Student ID : 1705071

Verifying Student ID : 1705028

Chapter : 1

Section : 1

Exercise : 41

Explain, without using a truth table, why $(p \vee q \vee r) \wedge (\neg p \vee \neg q \vee \neg r)$ is true when at least one of p, q and r is true and at least one is false, but is false when all three have the same truth value.

Answer

when all three have the same value →

let $b = p \vee q \vee r$ $\quad s = \neg p \vee \neg q \vee \neg r$

if p, q, r is T. $\quad b = T \quad s = F$.

thus, $\boxed{b \wedge s \equiv F}$

If at least one of them is T or F.

both b and s will amount to T.

thus → $\boxed{b \wedge s \equiv T}$.

let $p \equiv T$ and $r \equiv F$.

$\therefore b \equiv T \quad s \equiv T$.

$\therefore b \wedge s \equiv T$.

So, for $(p \vee q \vee r) \wedge (\neg p \vee \neg q \vee \neg r)$ to be true at least one of the variables have to be true or false.