

p, q, r

p is true
 q is false
 r is true

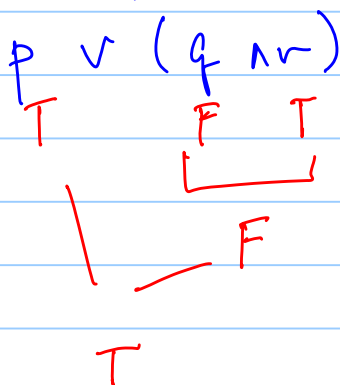
$\neg q$

$p \wedge r$

$p \vee r$

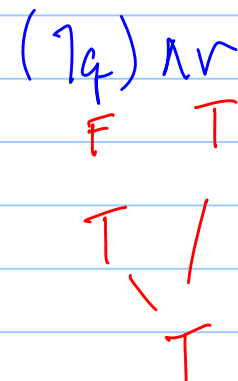
$p \vee q \wedge r$

Order of operations : Not, And, Or.

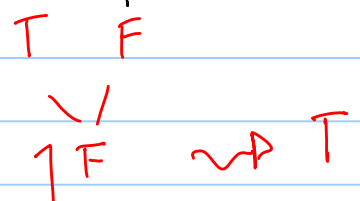


$p \vee (\neg r \wedge q)$

$\neg q \wedge r$



$\neg (r \wedge q)$



p	T
q	F
r	F
t	T

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

Compound proposition.

Truth table for $\neg(p \wedge r) \vee (\neg t \wedge q)$:

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

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

Truth table for $\neg(p \wedge r) \vee (\neg t \wedge q)$:

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

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

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

Rice cooker

t: temp over threshold
c: cooking complete,
w: warming feature activated.

$$t \vee (c \wedge w)$$

$$\left((cs \ 10 \text{ or } cs \ 12) \text{ and } cs \ 20, \right. \\ \left. cs \ 10 \text{ or } (cs \ 12 \text{ and } cs \ 20) \right)$$

Conditional Operators

Implication

$$P \rightarrow q$$

"If p then q".
p hypothesis
q conclusion.

P	q	$P \rightarrow q$
T	T	T
T	F	F
F	T	T
F	F	T

p: Mow lawn.

q: pay \$10

$$P \rightarrow q.$$

p : You finish your homework.
 q : You can go to the party.
 $p \rightarrow q$.

If you finish your homework, ^{then} you can go to the party.

You can go to the party if you finish your HW.

Finishing your HW implies that you can go to the party.

Finishing your HW is sufficient for going to the party.

p only if q . $\Rightarrow$

q is necessary for p .
necessary for p .

p : You take your drivers test

q : You get a drivers license.

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

You will get a license only if you take the test.
 $q \rightarrow p$.

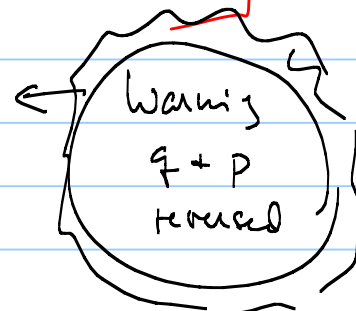
The driver's test is necessary for getting your license. q

P is necessary for q .

$$q \rightarrow P.$$

The only way q can be true is if P is also true.

P	q	$q \rightarrow P$
T	T	T
T	F	T
F	T	F
F	F	T



If $2+2=5$ then today is Wed. True.

If $2+2=5$ then today is Mon. True.

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

If $2+2=4$ then today is Mon. True.

$p \rightarrow q$ implication.

Converse $q \rightarrow p$

Contrapositive $\neg q \rightarrow \neg p$.

Inverse $\neg p \rightarrow \neg q$.

Biconditional $p \leftrightarrow q$.

p	q	$p \leftrightarrow q$	p if and only if q
-----	-----	-----------------------	------------------------

T	T	T
T	F	F
F	T	F
F	F	T

p iff q

p is necessary + sufficient for q .

if p then q and conversely.

(Not, $\wedge$, $\vee$, ~~imp~~ conditionals.)