14:7:25

QUESTIONS

1) What are logical connectivities ? Construct the truth table.

Proof:- Logical connectivities are symbols / words used in logic to connect two / more proposition (statement) to form a more complex logical expression.

These connectivities help us determine the Truth value of compound statement based on the truth values of the individual statement

Common logical connectivities :-

Name	Symbol	Meaning
AND	$\wedge$	True if both
OR	$\vee$	True if atleast one true
NOT	$\sim$	Negation (opposite)
IMPLIES	$\longrightarrow$	If .... then
BICONDITIONAL	$\longleftrightarrow$	If and only if (iff)

Truth table for logical connectives :-

Let P and Q be two statements.

P	Q	$\sim P$	$\sim Q$	$P \wedge Q$	$P \vee Q$	$P \rightarrow Q$	$P \leftrightarrow Q$
T	T	F	F	T	T	T	T
T	F	F	T	F	T	F	F
F	T	T	F	F	T	T	F
F	F	T	T	F	F	T	T

Explanation (in simple terms) :

i) Negation of P ($\neg P$) : opposite of P
ii) $\neg Q$: Opposite of Q
iii) $P \wedge Q$: True only when both P & Q are true.
iv) $P \vee Q$: True if atleast one of P/Q is true

v) $P \rightarrow Q$: False, only when P is true Q is false.

vi) $P \leftrightarrow Q$: True, when both P & Q are same. (Both are either true or false)

2. $P \wedge Q \rightarrow P$ is a tautology using the table of propositional equivalence.

Soln:-

It is enough to show that $P \wedge Q \rightarrow P$ is a tautology.

P	Q	$P \wedge Q$	$P \wedge Q \rightarrow P$
T	T	T	T
T	F	F	T
F	T	F	T
F	F	F	T

$\therefore P \wedge Q \rightarrow P$ is a tautology.

3) use the truth table method to determine whether $(\sim(P \vee q) \wedge (q \rightarrow \sim r \wedge \sim qp) \wedge (P \vee r)$ denoted by $Q\phi$ is satisfiable.

4) Proof: List all combinations of truth valuable of P, q, r. There are three variables:

$2^n \rightarrow 2^3 \rightarrow 8$

p	q	r	~p	(~p∨q)	~r	~r∧~p	q→~r∧~p	p∨r	ϕ
T	T	T	F	T	F	F	F	T	F
T	T	F	F	T	T	F	F	T	F
T	F	T	F	F	F	F	T	T	F
T	F	F	F	F	T	F	T	T	F
F	T	T	T	T	F	F	F	T	F
F	T	F	T	T	T	T	T	F	F
F	F	T	T	T	F	F	T	T	T
F	F	F	T	T	T	T	T	F	F

Conclusion:-

In all 8 cases, ϕ is false. So, ϕ is not satisfiable.

Hence, the result.

4) What is the rules of imbalance inference?

Sol:

Basic rules of inference:

1. Negation (NOT: ~, ¬)

Opposite meaning of the statement.

Eg:- It will rain today : P
It will not rain today : ¬P

Truth table:-

P	~P
T	F
F	T

2. Conjuction (AND: ∧)

If both P and Q are true, the P∧Q is true. Otherwise false.

Eg:- Prema will go for shopping : P
Prema will go for temple : Q

P∧Q: Prema will go for shopping and temple.

Truth table :-

P	Q	P ∧ Q
T	T	T
T	F	F
F	T	F
F	F	F

3) Disjuction (OR : V)

If either P or Q is true, then PVQ is true ; Otherwise false.

Eg :- Kavya will go for a walk : P
Kavya will read a book : Q

PVQ : Kavya will go for a walk or read a book.

4) Conditional (if, then : →)

If P is true & Q is false, then P→Q

Truth Table :

P	Q	PVQ
T	T	T
T	F	T
F	T	T
F	F	F

Conditional

4) Conjuction (if, then : →)

If P is true & Q is false, then P→Q is true ; Otherwise false.

Eg :- You are a student : P
You go have a student ID : Q

P→Q : If you are a student, then you have a student ID.

Truth Table:

P	Q	P → Q
T	T	T
T	F	F
F	T	T
F	F	T

5) Bi-conditional (if and only if : ↔) [iff]

If P and Q are not equal, then it is false. Otherwise it is true.

Eg:- A number is even - P
It is divisible by 2 - Q

P ↔ Q : A number is even iff it is divisible by 2.

Truth Table:

P	Q	P ↔ Q
T	T	T
T	F	F
F	T	F
F	F	T