

p	q	$p \vee q$
T	T	T
T	F	T
F	T	T
F	F	F

d) Exclusive or ( $\oplus$ ) :

Let p and q be the propositions, the exclusive or of p and q is true when exactly one of p and q is true and otherwise false.

p	q	$p \oplus q$
T	T	F
T	F	T
F	T	T
F	F	F

e) Conditional Statement. (if... then... /  $\rightarrow$ )

Let p and q be the propositions, the conditional statement  $p \rightarrow q$  is false when p is true and q is false otherwise true.

p	q	$p \rightarrow q$
T	T	T
T	F	F
F	T	T
F	F	T

f) Biconditional Statement (if and only if /  $\leftrightarrow$ )

Let  $p$  and  $q$  be the propositions, the biconditional statement  $p \leftrightarrow q$  is true when  $p$  and  $q$  have same truth values. otherwise false

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

• If  $p \rightarrow q$  is the conditional statement then then.

- 1) Converse :  $q \rightarrow p$
- 2) Inverse :  $\neg p \rightarrow \neg q$
- 3) Contrapositive :  $\neg q \rightarrow \neg p$

eg: Find negation of following propositions

1)  $p$ : At least 10 inches of rain fall today in Mumbai.

$q$ : There is no pollution in New Jersey.

$r$ : It is raining now.

$\Rightarrow$  Negation of following propositions

$\neg p$ : Less than 10 inches of rain fall today in Mumbai.

$\neg q$ : There is pollution in New Jersey

$\neg r$ : It is not raining now.



but = and.

eg: 2)  $p$ : it is below freezing  
 $q$ : it is snowing

Write in following statements using  $p, q$  and logical connectives.

- a) it is below freezing and snowing  $p \wedge q$
- b) it is below freezing but not snowing  $p \wedge \neg q$
- c) it is not below freezing and not snowing.  $\neg p \wedge \neg q$
- d) it is either snowing or below freezing  $q \vee p$
- e) if it is below freezing, it is also snowing.  $p \rightarrow q$
- f) That it is below freezing is necessary and sufficient for it to be snowing.  $p \leftrightarrow q$

⇒ 3) Find conjunction and disjunction of following proposition.

$p$ : Today is Friday  
 $q$ : It is raining today.

→ Conjunction: ( $p$  and  $q$ )  $p \wedge q$   
Today is Friday and it is raining today.

Disjunction: ( $p$  or  $q$ )  $p \vee q$   
Today is Friday or it is raining today.

Conditional: (if... then...)  $p \rightarrow q$   
if Today is Friday then it is raining today

⊗ Biconditional: (if and only if)  $p \leftrightarrow q$   
Today is Friday if and only if it is raining today

- 4)  $p$ : You can take a flight  
 $q$ : You buy a ticket

Conjunction:  $(p \wedge q)$

You can take a flight and you can buy a ticket

Disjunction:  $(p \vee q)$

You can take a flight or you buy a ticket

Conditional:  $(p \rightarrow q)$

If you can take a flight then you buy a ticket

Bidirectional:  $(p \leftrightarrow q)$

You can take a flight if and only if you ~~can~~ buy a ticket.

~~alt~~ alt: if you can take a flight it is necessary to buy a ticket.

5)