact meaning as well as the sense of being compound. A statement and its negation have opposite truth values.

Truth Table



The rule of negation is that a negation is true if what is negated is false, and is false if what is negated is true.

Examples of Negation

Cricket is not a sport.

A Rupee does not have hundred paisa.

Thousand Rupee notes are not valid.

She did not do her homework.

Summation of two negatives is not positive.

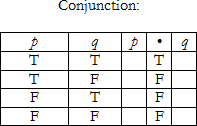
Connection: To help us remember this definition, think of a light bulb, which is either on or off, but not both.

**CONJUNCTION**:

When compound statements are joined by “and” they are conjunctions. It is a statement on two logical values, typically the values of two propositions, that produces a value of true if and only if both of its operands are true. The sentences which are combined are called conjuncts. As an exception, prepositions may be misleading sometimes.

As a rule of inference, conjunction introduction is a classically valid, simple argument form. The argument form has two premises, p1 and p2. Intuitively, it permits the inference of their conjunction.

Truth table



Eg : Sachin is talented and hard working.

What is the percentage of votes the party is expecting to get, and will they be able to get majority.

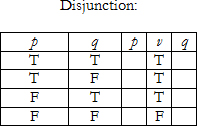
I took the bye-pass road and got down at the end of highway.

**DISJUNCTION**

Disjunction,also called alternation, is a combination of two sentences with connective **or** linking the sentences. Disjunction tells us that, “At least one is the case…”. The “**or”** of a set of operands is true if and only if one or more of its operands is true. An operand of a disjunction is called a **disjunct**.

"p1 or p2" is true if p1 is true, or if p2 is true, or if both p1 and p2 are true.

Truth Table



The sentential connective “v” can be used in two senses: Weak sense and strong sense.

1. The weak sense could be an inconclusive sense, which means either-or, or could be both.

Eg. Brij is lucky or he is sincere.

1. Strong or conclusive sense; wherein the disjuncts are mutually exclusive.

3. Answer any two of the following questions in about 250 words each:

**a) How do you relate the major, minor and middle terms in a syllogism?**

**Syllogism** is the most important form of inference. It a form of reasoning in which a conclusion is drawn from two given or assumed propositions (premises). Syllogism is the kind of logical form to which every deductive inference is reducible. Categorical syllogism is the essence of traditional logic. This is called mediate inference because the conclusion is drawn from two premises. It is called categorical because all propositions involved are categorical.

A categorical syllogism is an argument consisting of exactly three categorical propositions (two premises and a conclusion) in which there appear a total of exactly three categorical terms, each of which is used exactly twice. The most methodical way to study categorical syllogisms is to learn how to put them in standard-form, which looks like:

1. Major premise
2. Minor premise

The major term of the syllogism is whatever is employed as the predicate term of its conclusion. With the combination of a general statement (the major premise) and a specific statement (the minor premise), a conclusion is deduced.

The premise in which the minor occurs is called the minor premise and the premise in which the major occurs is called the major premise. One of the premises of the syllogism must be a categorical proposition that affirms some relation between its middle and major terms, it is called the major premise of the syllogism. The other premise, which links the middle and minor terms, is called the minor premise.

**b) What is digital logic? Write a note on Boolean operators.**

**Digital Logic** is the implementation of knowledge of logic and its implications in the digital, or electronic world. ‘Digit’ comes from digitus which is finger or toe. Digital logic implements interconnection of digital components and modules.

**Symbolic logic** is used widely in the modern era, in the fields of computer science, Mathematics, and philosophy. In mathematics, it is the extension of algebra and calculus. Symbolic logic is the method of representing logical expressions through the use of symbols and variables, rather than in ordinary language. Digital logic implementations have helped in the advancement of computing in commercial, technological, entertainment, architecture, medicine, space programmes, and so on.

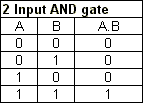
The digital applications employ the processing of binary data which has only two values which are zero, 0, and one, 1. Hence the base or radix of binary system is two. All complex calculations are carried out in the digital circuits in these two symbols. IN electronic devices, these are transferred as low voltage signal for number zero, 0, and high voltage signal for number one, 1. A binary digit is called a **bit**.

Digital systems are constructed by using logic gates. Boolean functions are practically implemented by using logic gates.

Boolean algebra has only three operators AND (•), OR (+) and NOT (‘) or Complement or Inverse.

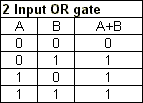
AND Operator:

The AND gate is an operator that gives a high output (1) only if all its inputs are high. A dot (.) is used to show the AND operation i.e. If one input variable is A, and the other is B, the output variable, which is C, would be shown as C = A.B.



OR Operator:

The OR gate is an electronic circuit that gives a high output (1) if one or more of its inputs are high. If one input variable is A, the other input variable is B and the output variable is C, it is shown as A+B.



NOT Gate:

The NOT gate is an electronic circuit that produces an inverted version of the input at its output. Hence, it is also known as inverter. The complement of one, 1 is zero, 0 and the complement of zero, 0 is one, 1.



4. Answer any four of the following in about 150 words each:

**a) Contrast between deduction and induction.**

Reasoning is the employment of intellect, which is to look beyond and within, which is available to senses. As it is a more of a psychological process, it is less concerned with logic, the philosophers replace it with inference.

There are two kinds of inference, deductive and inductive.

**Deductive** Inference regards the form or structure as primary and hence it is called formal logic. Deductive works from the more general to the more specific. The conclusion here is considered as the logical result of the premise or argument. The truth is based on the validity of the argument.

**Inductive** Inference regards matter or content of argument as primary. Inductive reasoning works the other way, moving from specific observations to broader generalizations and theories. The arguments support the conclusion but do not necessarily make it true. Even if all the premises are true, the conclusion can be false. Premises may be confirmed or falsified by certain circumstances or evidence.

**Deduction concludes with necessity while induction concludes with probability.**

**b) What do you understand by the mood of a syllogism?**

There are four types of categorical proposition; universal affirmative (A), universal negative (E), particular affirmative (I), and particular negative (O). The mood of a syllogism is simply a statement of which categorical propositions (A, E, I, or O) it comprises, listed in the order in which they appear in standard form. It is a string of three letters indicating, respectively, the forms of the major premise, minor premise, and conclusion of the syllogism. A syllogistic argument consists of three categorical propositions, they may occur in any order in the arguments.

When there is study of symbolic logic, the importance of the moods is known which are called the Rules of Inference. Taking an Example:

A: All rocks are hard things.

E: No rocks are liquid.

I: Some liquid things are not hard. The mood of this argument is AEI.

Every letter state symbolically states the quality and quantity of the prepositions and every letter occurs in the same order in which the prepositions occur in the argument. Hence, the order in which the preposition occurs is the mood of the syllogism.

Any preposition could occur in any way, hence, we could have 64 moods.

**c) Differentiate between reason and inference.**

Reasoning is the ability to see beyond, what is available to the senses. It is the capacity for consciously making sense of things, applying logic, establishing and verifying facts, and changing or justifying practices, institutions, and beliefs based on new or existing information.

We use reason to form inferences —conclusions drawn from propositions or assumptions that are supposed to be true. Inference is the process of extracting what is unknown from the known.

Reasoning is a psychological process, hence not the concern of logic. Hence, certain philosophers replace reasoning with inference.

An incorrect inference is known as a fallacy.

**d) Define Truth-table with an example.**

A Truth table provides the simplest way to understand the argument forms. It makes it easier to distinguish between valid and invalid forms. A logical statement which contains a finite number of logical variables (which covers any problem we have to deal with) can be analysed using a table which lists all possible values of the variables.

A truth table has a column for each input variable (for example, P and Q), and a column showing all of the possible results of the logical operation that the table represents (for example, P XOR Q). Each row of the truth table contains one possible configuration of the input variables (for instance, P=true Q=false), and the result of the operation for those values. Testing an argument form containing n distinct sentential variables requires a truth-table having 2n rows.

Logical operators: A Logical operator is a symbol which operates on a value or a variable. It is an operation that acts on binary numbers to produce a result according to the laws of Boolean logic (e.g. the AND, OR, and NOT functions).

Construction of truth-table is basic to our study of symbolic logic. To construct a Truth Table, write out the variables, corresponding to the number of statements. Start in the right-hand column and alternate T's and F's until all combinations are exhausted.

Truth table for And Operation.

|  |  |  |
| --- | --- | --- |
| p | q | p & q |
| T | T | T |
| T | F | F |
| F | T | F |
| F | F | F |

5. Write short notes on any five of the following in about 100 words each:

**a) Connotation of terms**

**Connotation**, or intension of a term means the complete meaning of a term as expressed by the sum total of its essential as opposed to accidental characteristics. Eg. Soceity, is an association of persons, or people united by a common interest.

Connotation is the emotional and imaginative association surrounding a word. It is defined as the associations that people make with a word. It refers to the wide array of positive and negative associations that most words naturally carry with them.

The word ‘connotation’ may vary in meaning from time to time. For example, ‘politician’ may acquire a different meaning in different societies at a given point of time or in the same society at different points of time. Therefore connotation is only conventional.

Connotations can be both positive and negative. Eg. To Nag has a negative intention, whereas Remid shows a positive one.

**b) Contrariety and subcontrariety.**

If two universal propositions differ only in ‘quality’, the opposition is called contrary. It is the opposition existing between a universal affirmative (A) and a universal negative (E). Eg. "All philosophers are idlers."(A) and "No philosophers are idlers."(E) could both be false, but both could not be true at the same time.

The Principle of Contradiction states that “A cannot be A and not A at the same time in the same respect.” If one is true, the other is necessary false, but if one if false, the other may or may not be true.

If two particular propositions differ only in ‘quantity’, the opposition is called sub-contrariety. It the opposition existing between a particular affirmative (I) and a particular negative (O). Eg. “"Some philosophers are idlers." and "Some philosophers are not idlers.", could both be true together, but not false, at the same time.

**c) Multi-value logic**

In Binary Logic, the values are either true or false. Hence, it has only 2 values. If the proposition contains more than 2 values, it is called multi-value logic.

In a three-valued logic, sometimes the two greatest truth-values (when they are represented as e.g. positive integers) are designated and the rules of inference preserve these values. Precisely, a valid argument will be such that the value of the premises taken jointly will always be less than or equal to the conclusion.

The classical two-valued logic can be extended into many-valued logic in many ways. Eg, the true (1) and false(0) values could be extended to 0, ½ and 1 in a three value logic. In fuzzy logic, the truth values are distributed to any real numbers between zero (0) and one (1). The number of values may vary to the degrees of freedom.

**d) Hasty generalization**

Hasty generalization becomes when association of events within fair sample is taken to represent association within the larger population. Hence, it is an informal fallacy of faulty generalization by reaching an inductive generalization based on insufficient evidence—essentially making a rushed conclusion without considering all of the variables.

If a person travels through a residential township for the first time and sees ten persons, all of whom are women, may erroneously conclude that there are no men residents in the town.

This generalisation, sometimes raises its ugly head when judgements are passed on humans divided by caste, religion or nationality. No judgement should be considered authoritative, unless, proved that dividing factors are the defining elements of character or personality.

**e) Bi-conditional**

A biconditional state is a compound, which is a combination of two sentences. It is a logical connective of two statements, asserting upon the antecedent and the consequent. The connective used for this proposition is “if and only if”.

A biconditional statement could be true only when both the conditions are considered true and both are false.

As per the biconditional truth table

|  |  |  |
| --- | --- | --- |
| P | Q | P ⬄ q |
| 1 | 1 | 1 |
| 1 | 0 | 0 |
| 0 | 1 | 0 |
| 0 | 0 | 1 |