Logical Equivalence: Two proposition P(p.q.s. --) and Q(p.q. 2 - . .) where p.q. 2, - . . are propositional variables, are Called Logical Equivalence of Equal if they have Same truth value in every possible case. and weether Al $P \approx Q$. P = Q $P \approx Q$

Note: To test whether the proposition P and & are Logically Equivalence the following steps are followed.

Step-I: Construct the truth table for P. (LHS)

Step 1 : Construct the touth table for & using the same propositional variable.

Step 11: Check each Combinations of touth Values of the peopositional variable to see whether the value of P is the same as truth value of Q.

If in each low the touth value of P is the lame as that

of Q. Then P and Q are logically Equipment.

Show that
$$-(\cancel{p} \lor \cancel{q}) = -\cancel{p} \nearrow -\cancel{q}$$

is the VIth & VIIth Column of T.V. Table are Identical

1 []	アンアゴナリー	Contingency
	TYPIT	0 0
T	TPAT	
\sim		

Note:	Page	Q ile	Peg	is	a	Tantology
	. ~	- ' '] ſ				<u> </u>

(1) Tantology (2) Centradiction (3) Contemporery

Tautologies and Contradiction: - A Compound peoposition that is always true for all possible touth Value of its Variable is Called a Tantology.

A compound proposition that is (alway False (F) for all possible Truth value is called Contradiction

Note: - A peoposition that is neither a Toutology (T) our Contradiction (F) is called a Contingency

T Tantohagy (F) Contradiction (F) T (ontingen)

Note: Number of Romes in the tenth table of a Compound Statement = 2 (No. of prop. Variable)

p. q) No. of prop. Variable = 2 (n=2) No. of Rows in T. V. Table = 2 = 4

No. of Rome = 4 P; TTFF q: TFTF

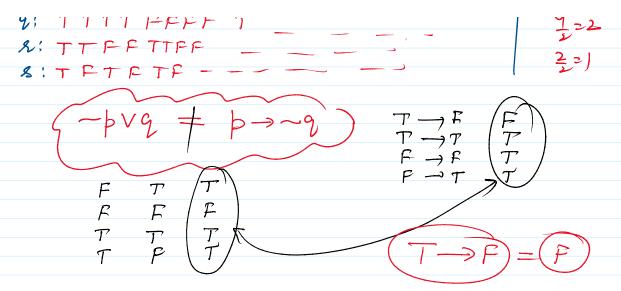
9: TTFFTTFF

2: TFTFTFTFJ

NodRows = 2=16 p: TTTTTTTFFFFFFFFF 91 TTTT PPPF T R: TTFFTTFF _ _

8 2 y

<u>16</u> = 8 $\frac{8}{2} = 4$ 722 221



Lanes of Prop. Logra

TABLE 6 Logical Equivalences.				
Equivalence	Name			
$p \wedge \mathbf{T} \equiv p$	Identity laws			
$p \lor \mathbf{F} \equiv p$	ŕ			
$p \lor T \equiv T$	Domination laws			
$p \wedge \mathbf{F} \equiv \mathbf{F}$				
$p \lor p \equiv p$	Idempotent laws			
$p \wedge p \equiv p$				
$\neg(\neg p) \equiv p$	Double negation law			
$p \vee q \equiv q \vee p$	Commutative laws			
$p \wedge q \equiv q \wedge p$				
$(p \vee q) \vee r \equiv p \vee (q \vee r)$	Associative laws			
$(p \land q) \land r \equiv p \land (q \land r)$				
$p \lor (q \land r) \equiv (p \lor q) \land (p \lor r)$	Distributive laws			
$p \wedge (q \vee r) \equiv (p \wedge q) \vee (p \wedge r)$				
$\neg (p \land q) \equiv \neg p \lor \neg q$	De Morgan's laws			
$\neg (p \lor q) \equiv \neg p \land \neg q$	19.9			
$p \lor (p \land q) \equiv p$ $p \land (p \lor q) \equiv p$	Absorption laws			
	Manadan Laur			
$p \lor \neg p \equiv T$ $p \land \neg p \equiv F$	Negation laws			
F F = 1				

$$x \cdot (y+3) = (x \cdot y) + (x \cdot 3)$$

$$AU(B\Omega C) = (AUB) \wedge (AUC)$$

TABLE 7 Logical Equivalences Involving Conditional Statements.

$$p \rightarrow q \equiv \neg p \lor q$$

$$p \rightarrow q \equiv \neg q \rightarrow \neg p$$

$$p \lor q \equiv \neg p \rightarrow q$$

$$p \land q \equiv \neg (p \rightarrow \neg q)$$

$$\neg (p \rightarrow q) \equiv p \land \neg q$$

$$(p \rightarrow q) \land (p \rightarrow r) \equiv p \rightarrow (q \land r)$$

$$(p \rightarrow r) \land (q \rightarrow r) \equiv (p \lor q) \rightarrow r$$

$$(p \rightarrow q) \lor (p \rightarrow r) \equiv p \rightarrow (q \lor r)$$

$$(p \rightarrow q) \lor (p \rightarrow r) \equiv p \rightarrow (q \lor r)$$

$$(p \rightarrow r) \lor (q \rightarrow r) \equiv (p \land q) \rightarrow r$$

TABLE 8 Logical Equivalences Involving Biconditional Statements.

$$\begin{split} p \leftrightarrow q &\equiv (p \to q) \land (q \to p) \\ p \leftrightarrow q &\equiv \neg p \leftrightarrow \neg q \\ p \leftrightarrow q &\equiv (p \land q) \lor (\neg p \land \neg q) \\ \neg (p \leftrightarrow q) &\equiv p \leftrightarrow \neg q \end{split}$$