



# COLLEGE OF ENGINEERING, PUNE

Wellesley Road, Shivajinagar, Pune-411 005

## DSGT TUTORIAL-2

i) Construct Truth Table for the following:

a)  $(p \vee q) \wedge r$

→

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

b)  $(p \vee \neg q) \rightarrow r$

→

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





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2) Is  $(p \vee \neg q) \wedge (\neg p \vee \neg q) \vee q$  a tautology?

$$\begin{aligned} &\rightarrow = (p \rightarrow \neg q) \wedge (p \rightarrow \neg q) \vee q \quad \text{--- } p \vee q \equiv \neg p \rightarrow q \\ &= (p \vee p) \rightarrow \neg q \vee q \quad \text{--- } (p \rightarrow r) \wedge (q \rightarrow r) \equiv (p \vee q) \rightarrow r \\ &= (T \rightarrow \neg q) \vee q \quad \text{--- } (p \vee p) = T \\ &= \neg q \vee q \\ &= T \end{aligned}$$

Hence, it's a Tautology.

3) Prove the following

a)  $p \vee (\neg p \wedge q) \equiv (p \vee q)$

$$\begin{aligned} &\rightarrow (p \vee \neg p) \wedge (p \vee q) \quad \leftarrow \text{LHS} \\ &= T \wedge (p \vee q) \quad \text{--- } p \vee \neg p = T \\ &= (p \vee q) \end{aligned}$$

$$\text{LHS} = \text{RHS} \quad \therefore p \vee (\neg p \wedge q) \equiv (p \vee q)$$

b)  $p \wedge (\neg p \vee q) \equiv (p \wedge q)$

$\rightarrow$  LHS

$$\begin{aligned} &(p \wedge \neg p) \vee (p \wedge q) \\ &= F \vee (p \wedge q) \quad \text{--- } p \wedge \neg p = F \\ &= (p \wedge q) \end{aligned}$$

4) Construct truth table for following:-

a)  $p \rightarrow q$





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$p$	$q$	$p \rightarrow q$
T	T	T
T	F	F
F	T	T
F	F	T

b)  $(p \rightarrow p) \vee (p \rightarrow \bar{p})$

$p$	$p$	$\bar{p}$	$p \rightarrow p$	$p \rightarrow \bar{p}$	$(p \rightarrow p) \vee (p \rightarrow \bar{p})$
T	T	F	T	F	T
F	F	T	T	T	T

c)  $(p \rightarrow p) \rightarrow (p \rightarrow \bar{p})$

$p$	$p$	$\bar{p}$	$p \rightarrow p$	$p \rightarrow \bar{p}$	$(p \rightarrow p) \rightarrow (p \rightarrow \bar{p})$
T	T	F	T	F	F
F	F	T	T	T	T

d)  $(p \vee \bar{q}) \vee \bar{p}$

$p$	$q$	$\bar{q}$	$\bar{p}$	$p \vee \bar{q}$	$(p \vee \bar{q}) \vee \bar{p}$
T	T	F	F	T	T
T	F	T	F	T	T
F	T	F	T	F	T
F	F	T	T	T	T

e)  $(p \vee \bar{q}) \rightarrow \bar{p}$

$p$	$q$	$\bar{p}$	$\bar{q}$	$p \vee \bar{q}$	$(p \vee \bar{q}) \rightarrow \bar{p}$
T	T	F	F	T	F
T	F	F	T	T	F
F	T	T	F	F	T
F	F	T	T	T	T





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$$f) p \leftrightarrow (\bar{p} \vee \bar{q})$$

$p$	$q$	$\bar{p}$	$\bar{q}$	$(\bar{p} \vee \bar{q})$	$p \leftrightarrow (\bar{p} \vee \bar{q})$
T	T	F	F	F	F
T	F	F	T	T	T
F	T	T	F	T	T
F	F	T	T	T	F

$$g) (p \rightarrow (q \rightarrow r)) \rightarrow ((p \rightarrow q) \rightarrow (p \rightarrow r))$$

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

$$p \rightarrow (q \rightarrow r) \rightarrow ((p \rightarrow q) \rightarrow (p \rightarrow r))$$

T

T

T

T

T

T

T

T

T





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$$h) (\bar{q} \rightarrow \bar{p}) \rightarrow (p \rightarrow q)$$

$\rightarrow$	$p$	$q$	$\bar{p}$	$\bar{q}$	$\bar{q} \rightarrow \bar{p}$	$p \rightarrow q$	$(\bar{q} \rightarrow \bar{p}) \rightarrow (p \rightarrow q)$
	T	T	F	F	T	T	T
	T	F	F	T	F	F	T
	F	T	T	F	T	T	T
	F	F	T	T	T	T	T
	<del>F</del>	<del>T</del>					
	<del>F</del>	<del>F</del>					
	<del>T</del>	<del>T</del>					
	<del>T</del>	<del>F</del>					

- 5) Let P denote statement "Weather is nice" and Q denotes "We have a Picnic". Translate the foll. symbolic statements in English statements.

$$a) p \wedge \bar{q}$$

$\rightarrow$  Weather is nice and we do not have a picnic.

$$b) p \leftrightarrow q$$

$\rightarrow$  It is necessary that weather is nice and it is sufficient that we have a picnic.

$$c) \bar{q} \rightarrow \bar{p}$$

$\rightarrow$  If weather is not nice then we do not have picnic

$$d) (\bar{p} \vee \bar{q}) \vee (p \wedge \bar{q})$$

$\rightarrow$  Either it is not the case that weather is not nice or we have a picnic or weather is nice and we do not have a picnic.





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6) Consider the foll. conditional statement:

If the flood destroys my house or the fires destroy my house, then my insurance company will pay me.

Converse

→ If my insurance company pay me, then flood will destroy my house or fires destroy my house.

Inverse

→ If the flood do not destroy my house or the fires do not destroy my house then my insurance company will not pay me.

Contrapositive

→ If my insurance company will not pay me then my house is not destroyed by flood or my house is not destroyed by fires.