

Math 321

Q5

propositional variables : (ex) p, q, r , etc

p, q	$\neg p$	$\neg q$	$p \wedge q$	$p \vee q$	$p \oplus q$
T T	F	F	T	T	F
T F	F	T	F	T	T
F T	T	F	F	T	T
F F	T	T	F	F	F

Implication / Conditional

if p , then q

(ex) p : "you elect me"

q : "I give you a hippo"

Symbol

$p \rightarrow q$

english

See p. 6

	p	q	$p \rightarrow q$
①	T	T	T
②	T	F	F
③	F	T	T
④	F	F	T

hypothesis
premise
sufficient

condition
conseq.
necessary

Given $p \rightarrow q$ "implication"

based on this we can consider variants.

$q \rightarrow p$ "converse"

$\neg p \rightarrow \neg q$ "inverse"

$\neg q \rightarrow \neg p$ "contrapositive"

Biconditional p if and only if q

Symbol:

$p \leftrightarrow q$

$(p \rightarrow q) \wedge (q \rightarrow p)$

p q
 T T
 T F
 F T
 F F

$p \rightarrow q$
 T
 F
 T
 T

$q \rightarrow p$
 T
 F
 F
 T

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

$p \leftrightarrow q$
 T
 F
 F
 T

p	q	$p \leftrightarrow q$
T	T	T
T	F	F
F	T	F
F	F	T

Truth Table Everyone Should know

P	Q	$\neg P$	$\neg Q$	$P \wedge Q$	$P \vee Q$	$P \oplus Q$	$P \rightarrow Q$	$P \leftrightarrow Q$
T	T	F	F	T	T	F	T	T
T	F	F	T	F	T	T	F	F
F	T	T	F	F	T	T	T	F
F	F	T	T	F	F	F	T	T

Compound Propositions (New propositions using the operations)

ex $\neg P \rightarrow (Q \wedge P)$

P	Q	$\neg P$	$Q \wedge P$	$\neg P \rightarrow (Q \wedge P)$
T	T	F	T	T
T	F	F	F	F
F	T	T	F	T
F	F	T	F	T

order of ops.

parenth. ()
neg \neg
 \wedge, \vee, \oplus
 $\rightarrow, \leftrightarrow$

ex

II

P : "Saw Grizzly"

Q : "Safe hike"

R : "Ripe berries"

For Safe hike, necessary but not suff.
 Pipe berries and not saw griz.
 \uparrow \wedge \neg P

$$[q \rightarrow (\neg r \wedge \neg p)] \wedge \neg [(\neg r \wedge \neg p) \rightarrow q]$$

(Note: later to lecture to get
English version of)

