

Lecture 2

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4. **Exclusive:** Let p and q be propositions. The exclusive of p and q is denoted by $p \oplus q$ and is true when exactly one of p and q is true and is false otherwise.

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

Exactly one.

Eg: (a) Tea **or** Coffee will come with Lunch.
↓
 Exclusive

(b) This course will be offered to the students who have studied Computer Science **or** Discrete Mathematics.
Inclusive

Conditional Statement: Let p and q be propositions. The conditional statement of p and q is denoted by $p \rightarrow q$.

It is read as "If p , then q ".

Here p is known as hypothesis or antecedent or premise and q is called conclusion or consequence.

The conditional statement $p \rightarrow q$ is

p	q	$p \rightarrow q$	$\neg p$	$\neg p \vee q$
T	T	T	F	T
T	F	F	F	F
F	T	T	T	T
F	F	T	T	T

Example:

... marks. Then you will get A grade.

Example:

If you get 100% marks, Then you will get A grade.

* $p \rightarrow q$ can be written as $\neg p \vee q$

Converse, Contrapositive and Inverse Statement

for given $p \rightarrow q$ statement

* Converse statement is : $q \rightarrow p$

* Contrapositive statement: $\neg q \rightarrow \neg p$

* Inverse Statement : $\neg p \rightarrow \neg q$

p	q	$p \rightarrow q$	Converse $q \rightarrow p$	Contrapositive $\neg q \rightarrow \neg p$	Inverse $\neg p \rightarrow \neg q$
T	T	T	T	T	T
T	F	F	F	F	F
F	T	T	T	T	T
F	F	T	T	T	T

If p, Then q

If p, q

q if p

p implies q

q follows p

q whenever p

p is sufficient for q
q is necessary for p.

q unless $\neg p$

✓

$\neg p$ false
p true

q only if p

q whenever p

q only if p

Biconditional Statement

Let p and q be propositions. The biconditional statement of p and q is denoted by $p \leftrightarrow q$.

It is read as " p if and only if q ".

The biconditional statement $p \leftrightarrow q$ is true when both has same truth values.

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

p if and only if q

p iff q

p is necessary and sufficient for q .

Practice Questions

Q1. Construct truth tables for

(A) $(p \vee q) \rightarrow (p \oplus q)$

p	q	$p \vee q$	$p \oplus q$	$(p \vee q) \leftrightarrow (p \oplus q)$
T	T	T	F	F
T	F	T	T	T
F	T	T	T	T
F	F	F	F	T

(B) $(p \leftrightarrow q) \oplus (\neg p \leftrightarrow q)$

p	q	$p \leftrightarrow q$	$\neg p \leftrightarrow q$	$(p \leftrightarrow q) \oplus (\neg p \leftrightarrow q)$
T	T	T	F	T
T	F	F	T	T
F	T	F	T	T
F	F	T	F	T

Tautology

Translating English Sentence in logical statement

(2) p : It is below freezing
 q : It is Snowing

(A) It is below freezing but not snowing.

(B) It is below freezing is necessary and sufficient for it to be it is snowing.

(C) Below freezing is sufficient for it to be snowing.

Q3 Find truth values of following:

(a) If $1+1=2$, Then $2+2=5$

(b) If monkeys can fly, Then $1+1=3$