(1) 3-10-16

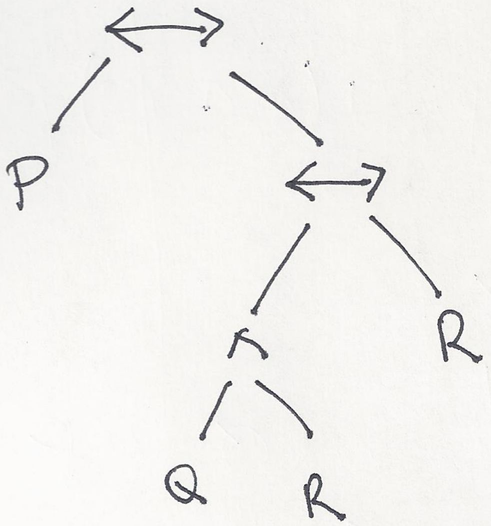
logic Puzzle.

$$A = P \leftrightarrow ((Q \wedge R) \leftrightarrow R)$$

$v_1(P) = 0$

$v_1(Q) = 0$ $\qquad v_1(A) = ?$

$v_1(R) = 1.$



$$P \leftrightarrow ((Q \wedge R) \leftrightarrow R)$$

$$\underbrace{0 \leftrightarrow 1}.$$

$$\underbrace{0 \leftrightarrow 0}_{1}. \qquad v_1(A) = 1.$$

(2)

A	B	$A \to B$	$\neg A \vee B$	$(A \to B) \leftrightarrow (\neg A \vee B)$
0	0	1	1	1
0	1	1	1	1
1	0	0	0	1
1	1	1.	1.	1.

If $A \to B \equiv \neg A \vee B$, then
$(A \to B) \leftrightarrow (\neg A \vee B)$ is a tautology.

$$P \vee 1 \equiv 1.$$

$$P \vee (Q \vee \neg Q) \equiv 1.$$

$$\underbrace{\left((A \to B) \leftrightarrow (C \vee D)\right)}_{\text{like your } \underline{\underline{P}}} \vee \underbrace{(E \vee \neg E)}_{\Downarrow \; 1.}$$

$$\equiv 1.$$

(3)

· DNF

disjunctive normal form.

disjunctions.

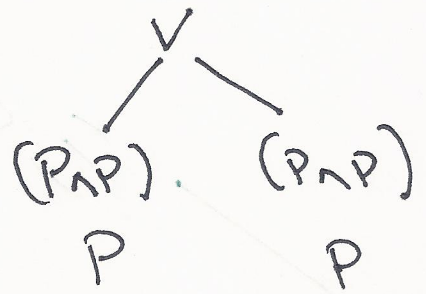
↓

conjunctions

↓

literals.

$P \Rightarrow$ is in DNF.

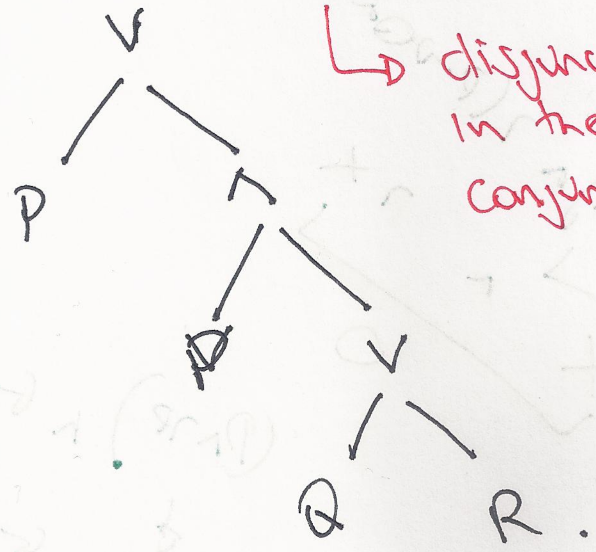


$P \vee P$

$\Rightarrow$ conjunctions in the scope of disjunctions ✓

$P \vee (P \wedge (Q \vee R))$. NOT DNF.

↳ disjunction ($\vee$) in the scope of conjunction ($\wedge$) ✗



$P \vee \neg Q$

CNF

$$\wedge$$

$$(P \vee \neg Q) \quad (P \vee \neg Q)$$

✓ disjunctions in the scope of conjunctions

$P \wedge \neg Q$

$$\wedge$$

$$(P \vee P) \wedge (\neg Q \vee \neg Q)$$

$$\equiv P \qquad \equiv \neg Q$$

$$\equiv P \wedge \neg Q$$

DNF transformations

$$A \to B \equiv \neg A \vee B$$

$$
\begin{aligned}
(F \to G) \to H &\equiv \neg(F \to G) \vee H \\
&\equiv \neg(\neg F \vee G) \vee H \\
&\equiv (\neg\neg F \wedge \neg G) \vee H \\
&\equiv (F \wedge \neg G) \vee H
\end{aligned}
$$

(5)

$(P \to Q) \wedge (Q \to P) \equiv P \leftrightarrow Q$.

DNF ?

	P	Q	$P \to Q$	$Q \to P$	$(P \to Q) \wedge (Q \to P)$	$P \leftrightarrow Q$
*A	0	0	1	1	1	1
	0	1	1	0	0	0
	1	0	0	1	0	0
*B	1	1	1	1	1	1

$P=0 \quad Q=0$

$*A \Rightarrow (\neg P \wedge \neg Q)$

$P=1 \quad Q=1$

$*B \Rightarrow (P \wedge Q)$

$\Rightarrow (\neg P \wedge \neg Q) \vee (P \wedge Q)$.

$$\neg[(\neg P \wedge Q) \vee (P \wedge \neg Q)] \equiv \neg(\neg P \wedge Q) \wedge \neg(P \wedge \neg Q)$$

$$(\neg\neg P \vee \neg Q) \wedge (\neg P \vee \neg\neg Q)$$

$$(P \vee \neg Q) \wedge (\neg P \vee Q)$$

$$\equiv (Q \to P) \wedge (P \to Q)$$

$$(P \to Q) \wedge (Q \to P)$$

$$\equiv P \leftrightarrow Q.$$

(6)

Tutorial 1.

(A)

Q5

$$\neg P_4 \rightarrow (\neg P_2 \vee P_3 \vee \neg P_1)$$

$$1 \rightarrow (0 \vee 0 \vee 0)$$

$P_1 = 1.$

$P_2 = 1.$

$P_3 = 0$

$P_4 = 0.$

$$1 \rightarrow (0)$$

$$0$$

$P_4 \Rightarrow 1$ the implication will be true.

(B)

P	Q	P|Q	$P \wedge Q$	$\neg(P \wedge Q)$	$P \downarrow Q$	$P \vee Q$	$\neg(P \vee Q)$
			0	1	1	0	1
0	0	1	0	1	0	1	0
0	1	1	0	1	0	1	0
1	0	1			0	1	0
1	1	0	1	0			

$\equiv$

$\equiv$

$A \equiv B$ All rows for A produce the same result as B!

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$$\underbrace{(P \vee \neg R)}_{A} \to \underbrace{\neg(\neg Q \vee R)}_{B}$$

$$A \to B \;.\; \equiv \neg A \vee B \;.$$

$$\neg(P \vee \neg R) \vee \neg(\neg Q \vee R)$$

$$(\neg P \wedge \neg\neg R) \vee (\neg\neg Q \wedge \neg R) \;.$$

$$\underbrace{(\neg P \wedge R)}_{A} \vee \underbrace{(Q \wedge \neg R)}_{(B \wedge C)}$$

$$A \vee (B \wedge C)$$

$$(A \vee B) \wedge (A \vee C) \;.$$

P	Q	R	$\to$
0	0	0	x_1
0	0	1	x_2
	$\vdots$		
1	1	1	x_8 .

$$\neg(\neg P \wedge \neg Q \wedge R) \qquad x_2 \,.\, 0$$

$$(P \vee Q \vee \neg R) \wedge$$