p. q statements

$p \vee q$ "p or q"

$p \wedge q$ "p and q"

$\sim p$ "not p"
"It is not the case that p."

Truth table: keeps track of possible values of everything in the table for any propositions listed.

$\rightarrow$ "implies"

$p \rightarrow q$ "p implies q"
"If p, then q"

Ex $\boxed{\text{If it rains today, I will drive to work.}}$

p = "It rains today."
q = "I'll drive to work."

is written $p \rightarrow q$.

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

conditional

$\oplus$ "exclusive or"

$p \oplus q$ p or q but not both.

Use a truth table to find the truth values of ~~$(\sim p \vee q) \vee p$~~

$\sim (p \wedge \sim q) \vee p$

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

This is always ~~true~~, so it's called a tautology

Def'n A **tautology** is a statement with logical value TRUE independent of the truth value of individual statement variables it contains.

Similarly, a **contradiction** is a statement that is always false.

$p \wedge (\sim p)$ is a contradiction.

Pf

p	$\sim p$	$p \wedge (\sim p)$
T	F	F
F	T	F

19. p. 13

Truth table for $p \oplus (q \vee r)$

p	q	r	$q \vee r$	$p \oplus (q \vee r)$
→ T	T	T	T	F
→ T	T	F	T	F
→ T	F	T	T	F
T	F	F	F	T
F	T	T	T	T
F	T	F	T	T
F	F	T	T	T
→ F	F	F	F	F

$p \oplus q$ means $(p \vee q) \wedge \sim(p \wedge q)$

p	q	$p \oplus q$
T	T	F
T	F	T
F	T	T
F	F	F

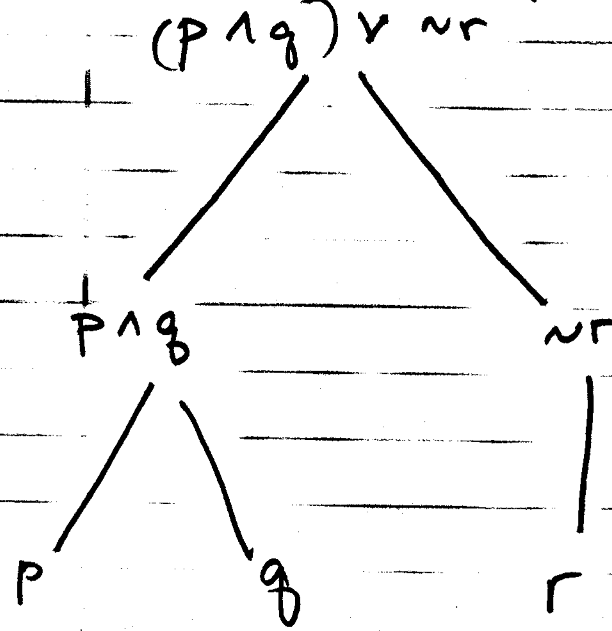
29 p. 13 Compare truth tables $\sim p \vee \sim q$ and $\sim(p \wedge q)$

[Put both in a single truth table and compare]

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

They have same truth values.
These statements are logically equivalent.

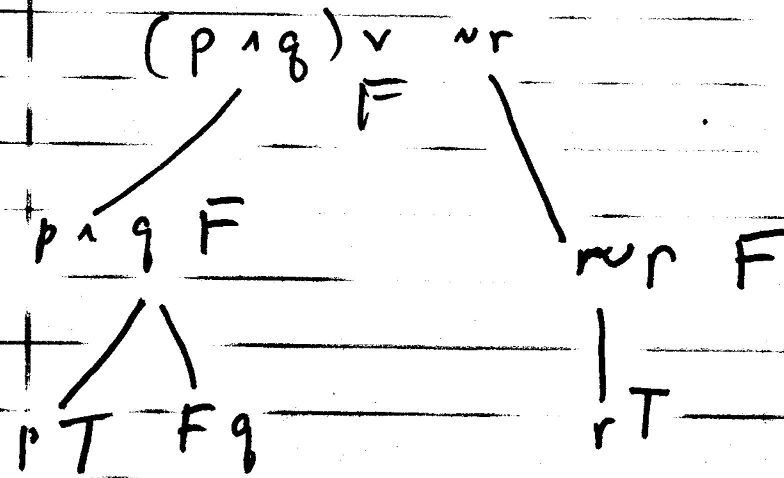
Trees



break into smaller units from which I can determine truth/falsehood of the "parent" in tree.

Why is this good? A table requires evaluating the answer for every truth value of P, q, r. A <u>tree</u> is a fast way to get an answer for <u>one</u> value of p, q, r.

Ex Find the value of $(p \wedge q) \vee \sim r$ when p is T, q is F, r is T.



p = "Jack ~~was~~ is drunk."

q = "Jack has an accident"

$p \to q$ " If Jack is drunk, he has an accident."

$q \to p$ " If ~~he~~ J has an accident then ~~he's~~ J's drunk."

~~$p \to q$ is saying p is a necess~~

To have an accident, it is sufficient that he was drunk.

In our story, being drunk guarantees an accident on the ice patch.

But maybe if not drunk, you'd still have an accident.

It is not necessary that he be drunk.

" Sufficient but not necessary."

But... passing 112 is necessary to graduate w/ IT major, but not sufficient.