27th Nov

For implication

$p \to q$

- converse
  - ~~ta~~ p lai q
    q lai p

  $q \to p$

- Inverse
  - dubai ma negation

  $\neg p \to \neg q$

- contrapositive
  - $\neg q \to \neg p$

logical equivalence → same TT

converse

- computed by interchanging the hypothesis & conclusion.

If we have conditional statement $p \to q$, the converse is $q \to p$.

Inverse

- Negation of both hypothesis & the conclusion

If we have conditional statement $p \to q$ the inverse is $\neg p \to \neg q$

contrapositive

- computed by interchanging hypothesis & conclusion of inverse.

If we have conditional statement $p \to q$ the contrapositive is $\neg q \to \neg p$

Prove contrapositive is logically equivalent to $p \to q$

p	q	$\neg p$	$\neg q$	$p \to q$	$\neg q \to \neg p$
T	T	F	F	T	T
T	F	F	T	F	F
F	T	T	F	T	T
F	F	T	T	T	T

Among these three conditional statement formed from $p \to q$, only contrapositive is logically equivalent to $p \to q$

① I go to the beach whenever it is a sunny summer day.

p: It is a sunny summer day

q: I go to the beach. $\quad p \to q$

- converse

$q \to p$

If I go to the beach then it is a sunny ~~it is a sunny~~ summer day.

- Inverse

$\neg p \to \neg q$

I do not go to the beach whenever it is not a sunny summer day.

- contrapositive

$\neg q \to \neg p$

If I do not go to the beach then it is not a sunny summer day.

e) Bi-conditional or Bi-implication (↔)

Let p & q be two propositions, the bi-conditional statement $p \leftrightarrow q$ is "p if & only if q"

↳ It is true when p & q have same truth values otherwise false.

• ways to express ↔

(i) p if & only if q

(ii) p (iff) q

(iii) p is necessary & sufficient condⁿ for q

(iv) if p then q & conversely.

AND

$$p \leftrightarrow q \Leftrightarrow (p \rightarrow q) \wedge (q \rightarrow p)$$

• Truth Table

p	q	$p \leftrightarrow q$
T	T	T
T	F	F
F	T	F
F	F	T