40111159
CSE-E1

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Assignment-1

Part-A

1) $P \leftrightarrow q$ (a)

2) $(P \wedge T) \vee (q \wedge F)$ (b)

3) $(P \rightarrow q) \wedge (r \rightarrow q) \Leftrightarrow (P \vee r) \rightarrow q$ (d)

4) $P \vee (\neg P \wedge q)$

P	Q	$\neg P$	$\neg P \wedge q$	$P \vee (\neg P \wedge q)$
T	T	F	F	T
T	F	F	F	T
F	T	T	T	T
F	F	T	F	F

The PDNF of given statement $(P \wedge q) \vee (P \wedge \neg q) \vee (\neg P \wedge q)$ (b)

5) $(\forall x)(m(x) \rightarrow w(x))$ (a)

Part-B

6)

Step	Statement	Reason
①	$P \to q$	Rule P
②	$q \to r$	Rule P
③	$P \to r$	Rule T, ① and ② chain rule
④	P	Rule P
⑤	R	Rule T, ③ and ④ modus rule

7) (1) $(\neg P \wedge q) \to r$

(2) $r \to (P \vee q)$

8) (1) $P \Leftrightarrow (P \wedge q) \vee (P \wedge \neg q)$ = let the statement be S

P	q	$P \wedge q$	$\neg q$	$P \wedge \neg q$	$(P \wedge q) \vee (P \wedge \neg q)$
T	T	T	F	F	T
T	F	F	T	T	T
F	T	F	F	F	F
F	F	F	T	F	F

(2) let S be $(P \vee Q) \wedge (P \vee \neg Q)$

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

9) $(P \to (Q \to R)) \Rightarrow (P \to Q) \to (P \to R)$ let the statement be S

P	Q	R	$Q \to R$	$P \to (Q \to R)$	$P \to Q$	$P \to R$	$(P \to Q) \to (P \to R)$	S
T	T	T	T	T	T	T	T	T
T	T	F	F	F	T	F	F	T
T	F	T	T	T	F	T	T	T
T	F	F	T	T	F	F	T	T
F	T	T	T	T	T	T	T	T
F	T	F	F	T	T	T	T	T
F	F	T	T	T	T	T	T	T
F	F	F	T	T	T	T	T	T

∴ The given statement S is a tautology

(10) $(P \vee q \vee \gamma) \wedge (P \vee T \vee \neg q) \wedge (P \vee \neg T \vee \gamma)$

$\Leftrightarrow (P \vee q \vee \gamma) \wedge (T \vee \neg q) \wedge (D \vee F \vee \gamma)$

$\Leftrightarrow (P \vee q \vee \gamma) \wedge T \wedge (P \vee \gamma)$

$\Leftrightarrow (P \vee q \vee \gamma) \wedge (P \vee \gamma)$

$\Leftrightarrow (P \vee \gamma \vee q) \wedge (P \vee \gamma)$ (Absorption law $(A \vee B) \wedge B \Rightarrow A$)

$\Leftrightarrow P \vee \gamma$

Part-C

(11) Let S: $P \rightarrow [(P \rightarrow q) \wedge \neg(F \vee \neg P)]$

$\Leftrightarrow P \rightarrow [(\neg P \vee q) \wedge (q \wedge P)]$

$\Leftrightarrow \neg P \vee [(\neg P \vee q) \wedge (P \wedge q)]$

$\Leftrightarrow \neg P \vee [(P \wedge q) \wedge (\neg P \vee q)]$

$\Leftrightarrow \neg P \vee [(P \wedge q \wedge \sim P) \vee (P \wedge q \wedge q)]$

$\Leftrightarrow \neg P \vee [(F \wedge q) \vee (P \vee q)]$

$\Leftrightarrow \neg P \vee [F \vee (P \wedge q)]$

$\Leftrightarrow \neg P \vee (P \wedge q)$

$\Leftrightarrow \neg P \wedge (q \vee \neg q) \vee (P \wedge q)$

$\Leftrightarrow$

The PDNF of given $\neg S \Leftrightarrow (P \wedge \neg q)$