**1.3 Propositional Equivalences**

**Q14. Show that (p ∨ q) ∧ (¬p ∨ r) → (q ∨ r) is a tautology:**

q ∨ r will be always true except when q and r are both false.

But if q and r are both false, then one of p ∨ q or ¬p ∨ r will be false,

So in this case the hypothesis (p ∨ q) ∧ (¬p ∨ r) will be false.

An conditional statement in which the conclusion is true or the hypothesis is false is **true**, and that completes the argument

**Q36. How many of the disjunctions p ∨¬q, ¬p ∨ q, q ∨ r, q ∨¬r, and ¬q ∨¬r can be made simultaneously true by an assignment of truth values to p, q, and r ?**

We assume that p and q are true to make first and second expressions true.

Third and fourth expressions will be also true .

Then we need to set r to be false to make last expression true

So these disjunctions will be true if p, q are T and r is F.

**Q38. Show that the negation of an unsatisfiable compound proposition is a tautology and the negation of a compound proposition that is a tautology is unsatisfiable ?**

An unsatisfiable compound proposition is one that is true for no assignment of truth values to its variables

So it is false for every assignment of truth values,

And its negation is true for every assignment of truth values. which is a **tautology.**

Conversely, the negation of a tautology (a proposition that is true for every assignment of truth values to its variables)

will be false for every assignment of truth values, which is **unsatisfiable.**