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Q.1. What are variables and constants?

Ans: - Variables are a type of symbols which can assume any value within a definite range. For example, when we say $ab = 12$, a and b can assume any value within the range of $1 \dots 12$.

Logical constants are the symbols which express the logical form of compound proposition and bear the same meaning throughout every occurrence in the propositional formulae.

Q.2. What are the truth values of a statement? If P is true and Q is false, what is the truth value of $P \cdot Q$?

Ans: - The truth values of a statement are either true or false. If P is true and Q is false, the truth value of $P \cdot Q$ is false.

Q.3. What is truth function?

Ans: - In logic, a truth function is defined as a compound expression containing variables and its truth value is determined by the truth values of its component variables.

Q.4. Explain contradictory, conjunctive, implicative and disjunctive truth functions along with truth tables.

Ans: - Let us construct truth tables for the five basic truth functions: -

Negative or Contradictory function —

If we assume p as a statement, then its corresponding negative proposition will be $\neg p$. If p is true, then $\neg p$ will be false, again, if p is false, then its corresponding $\neg p$ will be true.

p	$\neg p$
T	F
F	T

Conjunctive function — $(p \cdot q)$:- When two simple propositions are combined by the connective 'and' to form a compound proposition, it is called a 'conjunctive proposition'. Let us construct a truth table for this conjunctive function $p \cdot q$ as below:

p	q	$p \cdot q$
T	T	T
T	F	F
F	T	F
F	F	F

Implicative function — $(p \supset q)$:- If two simple propositions are combined together by the connective 'if-then', then the compound proposition is called an implicative proposition. Let us construct a truth table for the implicative function as below :-

p	q	$p \supset q$
T	T	T
T	F	F
F	T	T
F	F	T

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d) Disjunctive Function - $(p \vee q)$ - The Compound proposition in which two simple propositions are combined together by the connective 'either...or' is called a disjunctive proposition. Its truth table for disjunctive function is constructed below:

P	q	$P \vee q$
T	T	T
T	F	T
F	T	T
F	F	F

e) Biconditional or Equivalence Function - $(P \equiv q)$: The truth function of the compound propositions of the form $P \equiv q$ is called biconditional or equivalence function. Let us construct a truth table for $P \equiv q$ as below:

P	q	$P \equiv q$
T	T	T
T	F	F
F	T	F
F	F	T

$P \equiv q$	P	q
T	T	T
F	T	F
F	F	T
T	F	F