PROBLEM:

41. Explain, without using a truth table, why (p ∨ q ∨r) ∧(¬p ∨ ¬q ∨ ¬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 variables have the same truth value.

ANSWER:

The first clause (p ∨ q ∨ r) is TRUE if and only if at least one of p,q,r is TRUE.

The second clause (¬p ∨ ¬q ∨ ¬ r) is TRUE if and only if at least one of the three variables is FALSE.

So ,both clauses are TRUE and therefore the entire statement is TRUE, if and only if at least one T and one F among the truth values of the variables.

So,if all of three variables have same values (can be TRUE or FALSE),then the whole statement will be FALSE.

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