

16/09/2022-

# DMS Tutorial. I

Q.1 Write the following statements in symbolic form:

a) Mark is poor but happy  
→  $\neg R \wedge H$

→ c)  $\neg R \wedge \neg H$

d) Mark is poor or he is both rich and unhappy.  
→  $\neg R \vee (R \wedge \neg H)$

Q.2 Construct the truth table for the following.

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

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

d)  $P \wedge (Q \wedge P)$

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



Q.3

$$\begin{aligned} a) & p \vee (q \wedge r) \\ &= T \vee (T \wedge F) \\ &= T \vee (F) \\ &= T \end{aligned}$$

$$\begin{aligned} b) & (p \wedge (q \wedge r)) \vee \neg((p \vee q) \wedge (r \vee s)) \\ &= (T \wedge (T \wedge F)) \vee \neg((T \vee T) \wedge (F \vee F)) \\ &= (T \wedge F) \vee \neg(T \wedge F) \\ &= F \vee \neg(F) \\ &= F \vee T \\ &= T \end{aligned}$$

Q.4.  $p$  : Houses are cold = F  
 $q$  : Houses are haunted = F  
 $r$  : Cottages are warm. = F  
 $s$  : Houses were ugly. = F

$$\begin{aligned} &= \neg(p \vee q) \wedge \neg(r \vee s) \\ &= \neg(F \vee F) \wedge \neg(F \vee F) \\ &= \neg(F) \wedge \neg(F) \\ &= T \wedge T \\ &= T \end{aligned}$$

Q.5

$$a) (p \wedge (p \rightarrow q)) \rightarrow q.$$



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P	Q	$P \rightarrow Q$	$P \wedge (P \rightarrow Q)$	$T \rightarrow Q$
F	F	F	F	T
F	T	T	F	T
T	F	F	F	T
T	T	T	T	T

$\therefore$  The given formula is tautology.

c)  $(P \rightarrow Q) \wedge (Q \rightarrow R) \rightarrow (P \rightarrow R)$

P	Q	R	$P \rightarrow Q$	$Q \rightarrow R$	$P \rightarrow R$	$(P \rightarrow Q) \wedge (Q \rightarrow R)$	$(P \rightarrow Q) \wedge (Q \rightarrow R) \rightarrow (P \rightarrow R)$
T	T	T	T	T	T	T	T
T	T	F	T	F	F	F	T
T	F	T	F	T	T	F	T
T	F	F	F	T	F	F	T
F	T	T	T	T	T	T	T
F	T	F	T	F	T	F	T
F	F	T	T	T	T	T	T
F	F	F	T	T	T	T	T

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

T	T
F	T
F	T
F	T
T	T
F	T
T	T
T	T

$\therefore$  The given formula is tautology