



# CS & IT ENGINEERING

Mathematical Logic

DPP 02  
Discussion Notes

[MCQ]

1. Which of the following is/are logical equivalence?

- I.  $\sim(p \rightarrow q)$
- II.  $(p \rightarrow r) \wedge (q \rightarrow r)$
- III.  $p \wedge \sim q$
- IV.  $(p \vee q) \rightarrow r$

- (a) I and II  
 (c) II and IV

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

$$\equiv p \wedge \neg q$$

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

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

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

Ans: (b, c)

[MCQ]

2. Consider the following statement

$$\begin{array}{c} (P \rightarrow Q) \wedge (P \rightarrow R) \\ \downarrow \\ (\neg P \rightarrow \neg Q) \wedge (\neg P \rightarrow \neg R) \end{array}$$

$$S_1: \quad (\underline{P} \rightarrow Q) \wedge (\underline{P} \rightarrow R)$$

$$S_2: \quad P \rightarrow (Q \wedge R)$$

Which of the following is True?

$$(P \rightarrow Q) \wedge (P \rightarrow R)$$

$$P \rightarrow (Q \wedge R)$$

$$(\boxed{P \rightarrow Q}) \wedge (\boxed{P \rightarrow R})$$

$$\begin{array}{c|c} T & F \\ \hline (\neg P \rightarrow \neg Q) & T \\ (\neg P \rightarrow \neg R) & F \end{array}$$

$$\boxed{F \wedge} \quad \text{False}$$

- (a)  $S_1$  is tautology ( $\neq$ )
- (b)  $S_1$  is contingency ( $T$ )
- (c)  $S_1$  is logically equivalence to  $S_2$  ( $\equiv$ )
- (d) None of these

[MCQ]

 $(\alpha \equiv \beta)$ 

3. Which of the following is logically equivalence?

Assum: logically  
eq.

- (a)  $(p \rightarrow r) \vee (q \rightarrow r)$
- (b)  $(p \leftrightarrow q) \vee (q \rightarrow r)$
- (c)  $(p \wedge q) \rightarrow r$
- (d)  $(p \leftrightarrow r) \wedge (q \leftrightarrow r)$

$$(p \leftrightarrow q) \vee (q \rightarrow r) \equiv (p \leftrightarrow r) \wedge (q \leftrightarrow r)$$

$(\leftrightarrow F) \uparrow$        $(F \rightarrow F) \uparrow$

$$(\leftrightarrow F) \wedge (\top \leftrightarrow F)$$

$$\begin{aligned} & (p \rightarrow r) \vee (q \rightarrow r) & \neg(p \wedge q) \vee r \\ & (\neg p \vee r) \vee (\neg q \vee r) & (p \wedge q) \rightarrow r \\ & (\neg p \vee \neg q) \vee r & \end{aligned}$$

[MCQ]

4. Consider the following statement

$$S_1: \sim(p \leftrightarrow q)$$

$$S_2: p \leftrightarrow \sim q$$

Which of the following is correct?

(a)  $S_1$  is tautology(b)  $S_2$  is contradiction(c)  $S_1$  is equivalence to  $S_2$ 

(d) None of these

$$\begin{array}{c} A \\ \neg(p \leftrightarrow q) \\ \neg(\top \leftrightarrow \top) \\ \equiv F \end{array}$$

$$\begin{array}{c} B \\ p \leftrightarrow \neg q \\ \top \leftrightarrow F \equiv F \end{array}$$

$$\begin{array}{ccccccccc} P & Q & A & B & P & Q & F \leftrightarrow F \\ \top & \top & \top & \top & \top & \top & \top \\ \top & \text{F} & \text{F} & \text{F} & \text{F} & \text{F} & \text{F} \\ \top & \text{F} & \text{F} & \text{F} & \text{F} & \text{F} & \text{F} \\ \text{F} & \top & \text{F} & \text{F} & \text{F} & \text{F} & \top \\ \text{F} & \text{F} & \text{F} & \text{F} & \text{F} & \text{F} & \text{T} \\ \text{F} & \text{F} & \text{F} & \text{F} & \text{F} & \text{F} & \text{T} \\ \neg(p \leftrightarrow q) & \equiv T & \neg(\top \leftrightarrow \top) & \equiv T & \neg(\text{F} \leftrightarrow \text{T}) & \equiv T & \neg(\text{F}) \\ \neg(\top \leftrightarrow \top) & \equiv T & \neg(\text{F} \leftrightarrow \text{T}) & \equiv T & \neg(\text{F}) & \equiv T & \neg(\text{F}) \\ \equiv T & & \equiv T & & \equiv T & & \equiv T \end{array}$$

[MCQ]

5. Consider the following statement

$$S_1: \sim(p \vee (\sim p \wedge q))$$

$$S_2: \sim p \wedge \sim q$$

Which of the following is correct?

(a)  $S_1$  is tautology(b)  $S_2$  is contradiction(c)  $S_1$  is equivalence to  $S_2$  ✓(d)  $S_1$  is not equivalence to  $S_2$ 

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

$$\sim p \wedge \sim(\sim p \wedge q)$$

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

$$(\underline{\sim p} \wedge p) \vee (\sim p \wedge \sim q)$$

$$F \vee (\sim p \wedge \sim q) \equiv \sim p \wedge \sim q$$

