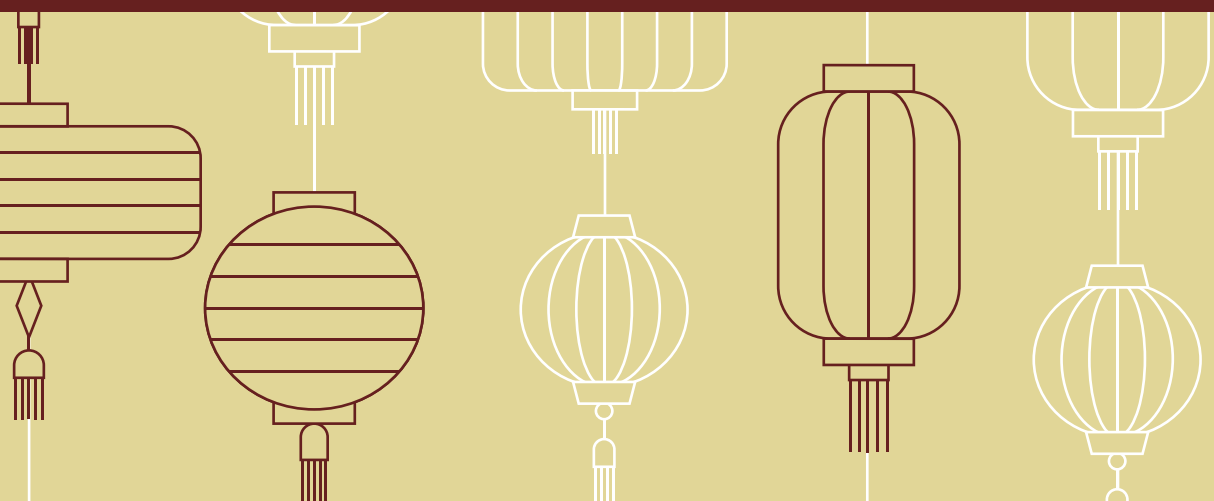

Logical Equivalence Laws

1. Reflexitivity
   $p \equiv p$
2. Double Negation
   $\neg(\neg p) \equiv p$
3. De Morgan's Law
   $\sim(p \vee q) \equiv \sim p \wedge \sim q$ $\quad \sim(p \wedge q) \equiv \sim p \vee \sim q$
4. Identity
   $p \vee F \equiv p$ $\quad p \wedge T \equiv p$
5. Inverse
   $p \wedge \sim p \equiv F$ $\quad p \vee \sim p \equiv T$
6. Dominance
   $p \wedge F \equiv F$ $\quad p \vee T \equiv T$
7. Distributivity
   $p \vee (q \wedge r) \equiv (p \vee q) \wedge (p \vee r)$
8. Associativity
   $p \vee (q \vee r) \equiv (p \vee q) \vee r$
9. Commutativity
   $p \vee q \equiv q \vee p$
10. Material Implication
    $p \rightarrow q \equiv \sim p \vee q$
11. Material Equivalence
    $p \leftrightarrow q \equiv (p \rightarrow q) \wedge (q \rightarrow p)$
12. Idempotency
    $p \wedge p \equiv p$, $p \vee p \equiv p$
13. Absorption
    $p \wedge (p \vee q) \equiv p$, $p \vee (p \wedge q) \equiv p$
14. Contrapositive Law
    $p \rightarrow q \equiv \neg q \rightarrow \neg p$

Logical Interference Laws

1. Conjunction

p
q
$\therefore p \wedge q$

2. Disjunctive Syllogism

$p \vee q$
$\sim p$
$\therefore q$

3 Hypothetical Syllogism

$p \wedge q$ $\quad$ $p \to q$
q $\quad$ $q \to r$
$\therefore p$ $\quad$ $p \to r$

4 Modus Ponens

$p \to q$
p
$\therefore q$

5 Modus Tollens

$p \to q$
$\sim q$
$\therefore \sim p$

6 Addition

p
$\therefore p \vee q$

7. Simplification

$p \wedge q$
$\therefore p$

Logical Equivalence Laws

1. Reflexivity
   $p \equiv p$
2. Double Negation
   $\sim(\sim p) \equiv p$
3. Associativity
   $(p \vee q) \vee r \equiv p \vee (q \vee r)$
4. Material Interference
   $p \to q \equiv \sim p \vee q$
5. Material Equivalence
   $p \leftrightarrow q \equiv (p \to q) \wedge (q \to p)$
6. Distributivity
   $p \vee (q \wedge r) \equiv (p \vee q) \wedge (p \vee q)$
7. Idempotency
   $p \vee p \equiv p$
8. Commutativity
   $p \vee q \equiv q \vee p$
9. De Morgan's Law
   $\sim(p \vee q) \equiv \sim p \wedge \sim q$
10. Dominance
11. Inverse
12. Identity
13. Absorption
14.

$[(p \to q) \wedge (q \to r)] \to (p \to r)$

1.	$[(\sim p \vee q) \wedge (q \to r)] \to (p \to r)$	MI
2.	$[(\sim p \vee q) \wedge (\sim q \vee r)] \to (p \to r)$	MI
3.	$[(\sim p \vee q) \wedge (\sim q \vee r)] \to (\sim p \vee r)$	MI
4.	$\sim[(\sim p \vee q) \wedge (\sim q \vee r)] \vee (\sim p \vee r)$	MI
5.	$[\sim(\sim p \vee q) \vee \sim(\sim q \vee r)] \vee (\sim p \vee r)$	DM
6	$[(\sim(\sim p) \wedge \sim q) \vee \sim(\sim q \vee r)] \vee (\sim p \vee r)$	DM
7	$[(p \wedge \sim q) \vee \sim(\sim q \vee r)] \vee (\sim p \vee r)$	DN
8	$[(p \wedge \sim q) \vee (\sim(\sim q) \wedge \sim r)] \vee (\sim p \vee r)$	DM
9	$[(p \wedge \sim q) \vee (q \wedge \sim r)] \vee (\sim p \vee r)$	DN
10	$(\sim p \vee r) \vee [(p \wedge \sim q) \vee (q \wedge \sim r)]$	Com
11	$(\sim p \vee r) \vee (p \wedge \sim q) \vee (q \wedge \sim r)$	Associa
12	$\sim p \vee r \vee (p \wedge \sim q) \vee (q \wedge \sim r)$	Associa
13	$\sim p \vee (p \wedge \sim q) \vee r \vee (q \wedge \sim r)$	com
14	$[\sim p \vee (p \wedge \sim q)] \vee r \vee (q \wedge \sim r)$	Associa
15	$[\sim p \vee (p \wedge \sim q)] \vee [r \vee (q \wedge \sim r)]$	Associa
16	$[(\sim p \vee p) \wedge (\sim p \vee \sim q)] \vee [r \vee (q \wedge \sim r)]$	Distri
17	$[(p \vee \sim p) \wedge (\sim p \vee \sim q)] \vee [r \vee (q \wedge \sim r)]$	Com
18	$[T \wedge (\sim p \vee \sim q)] \vee [r \vee (q \wedge \sim r)]$	Inverse
19	$[(\sim p \vee \sim q)] \vee [r \vee (q \wedge \sim r)]$	Identity
20	$(\sim p \vee \sim q) \vee [r \vee (q \wedge \sim r)]$	Associativity
21	$(\sim p \vee \sim q) \vee [(r \vee q) \wedge (r \vee \sim r)]$	Distri
22	$(\sim p \vee \sim q) \vee [(r \vee q) \wedge T]$	Inverse
23	$(\sim p \vee \sim q) \vee [(r \vee q)]$	identi
24	$(\sim p \vee \sim q) \vee (r \vee q)$	Associa
25.	$\sim p \vee \sim q \vee (r \vee q)$	Associa
26	$\sim p \vee \sim q \vee r \vee q$	Associa
27	$\sim p \vee r \vee q \vee \sim q$	Com

28	$\sim p \vee r \vee (q \vee \sim q)$	Associa
29	$\sim p \vee r \vee T$	Inverse
30	$\sim p \vee (r \vee T)$	Associa
31	$\sim p \vee T$	Dominance
32	TRUE	Dominance

QED