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. ✓
- $1+1=2$. ✓
- $1+3=5$ ✓
- $x+3=6$. ✗
- 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".

$2\times3=6$.
Let p_2 $2\times3=6$.

Operations on Propositions.

Arithmatics. 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

$p \equiv \neg(\neg p)$

¬

p	¬p	¬(¬p)
T	F	T
F	T	F

$p \equiv \neg(\neg p)$.

Syntax ⇓ ترکیب نحوی

Semantics ⇓ معنی Meaning.

Ex3 / p3 :- Today is Friday.

let p = "Today is friday".

$\neg p$ = "Today is not friday".

Ex from myself:- $3 = 5$

let p : $3 = 5$.

$\neg p$: $3 \neq 5$.

$\neg(=) \equiv \neq$
$\neg(>) \equiv \leq$
$\neg(\geq) \equiv <$
$\neg(<) \equiv \geq$
$\neg(\leq) \equiv >$.

Ex3 / p3 :- HW.

Conjunction. ∧ "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.

$2^2 = 4$,
$2^3 = 8$.
$2^4 = 16$.

Ex5 / p4 :- find Conjunction. of p = "Today is friday" q = "It is raining".

P4 of p = "Today is Friday" $2^4 = 16$.
q = "It is raining".

Sol:- $p \wedge q$ = ?

Variables. Values

Today is Friday and It is raining.

Disjunction:- "OR" "Either"
$\vee$

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

Ex 6 :- HW.
P5

q: $p \wedge (q \wedge r)$.

q: $(q \wedge r)$

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

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

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

$P \to q$.

If P then q. P is sufficient for q.
q when p.

Ex7 :- P7 find the truth value of.

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

Solution:- Let p: "today is friday."
q: "$2+3=5$".

$p \to q$.
$F \to T = T$.

$P \to (q \to r \to s \to z)$
$F \qquad = T$.