Formula sheet

Mathematical Logic.

- Logical connective:

Types of compound statement	Connective	Symbol	Examples.
1) Conjuction	and	$\wedge$	p and q . $P \wedge q$
2) Disjunction	or	$\vee$	p or q . $P \vee q$
3) Negation	not	$\sim$	negation p . $\sim p$
4) Conditional or implication	if..... then	$\rightarrow$	If p then q . $p \rightarrow q$
5) Bicondition or double implication	if and only if	$\leftrightarrow$	p iff q . $p \leftrightarrow q$

- Truth tables:

1) conjuction:

P	q	$P \wedge q$
T	T	T
T	F	F
F	T	F
F	F	F

2) Disjunction:

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

3) Negation:

P	$\sim P$
T	F
F	T

4) implication:

P	q	$P \rightarrow q$
T	T	T
T	F	F
F	T	T
F	F	T

5) double implication:

P	q	$P \leftrightarrow q$
T	T	T
T	F	F
F	T	F
F	F	T

- converse : $q \rightarrow p$
- inverse : $\sim p \rightarrow \sim q$
- contrapositive : $\sim q \rightarrow \sim p$

Date:

- Duality theorem: (No chedchad)
  - $\vee \leftrightarrow \wedge$
  - $t \leftrightarrow c$
  - negation ($\sim$) remain unaltered.

- Negation of statement:
  - All → Some
  - $\vee \rightarrow \wedge$
  - $< \rightarrow \geq$ or $\neq$ $\quad > \rightarrow \leq$ or $\neq$
  - or → and
  - $\sim$ (not) दिया हो → हटा दो ।
    नहीं हो → लगा दो।

  for quantifier ←

- Quantifiers and Quantified statement:

Quantifier Symbol	Stands for	Known as
$\forall$	"all value of", "for every"	Universal
$\exists$	"there exist atleast 1"	Existential

- Important results:

1) $p \vee q \equiv q \vee p$
   $p \wedge q \equiv q \wedge p$
   - commutative

2) $(p \vee q) \vee r \equiv p \vee (q \vee r)$
   $(p \wedge q) \wedge r \equiv p \wedge (q \wedge r)$
   - Associative

3) $p \vee (q \wedge r) \equiv (p \vee q) \wedge (p \vee r)$
   - distributive

4) $\sim(p \vee q) \equiv \sim p \wedge \sim q$
   - demorgan's

5) $p \rightarrow q \equiv \sim p \vee q$
   $p \leftrightarrow q \equiv (p \rightarrow q) \wedge (q \rightarrow p)$
   $\equiv (\sim p \vee q) \wedge (\sim q \vee p)$
   - equivalent

6) $p \vee f \equiv p \quad p \wedge T \equiv p$
   - identity

7) $p \wedge F \equiv F \quad p \vee T \equiv T$
   - domination

8) $p \vee \sim p \equiv T \quad p \wedge \sim p \equiv f$
   - complement

9) $p \vee p \equiv p \quad p \wedge p \equiv p$
   - idempotent

10) $\sim(\sim p) \equiv p$
    - involution

11) $p \vee (p \wedge q) \equiv p$
    - absorption.