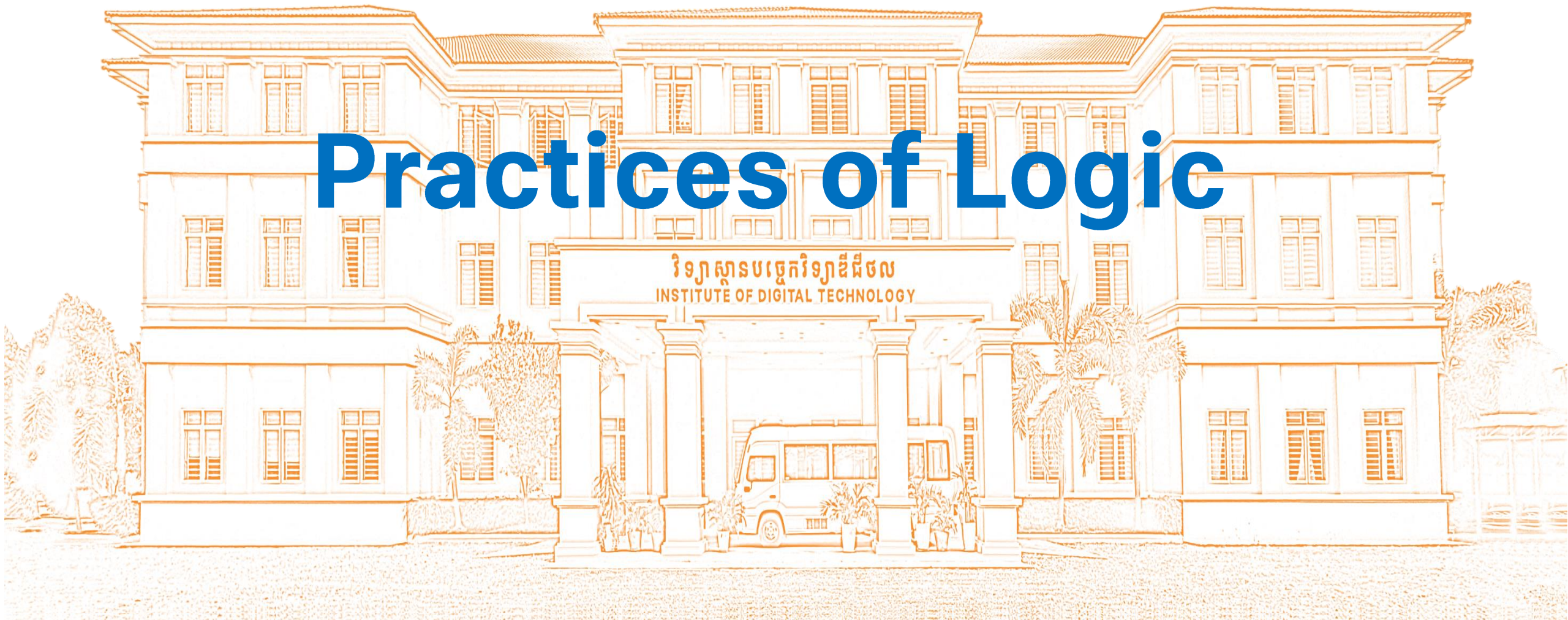


Practices of Logic



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Most Common and famous logical Equivalences

1. Identity Law	:	$a. p \wedge T \equiv p$	$b. p \vee F \equiv p$
2. Domination Law	:	$a. p \vee T \equiv T$	$b. p \wedge F \equiv F$
3. Idempotent Law	:	$a. p \vee p \equiv p$	$b. p \wedge p \equiv p$
4. Double Negation Law:		$\neg(\neg p) \equiv p$	
5. Commutative Law	:	$a. p \vee q \equiv q \vee p$	$b. p \wedge q \equiv q \wedge p$
6. Associative Law	:	$a. (p \vee q) \vee r \equiv p \vee (q \vee r)$	$b. (p \wedge q) \wedge r \equiv p \wedge (q \wedge r)$
7. Distributive Law	:	$a. p \vee (q \wedge r) \equiv (p \vee q) \wedge (p \vee r)$	$b. p \wedge (q \vee r) \equiv (p \wedge q) \vee (p \wedge r)$
8. De Morgan's Law	:	$a. \neg(p \wedge q) \equiv \neg p \vee \neg q$	$b. \neg(p \vee q) \equiv \neg p \wedge \neg q$
9. Absorption Law	:	$a. p \vee (p \wedge q) \equiv p$	$b. p \wedge (p \vee q) \equiv p$

Logical Equivalences Involving Conditional Statements

1. $p \Rightarrow q \equiv \neg p \vee q$

2. $p \Rightarrow q \equiv \neg q \vee \neg p$

3. $p \vee q \equiv \neg p \Rightarrow q$

4. $p \wedge q \equiv \neg(q \Rightarrow \neg p)$

5. $\neg(p \Rightarrow q) \equiv p \wedge \neg q$

6. $(p \Rightarrow q) \wedge (q \Rightarrow r) \equiv p \Rightarrow (q \wedge r)$

7. $(p \Rightarrow r) \vee (q \Rightarrow r) \equiv (p \vee q) \Rightarrow r$

8. $(p \Rightarrow q) \vee (p \Rightarrow r) \equiv p \Rightarrow (q \vee r)$

9. $(p \Rightarrow r) \vee (q \Rightarrow r) \equiv (p \wedge q) \Rightarrow r$

Logical Equivalences Involving Bi-conditionals Statements

1. $p \Leftrightarrow q \equiv (p \Rightarrow q) \wedge (q \Rightarrow p)$

2. $p \Leftrightarrow q \equiv \neg p \Leftrightarrow \neg q$

3. $p \Leftrightarrow q \equiv (p \wedge q) \vee (\neg p \wedge \neg q)$

4. $\neg(p \Leftrightarrow q) \equiv p \Leftrightarrow \neg q$

Part of Exercises

Show that all statements below are true

1. $p \Rightarrow (q \wedge r) \equiv (p \Rightarrow q) \wedge (p \Rightarrow r)$

2. $(p \wedge q) \Rightarrow r \equiv (p \Rightarrow r) \vee (q \Rightarrow r)$

3. $p \wedge \neg p \Rightarrow q$

4. $(\neg p \Rightarrow q) \Rightarrow p$

5. $(p \wedge q) \equiv \neg(\neg p \vee \neg q)$

1. Show that $2024^n + 2024^m \geq 2\sqrt{2024^{n+m}}$ all $m, n \in \mathbb{R}$
2. Show that $(p \vee \neg(p \wedge q))$ is Tautology
3. Show that $(p \wedge q) \wedge \neg(p \vee q)$ is Contradiction
4. If $p \vee \neg p$ is tautology show that $(p \wedge \neg p) \vee \neg(p \wedge \neg p)$ is tautology
5. Show that $p \Rightarrow (q \wedge r) \equiv (p \Rightarrow q) \wedge (p \Rightarrow r)$
6. Show that $p \Rightarrow (q \Rightarrow r) \neq (p \Rightarrow \neg r) \wedge \neg q$
7. Show that $n^3 - n$ can divide by 3 all n is integer number

Draw the truth table of all statements below

1. $(p \vee \neg q) \Leftrightarrow (q \Rightarrow \neg p)$

2. $[p \wedge (\neg q \Rightarrow p)] \wedge \neg [(p \Leftrightarrow \neg q) \Rightarrow (q \vee \neg p)]$

3. $[q \Leftrightarrow (r \Rightarrow \neg p)] \vee [(\neg q \Rightarrow p) \Leftrightarrow r]$

4. $(p \Leftrightarrow \neg q) \Leftrightarrow (q \Rightarrow p)$

Simplify statements below

$$[\neg q \wedge (p \Rightarrow q)] \Rightarrow \neg p$$