

Exercise No. 01:

We consider the formulas $F1 = p \wedge (\neg q \Rightarrow (q \Rightarrow p))$ and $F2 = (p \vee q) \Leftrightarrow (\neg p \Rightarrow \neg q)$.

Let I be an interpretation.

- 1- Compute the truth tables of F1 and F2
- 2- Determine the set of models of the formula F2.
- 3- Determine, if possible, the truth values of F1 and F2 in each of the following four cases:
 - (a) Knowing $I(p) = 0$ and $I(q) = 1$;
 - (b) Knowing $I(p) = 0$;
 - (c) Knowing $I(q) = 1$;
 - (d) Knowing nothing about $I(p)$ and $I(q)$.

Exercise No. 02:

Check that the following formulas are tautologies:

- $F1 = \neg(p \Rightarrow q) \Rightarrow \neg q$
 - $F2 = (p \Rightarrow q) \vee (q \Rightarrow p)$
1. Using equivalent transformations.
 2. Using truth table.

Exercise No. 03:

Check the following logical equivalents using truth table.

1. $F1 = p \vee (p \wedge q)$ et $F2 = p$
2. $F3 = p \wedge (q \vee r)$ and $F4 = (p \wedge q) \vee (p \wedge r)$
3. $F5 = (p \Rightarrow q) \Rightarrow r$ and $F6 = p \Rightarrow (q \Rightarrow r)$

Exercise No. 04:

I. Convert the following formulas into CNF & DNF using truth table:

- $F1 = (p \wedge q) \Leftrightarrow (\neg p \Rightarrow q)$
- $F2 = (\neg p \Rightarrow q) \Rightarrow (q \Rightarrow \neg r)$
- $F3 = \neg(\neg p \vee q) \vee (p \Rightarrow r)$

II. Convert the following formulas into CNF using equivalent transformations.

- $F4 = \neg(\neg p \vee q) \wedge (\neg r \Rightarrow \neg s)$
- $F5 = \neg(\neg p \wedge \neg q) \wedge (\neg p \vee \neg q)$
- $F6 = (p \wedge \neg q) \Rightarrow \neg r$

Exercise No. 05:

Use the truth table method to verify whether the following formulas are valid, satisfiable, or unsatisfiable.

- $F1 = (p \Leftrightarrow q) \Rightarrow ((p \Rightarrow q) \vee (q \Rightarrow p))$
- $F2 = (p \Rightarrow q) \Rightarrow (q \vee \neg p)$
- $F3 = p \wedge \neg(q \vee p)$
- $F4 = (p \wedge q) \wedge \neg p$
- $F5 = (p \Rightarrow \neg q) \wedge q$