

lec #2.

Thursday, 24 August 2023 11:22 am

## Propositional Logic.

**Proposition:-** A declarative Statement which is either true or false but not both.

Examples:-  
P2.

Washington is the Capital of US. ✓

$1+1=2$ . ✓

$1+3=5$ . ✓

$x+3=6$ . X

It is raining today. ✓

Ex2:- HW.  
P2

**Propositional Variable:-**

A Variable which represents a Proposition.

P

Example:- I am feeling happy.  
let  $p =$  "I am feeling happy".

$2 \times 3 = 6$ .

let  $p = 2 \times 3 = 6$ .

Operations on Propositions.

Arithmetics. operand 0, 1, 2, 3 ... 9.  
operation.  $\times, +, -, \div$

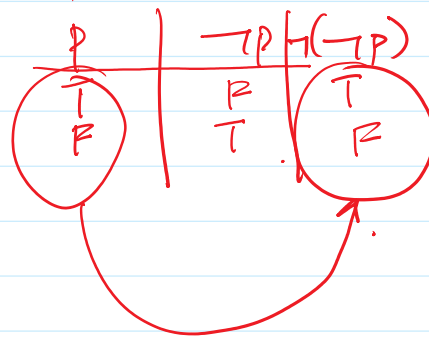
**Negation:-** "Not", "It is not the case".

$\neg$

P	$\neg P$	$\neg(\neg P)$
T	F	T

$p = \neg(\neg p)$

0  
1



$$P \equiv \neg(\neg P)$$

Syntax  
↓  
لفظي

Semantics  
↓  
المعنى  
Meaning.

Ex 3 :- Today is Friday.

P3

Let  $P \equiv$  "Today is Friday".

$\neg P \equiv$  "Today is not Friday".

Ex from myself:-

$$3 \equiv 5$$

Let  $P \equiv 3 \equiv 5$ .

$\neg P \equiv 3 \neq 5$ .

$$\neg(=) \equiv \neq$$

$$\neg(\neg) \equiv \leq$$

$$\neg(\neq) \equiv <$$

$$\neg(<) \equiv >$$

$$\neg(\leq) \equiv \geq$$

Ex 3 :- HW.

P3

Conjunction.  
 $\wedge$

"and" "but"

P	q	P ∧ q
T	T	T
T	F	F
F	T	F
F	F	F

2 Variables :- 2, 3, 4

3 Values :- 2.

Ex 5 :-  
P4

find of Conjunction.

$P \equiv$  "Today is Friday"  
 $q \equiv$  "It is raining".

$$2^2 \equiv 4$$

$$2^3 \equiv 8$$

$$2^4 \equiv 16$$

p4

of  $p \equiv$  "Today is Friday"  $q \equiv$  "It is raining".

Sol :-

$p \wedge q \equiv ?$  Values Variables:  
Today is Friday and It is raining.

Disjunction:-  
 $\vee$

"OR"

"Either"

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

Ex 6:- HW.  
 p5

$p \wedge (q \wedge r)$

p	q	r	$(q \wedge r)$
T	T	T	T
T	T	F	F
T	F	T	F
T	F	F	F
F	T	T	T
F	T	F	F
F	F	T	F
F	F	F	F

$p \wedge q \equiv q \wedge p$   
 $p \wedge (q \wedge r) \equiv (p \wedge q) \wedge r$   
 $p \wedge (q, r):$

HW 4 Variables

Implication:-  
 $\rightarrow$

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

T	F	F
F	T	T
F	F	T

If I win the election then I will lower taxes.  
 $P$   $Q$

$$P \rightarrow Q.$$

If  $P$  then  $Q$ .  
 $Q$  when  $P$ .

$P$  is sufficient for  $Q$ .

Ex 7:- Find the truth value of.  
 $P \rightarrow Q$

"If today is Friday then  $2+3=5$ ".

Solution:- Let  $P$  = "today is Friday".  
 $Q$  = " $2+3=5$ ".

$$P \rightarrow Q.$$

$$F \rightarrow T = T.$$

$$P \rightarrow (Q \rightarrow R \rightarrow S \rightarrow T) = T.$$