

Esercitazione sul calcolo proposizionale

Calcolare la matrice logica delle seguenti proposizioni composte (**espressioni booleane**)

$$1) (p \wedge q) \vee r$$

$$2) (p \vee \bar{q}) \vee r$$

$$3) p \rightarrow \bar{q}$$

$$4) \bar{p} \leftrightarrow \bar{q}$$

$$5) (p \vee \bar{q}) \rightarrow r$$

$$6) (p \vee \bar{q}) \rightarrow p$$

Verificare le seguenti equivalenze

$$7) p \rightarrow q \equiv \overline{p \wedge \bar{q}}$$

$$8) p \wedge q \equiv \overline{p \rightarrow \bar{q}}$$

Verificare le seguenti tautologie

$$9) \overline{p \wedge q} \vee p$$

$$10) \left((p \vee q) \rightarrow r \right) \vee \bar{r}$$

$$11) p \rightarrow (q \rightarrow p)$$

Verificare le seguenti equivalenze

$$12) \overline{p \rightarrow q} \equiv p \wedge \bar{q}$$

$$13) p \rightarrow q \equiv \bar{q} \rightarrow \bar{p}$$

$$14) \overline{p \wedge q} \equiv \bar{p} \vee \bar{q}$$

$$15) \overline{p \vee q} \equiv \bar{p} \wedge \bar{q}$$

Soluzioni sintetiche

Esercizi 1→10

| 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| V | V | F | V | V | V | V | V | V | V |
| V | V | V | F | F | V | F | F | V | V |
| V | V | V | F | V | V | V | F | V | V |
| F | V | V | V | F | F | V | F | V | V |
| V | V | | | V | | | | | V |
| F | F | | | V | | | | | V |
| V | V | | | V | | | | | V |
| F | V | | | F | | | | | V |

Soluzioni analitiche

Esercizio 01

$$(p \wedge q) \vee r$$

| p | q | r | $p \wedge q$ | $(p \wedge q) \vee r$ |
|----------|----------|----------|--------------------------------|---|
| V | V | V | V | V |
| V | V | F | V | V |
| V | F | V | F | V |
| V | F | F | F | F |
| F | V | V | F | V |
| F | V | F | F | F |
| F | F | V | F | V |
| F | F | F | F | F |

Esercizio 02

$$(p \vee \neg q) \vee r$$

| p | q | r | $\neg q$ | $p \vee \neg q$ | $(p \vee \neg q) \vee r$ |
|----------|----------|----------|----------------------------|-----------------------------------|--|
| V | V | V | F | V | V |
| V | V | F | F | V | V |
| V | F | V | V | V | V |
| V | F | F | V | V | V |
| F | V | V | F | F | V |
| F | V | F | F | F | F |
| F | F | V | V | V | V |
| F | F | F | V | V | V |

Esercizio 03

$$p \rightarrow \neg q$$

| p | q | $\neg q$ | $p \rightarrow \neg q$ |
|----------|----------|----------------------------|--|
| V | V | F | F |
| V | F | V | V |
| F | V | F | V |
| F | F | V | V |

Esercizio 04

$$\neg p \leftrightarrow \neg q$$

| p | q | $\neg p$ | $\neg q$ | $\neg p \leftrightarrow \neg q$ |
|----------|----------|----------------------------|----------------------------|---|
| V | V | F | F | V |
| V | F | F | V | F |
| F | V | V | F | F |
| F | F | V | V | V |

Esercizio 05

$$(p \vee \neg q) \rightarrow r$$

| p | q | r | \neg q | $p \vee \neg q$ | $(p \vee \neg q) \rightarrow r$ |
|----------|----------|----------|--------------------------------|-----------------------------------|---|
| V | V | V | F | V | V |
| V | V | F | F | V | F |
| V | F | V | V | V | V |
| V | F | F | V | V | F |
| F | V | V | F | F | V |
| F | V | F | F | F | V |
| F | F | V | V | V | V |
| F | F | F | V | V | F |

Esercizio 06

$$(p \vee \neg q) \rightarrow p$$

| p | q | \neg q | $p \vee \neg q$ | $(p \vee \neg q) \rightarrow p$ |
|----------|----------|--------------------------------|-----------------------------------|---|
| V | V | F | V | V |
| V | F | V | V | V |
| F | V | F | F | V |
| F | F | V | V | F |

Esercizio 7

$$\neg (p \wedge \neg q) \equiv p \rightarrow q$$

| p | q | $\neg q$ | $p \wedge \neg q$ | $\neg (p \wedge \neg q)$ | $p \rightarrow q$ |
|----------|----------|----------------------------|-------------------------------------|--|-------------------------------------|
| V | V | F | F | V | V |
| V | F | V | V | F | F |
| F | V | F | F | V | V |
| F | F | V | F | V | V |

Esercizio 8

$$\neg(p \rightarrow \neg q) \equiv p \wedge q$$

| p | q | $\neg q$ | $p \rightarrow \neg q$ | $\neg(p \rightarrow \neg q)$ | $p \wedge q$ |
|----------|----------|----------------------------|--|--|--------------------------------|
| V | V | F | F | V | V |
| V | F | V | V | F | F |
| F | V | F | V | F | F |
| F | F | V | V | F | F |

Esercizio 9-Tautologia

$$\neg(p \wedge q) \vee p$$

| p | q | p ∧ q | ¬(p ∧ q) | ¬(p ∧ q) ∨ p |
|----------|----------|--------------|-----------------|---------------------|
| V | V | V | F | V |
| V | F | F | V | V |
| F | V | F | V | V |
| F | F | F | V | V |

Esercizio 10-Tautologia

$$((p \vee q) \rightarrow r) \vee \neg r$$

| p | q | r | ¬r | p ∨ q | (p ∨ q) → r | ((p ∨ q) → r) ∨ ¬r |
|----------|----------|----------|-----------|------------------|------------------------|---------------------------|
| V | V | V | F | V | V | V |
| V | V | F | V | V | F | V |
| V | F | V | F | V | V | V |
| V | F | F | V | V | F | V |
| F | V | V | F | V | V | V |
| F | V | F | V | V | F | V |
| F | F | V | F | F | V | V |
| F | F | F | V | F | V | V |

Esercizio 11-Tautologia

$$p \rightarrow (q \rightarrow p)$$

| p | q | p→q | q→p | p→(q →p) |
|----------|----------|------------|------------|-----------------|
| V | V | V | V | V |
| V | F | F | V | V |
| F | V | V | F | V |
| F | F | V | V | V |

