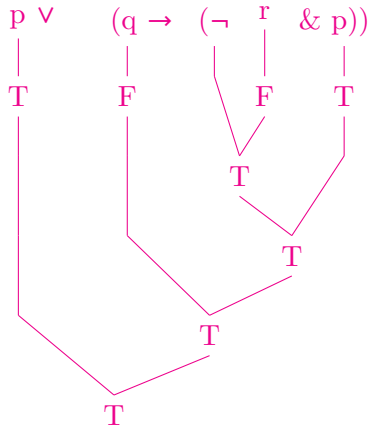


1 Extra practice (try on own at home)

1. Calculate the truth value of $p \vee (q \rightarrow (\neg r \& p))$ by supplying a tree, assuming that p is true, q is false, and r is false.



2. Construct the truth table for $q \rightarrow ((p \leftrightarrow \neg q) \vee \neg(q \& p))$.

p	q	$\neg q$	$p \leftrightarrow \neg q$	$q \& p$	$\neg(q \& p)$	$(p \leftrightarrow \neg q) \vee \neg(q \& p)$	$q \rightarrow ((p \leftrightarrow \neg q) \vee \neg(q \& p))$
T	T	F	F	T	F	F	F
T	F	T	T	F	T	T	T
F	T	F	T	F	T	T	T
F	F	T	F	F	T	T	T

3. Show that each of the following pairs of formulas are equivalences by showing the truth table for each one.

- (a) p and $\neg\neg p$

p
T
F

p	$\neg p$	$\neg\neg p$
T	F	T
F	T	F

- (b) $\neg p$ and $p \rightarrow (q \& \neg q)$

p	$\neg p$
T	F
T	F
F	T
F	T

p	q	$\neg q$	$q \& \neg q$	$p \rightarrow (q \& \neg q)$
T	T	F	F	F
T	F	T	F	F
F	T	F	F	T
F	F	T	F	T

(c) $\neg(p \vee q)$ and $\neg p \ \& \ \neg q$

(this one is called De Morgan's Law)

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

p	q	$\neg p$	$\neg q$	$\neg p \ \& \ \neg q$
T	T	F	F	F
T	F	F	T	F
F	T	T	F	F
F	F	T	T	T

(d) $\neg(\neg p \ \& \ \neg q)$ and $(p \rightarrow q) \rightarrow q$

p	q	$\neg p$	$\neg q$	$\neg p \ \& \ \neg q$	$\neg(\neg p \ \& \ \neg q)$
T	T	F	F	F	T
T	F	F	T	F	T
F	T	T	F	F	T
F	F	T	T	T	F

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