

# DMS

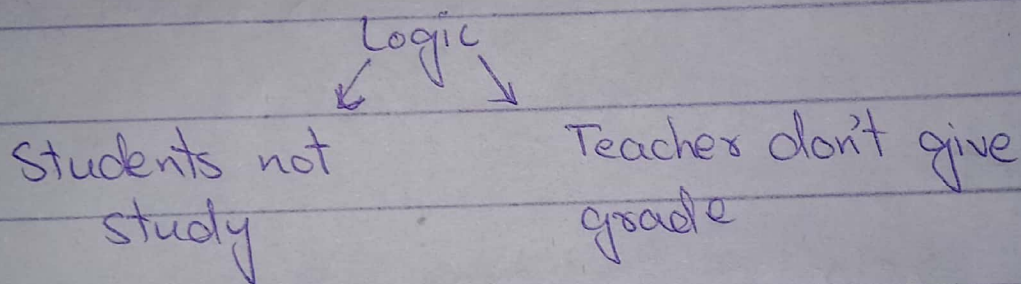
## Logic:

⇒ reason to present argument.

⇒ when we convince someone on our argument, we give reasons. This reason is called logic.

## Example

Most of the students get D grade



## Propositional logic:

Statement either true or false

## Proposition

⇒ It is declarative statement that has either a truth value "true" or "false".

⇒ It consists of propositional variables and connectives.

## Example

Following are the propositions:

$\Rightarrow$  Paris is in France. (True)

$\Rightarrow 2 < 4$  (False)

$\Rightarrow \boxed{2+x=4}$  is not a proposition bcz it has an unknown variable.

we are not sure about the statement either it is true or false.

## Fact

$\Rightarrow$  similar to proposition.

$\Rightarrow$  It also returns T/F.

$\Rightarrow$  It vary geographically, religiously or on gender base.

Variables assign to Proposition:

variables used in DMS,

$p, q, r, s, \dots$

This is DMS class  $\Rightarrow$  proposition



● Assigning Variable ( $\therefore$ )

$p \therefore$  This is DMS class.

● Negation ( $\neg$ )

$\neg p$  = This is not DMS class.

## Propositional Logic Operator:

### Conjunction:

$\Rightarrow$  Similar to AND operator.

$\Rightarrow$  denoted by ( $\wedge$ )

$\Rightarrow$  2 propositions are required.

$\Rightarrow$  If both propositions are true then the whole outcome will true.

### Example

$p$  = Today is thursday

$q$  = It is very hot today.

~~$p \wedge q$~~

$p \wedge q$

$p$	$q$	$p \wedge q$
T	T	T
T	F	F
F	T	F
F	F	F

Truth table

## ii) Disjunction:

⇒ Similar to OR operator

⇒ denoted by ( $\vee$ )

⇒ two propositions are required.

⇒ If both propositions are false then the outcome will be false.

in any other case it will return True.

Example: win cricket.

$p$  = makes a century

$q$  = takes 5 wickets

$p \vee q$

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

Truth table



### (iii) Implication:

- $\Rightarrow$  denoted by  $p \Rightarrow q$
- $\Rightarrow$  read as "if  $p$  then  $q$ ",  $p$  implies  $q$ .
- $\Rightarrow$  similar to if condition.
- $\Rightarrow q$  depends on  $p$  either what is the behaviour of  $q$ .
- $\Rightarrow$  It is false only when  $p$  is true and  $q$  is false and is true in all other situations.

#### Example

$p$ : Matric marks 950

$q$ : Nokia Mobile

$$p \rightarrow q$$

$\Rightarrow$  It is unidirectional.

$p$ (hypothesis) and  $q$ (conclusion)

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

Truth table

## (iv) Biimplication

⇒ denoted by  $(\leftrightarrow)$

⇒ bidirectional

→ The bi-implication of P and Q is true if and only if both P and Q are true or both P and Q are false.

## Example

p = I eat lunch

q = my mood improve.

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

Truth table

Additional Operators/Conditions by using basic Operators:

$$p \rightarrow q$$

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

converse:  $q \rightarrow p$

contrapositive:  $\neg q \rightarrow \neg p$



Tautology:

value which always return true.

value which always return false.

Predicate

⇒ A predicate is a statement that contains variables, sometimes referred to as predicate variables, and may be ~~to~~ true or false depending on those variables values.

Example

i)  $x > 5$        $p(x): x > 5$

ii)  $y = x + 5$

$p(x, y): y = x + 5$

(ii) This statement returns false for

$x = 2$  and  $y = 9$

$P(2, 9): 9 = 2 + 5$

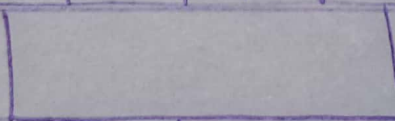
But it will return true for  $P(2, 7)$ .

# Logical Equivalence

When the truth-table of two compound propositions are equal.

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

P	q	$P \wedge q$	$\neg(P \wedge q)$	$\neg P$	$\neg q$	$\neg p \vee \neg q$
T	T	T	F	F	F	F
T	F	F	T	F	T	T
F	T	F	T	T	F	T
F	F	F	T	T	T	T



same

Hence proved

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