Vic, Hong 47523483 Tutorial Group Number : 1

1.

p	q	r	$\sim q$	$\sim r$	A: $q \to \sim r$	C: $\sim$	$(p \vee A)$	B: $p \vee \sim q$	D: $r \to B$	$C \leftrightarrow D$
T	T	T	F	F	F	F	T	T	T	F
T	T	F	F	T	T	F	T	T	T	F
T	F	T	T	F	T	F	T	T	T	F
T	F	F	T	T	T	F	T	T	T	F
F	T	T	F	F	F	T	F	F	F	F
F	T	F	F	T	T	F	T	F	T	F
F	F	T	T	F	T	F	T	T	T	F
F	F	F	T	T	T	F	T	T	T	F

AnS: $(\sim(p \vee (q \to \sim r))) \leftrightarrow (r \to (p \vee \sim q))$ is contradiction.

2.

(a) $(p \to (q \to r)) \wedge (\sim r) \equiv (p \to \sim q) \wedge (\sim r)$

$(p \to (\sim q \vee r)) \wedge (\sim r) \equiv (\sim p \vee \sim q) \wedge (\sim r)$ using implications are disjunctions.

$(\sim p \vee (\sim q \vee r)) \wedge (\sim r) \equiv (\sim p \vee \sim q) \wedge (\sim r)$ using implications are disjunctions.

$((\sim p \vee \sim q) \vee r) \wedge (\sim r) \equiv (\sim p \vee \sim q) \wedge (\sim r)$ using Associativity.

$(\sim r) \wedge ((\sim p \vee \sim q \vee r) \equiv (\sim r) \wedge (\sim p \vee \sim q)$ using Commutative law.

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

Because $(\sim r) \vee r$ is tataulogy.

We can have $\sim r \wedge (\sim p \vee \sim q) \equiv \sim r \wedge (\sim p \vee \sim q)$.

(b) I don't agree with this mark. Because the last part of the statement which is $\wedge(\sim r)$ would be needed, to secure that $(\sim r) \vee r$ would occur. If $\wedge(\sim r)$ is canceled at first step, these statements cannot be justified logically equivalent.

3. Let p = I go to work. q = I brush my teeth. r = I drive my car.
s = I tie my shoes. t = I wear socks.

So the question can be written as:

$p \to (q \cup r)$ - ①
$s \cap \sim t$ - ②
$t \to \sim q$ - ③
p - ④
$\therefore r \cup \sim s$ - ⑤

Suppose all the premises are true, but conclusion is false.

p is true.

$(q \cup r)$ is true (from ① & ④) - ⑥

$r \cup \sim s \equiv \sim s \cup r$ (using commutative law)

$\sim s \cup r \equiv s \to r$ (using implication is disjunction) is false

$s \to r$ is false, so s, r can be known are true & false. - ⑦

q must be True (from ⑥ & ⑦)

$\sim t$ must be True (from ⑦ & ②)

Thus, it is possible that all the premises are true but the conclusion is false.

Therefore the following arguements are "invalid."

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4. (a) $\exists x \in \mathbb{R}$ such that $x^2 \in \mathbb{Q}$ but $x \notin \mathbb{Q}$.

(b) $\forall x \in \mathbb{R}$, $x^2 \in \mathbb{Q} \to x \in \mathbb{Q}$.

Ans: (b) is true. For (a) no number x could be found that it square is rational but x is integer. For (b), yes, for every x is a real number, if x^2 is a rational number, then x is also a rational number.

5. (a) $\forall q \in \mathbb{Q}, \exists r \in \mathbb{Q}$ such that $\frac{q}{r} \in \mathbb{Z}$

its negation = $\exists q \in \mathbb{Q}$, such that $\forall r \in \mathbb{Q}, \frac{q}{r} \notin \mathbb{Z}$

And "$\forall q \in \mathbb{Q}, \exists r \in \mathbb{Q}$ such that $\frac{q}{r} \in \mathbb{Z}$" is true.

Because every rational number q has their own reciprocal r to make $\frac{q}{r}$ is a integer.

(b) $\exists z \in \mathbb{Z}$ such that $\forall x, y \in \mathbb{Z}$, $x - y < z$

its negation = $\forall z \in \mathbb{Z}, \exists x, y \in \mathbb{Z}$, such that $x - y \geq z$

And "$\forall z \in \mathbb{Z}$ $\exists x, y \in \mathbb{Z}$, such that $x - y \geq z$" is true

because x, y could be easily found for us that their difference is bigger then whatever z it is because x & y can be any two numbers on the number line.

6.

(a)

$$(P\land Q\land R\land S)\lor(P\land\sim Q\land R\land S)\lor(\sim P\land\sim Q\land R\land S)$$

(b)

$$(P\land Q\land R\land S)\lor(P\land\sim Q\land R\land S)\lor(\sim P\land\sim Q\land R\land S)$$

$$\equiv (P\land Q\land(A))\lor(P\land\sim Q\land(A))\lor(\sim P\land\sim Q\land(A))$$

$$\equiv ((A)\land(P\land Q))\lor((A)\land(P\land\sim Q))\lor((A)\land(\sim P\land\sim Q))$$

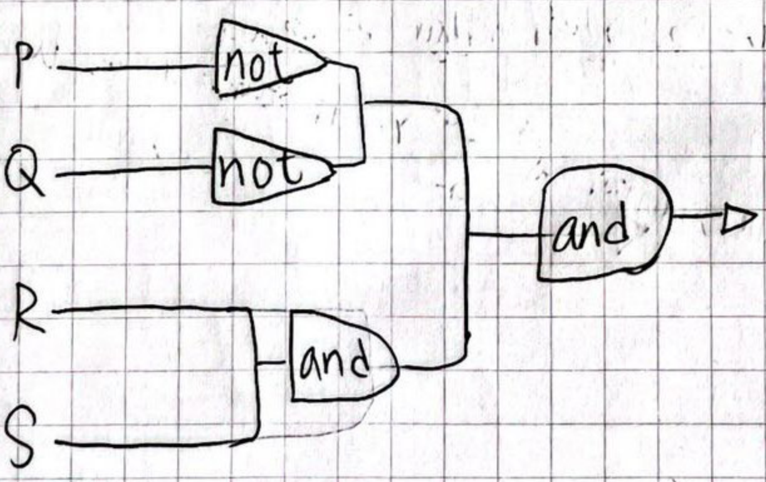
$$\equiv A\land((P\land Q)\lor(P\land\sim Q)\lor(\sim P\land\sim Q))$$

$$\equiv A\land((P\land(Q\lor\sim Q))\lor(\sim P\land\sim Q))$$

$$\equiv A\land((P\land t)\lor(\sim P\land\sim Q))$$

$$\equiv A\land(t)\lor A\land(\sim P\land\sim Q)\equiv(R\land S)\land(\sim P\land\sim Q)$$

(c)



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