22/09/17

Mathematical Reasoning

Statement :

A Sentence is called a statement if it is either True or false But not both.

→ Two Plus two equal four. (statement) (T)
→ Maths is fun (Not statement) X

→ All Prime no. are odd (f) ✓

→ Today is friday (X Not a statement)

→ Tomorrow is Saturday (Statement)
→ He is an engineer (not a statement)
→ Weather is fine (X)
→ Kashmir is far from here (X)
→ Open the door (X)

* Negation of a statement : (~P)

⇒ The denial of a Statement is called Negation of that Statement

→ P : New Delhi is Capital Of India (T)
~P : New Delhi is not Capital of India (false

it is false that New delhi is capital of India
It is not the case that " " " "

⇒ P: In Negation, 'It is not the case" or "it is false that' Phrases are used.

P	~P
T	f
f	T

Every one in germeny speaks germen (f)

~P ⇒ Every one in germeny ~~no~~ does not speaks germen.

It is false that every one in germeny speaks germen.

* Compound statement:

statement obtained by combining one or more statements using some connectings like and, or, are called Compound statement.

Seven is both Prime and odd no

⇒ There is something wrong in the bulb or the wire.

Ans There is something wrong in the bulb
There is son " " " " wire

* Compound Statements with "And" :

P, q are Statements connected with and.

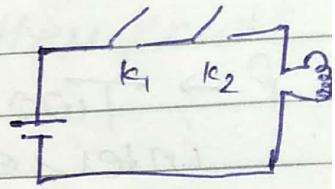
$P \wedge q$

and sign.

It will be true if all the statements are true either it is false statement

P - True] — True.
q - True

P	q	P ∧ q
T	T	T
T	f	f
F	T	f
f	f	f



ON = True
Of = false

⇒ 42 is divisible by 6, 7, and 5
(statement is false)

⇒ 2 is Prime and even
(st. is true).

* Compound Statement with 'OR' :

P, q are statement, connected with 'OR'

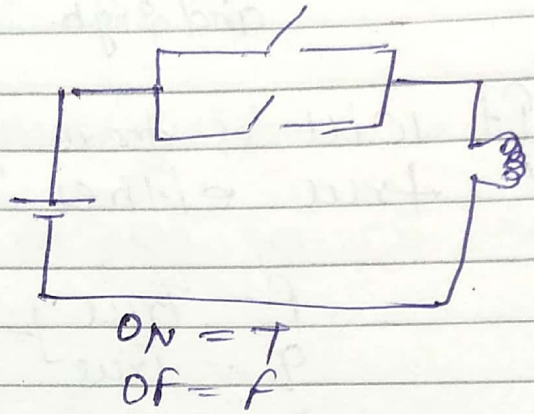
$P \vee q$

OR

* It is false when all the statements are false either it is true.

42 is divisible by 5 or 6.
True

p	q	p ∨ q
T	T	T
T	f	T
f	T	T
f	f	f



P → Two distinct line in a plane either intersect or parallel.
(Statement is True)

* If two statement can not be similatously true then the connective 'OR' is called exclusive OR.

P: An icecream or Pepsi is available with a Thali in a Restrant
Exclusive OR

* If two statement can be similatinously True then it is called inclusive OR

⇒ A statement who has taken Biology or chemistry can apply for M.Sc in Microbiology

Inclusive OR.

⇒ 125 is multiple of 7 & 8 (False)

Chandigrah is capital of Bihar or Punjab (True)

$\sqrt{2}$ is Rational or Irrational (True).

* Quantifers :- are phrases like "there exist" or "for all." or "for every"

There exist a prime no. which is even (True)

for every Prime P, $\sqrt{P}$ is Irrational (True)

s.t.

Maths

$p \wedge \sim q$

p	q	~q	p∧~q
T	T	f	f
T	f	T	T
F	T	f	f
f	f	T	f

$\sim p \vee q$

q	p	~p	~p∨q	(p∧~q) ∨ (~p∨q)
T	T	f	T	T
T	f	T	T	T
f	T	f	f	f
f	f	T	T	T

★ if all are True — tautology

★ if all are false = Contradiction.

p	q	~q	p∧~q	~p	~p∨q	(p∧~q)∨(~p∨q)
T	T	f	f	f	T	T
T	f	T	T	f	f	T
f	T	f	f	T	T	T
F	f	T	f	T	T	T

It is a Tautology

$\sim(p \wedge q) =$

$\sim p \vee \sim q$

$\Rightarrow \quad \sim p(\vee \exists) = \sim p \wedge \sim q$

$\sim(\sim p) = p$

$\sim(p \wedge \sim q) = \sim p \vee q$

$p \wedge (p \vee q) = (p \wedge p) \vee (p \wedge q)$

$p \vee (q \wedge r) = (p \vee q) \wedge (p \vee r)$

Implies

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

* Biconditional (Iff)
(If and only if).

p	q	$p \longleftrightarrow q$
T	T	T
T	F	F
F	T	F
F	F	T

(+ −)

$P \rightarrow (P \vee Q)$

P	Q	$P \vee Q$	$P \rightarrow (P \vee Q)$	
T	T	T	T	
T	F	T	T	
F	T	T	T	Tautology
F	F	F	T	

$(P \vee Q) \wedge (\sim P \wedge \sim Q) \equiv \sim(P \wedge Q)$

P	Q	$P \vee Q$	$P \wedge Q$	$\sim(P \vee Q)$	
T	T	T		F	F
T	F	T		F	F
F	T	T		F	F
F	F	F		T	F

Quant

Contradiction, fallacy

* Logical equivalent :

two comp. statements are called logically equivalent if they have identical true tables.

$$\sim(P \leftrightarrow q) \equiv (P \wedge \sim q) \vee (\sim P \wedge q)$$

$$P \longrightarrow q \quad = \sim q \longrightarrow -P$$