Oct 6, Monday

Note Title 10/6/2014

Piazza access code: f14dm

Proposition: Statement either True T
False F.

$2+3=5$

π is a real number

4 is a prime number.

Go to your room. (not a prop)

p: Sam is happy. p, q

q: Sam is poor. propositional vars T or F

[x y, x+y

Logical operator: conjunction "and"

$p \wedge q$ Sam is happy and Sam is poor.
Sam is poor but he's happy.

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

Disjunction: p or q $p \vee q$.

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

$\neg q$

q	$\neg q$
T	F
F	T

$q = T$
$r = F$
$p = T$

$(p \wedge q)^{T}$ $\neg r^{T}$

$(r \vee p)^{T}$

$3 + 5 \times 5$

Not, And, Or → Order of precedence: $\neg$, $\wedge$, $\vee$.

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

$\neg r \vee p \neq \neg(r \vee p)$

$= (\neg r) \vee p$

$\neg r \vee p$.

$T \vee T = T$

$q = T$
$r = F$
$p = T$

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

$\neg T \wedge T$

$F \wedge T \Rightarrow$ False.

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

Conditional $p \to q$ If p then q.

hypothesis ↑ conclusion ↑

p	q	$p \to q$
T	T	T
T	F	F
F	T	T
F	F	T

q if p

p implies q.

p only if q

p: You take your drivers test.
q: You get a drivers license

Taking the test is sufficient for getting a license. $p \to q$

You will get your license only if you take the test. $q \to p$.

Taking the drivers test is necessary for getting your license. $q \to p$.

h=F

If $2+2=5$ then 4 is prime. True

If $2+2=4$ then today is Wed. False

h=T c=F

$\neg, \wedge, \vee, \rightarrow$

$p \rightarrow (r \wedge q)$

$(\neg r \vee q) \rightarrow p$

Logical Equivalence (1.4) Not cover Laws of prop logic.

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

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

Predicates (1.5)

$x > 3$

$P(x)$: x is a perfect square.

Domain: set of all integers.

$P(49)$ True
$P(48)$ False.

$P(x)$ not a prop.

$P(48)$ prop.

Universal Quantifier

$\forall x\ P(x)$ For every x (in the domain) $P(x)$ is true

Students in ICS 6D (domain)

$S(x)$ person x has a uscid.

$\forall x\ S(x)$ Every student has a uscid

$S(\text{student}_1) \wedge S(\text{student}_2) \wedge \cdots \wedge S(\text{student}_{345})$

$\forall x\ x^2 > 0$ False

Counterexample: $x = 0$.

$\forall x\ x+1 > x$