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TAUTOLOGY AND CONTRADICTION :

(i) **Tautology** : A statement is said to be a tautology if it is true for all logical possibilities i.e. its truth value always T. it is denoted by t.

(ii) **Contradiction** : A statement is a contradiction if it is false for all logical possibilities. i.e. its truth value always F. It is denoted by c.

(Fallacy)

9) Which one of the following statements is not a tautology? (2019 Main, 8 April II)

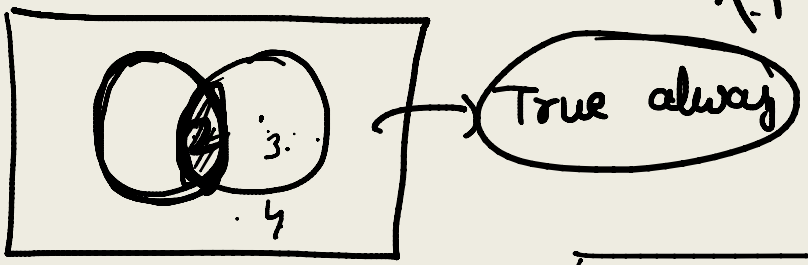
(a) $(p \wedge q) \rightarrow (\sim p) \vee q$

(b) $(p \wedge q) \rightarrow p$

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

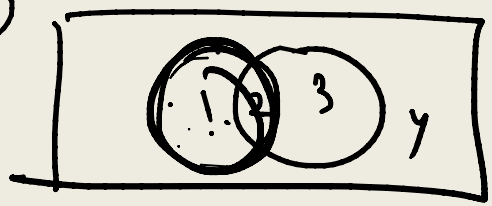
(d) $(p \vee q) \rightarrow (p \vee (\sim q))$

a)

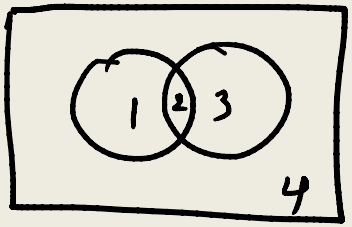


True always

b)



c).



$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

Distributive laws : (a) $p \wedge (q \vee r) \equiv (p \wedge q) \vee (p \wedge r)$

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

De Morgan Laws : (a) $\sim(p \wedge q) \equiv \sim p \vee \sim q$

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

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

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

NEGATION OF COMPOUND STATEMENTS :

If p and q are two statements then

(i) **Negation of conjunction** (AND) : $\sim(p \wedge q) \equiv \sim p \vee \sim q$

(ii) **Negation of disjunction** (OR) : $\sim(p \vee q) \equiv \sim p \wedge \sim q$

(iii) **Negation of conditional** : $\sim(p \to q) \equiv p \wedge \sim q$

(iv) **Negation of biconditional** : $\sim(p \leftrightarrow q) \equiv (p \wedge \sim q) \vee (q \wedge \sim p)$

$p \leftrightarrow q \equiv \sim[(p \to q) \wedge (q \to p)]$

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

$p \to q \equiv \sim p \vee q$

$\sim(p \to q) \equiv \sim(\sim p \vee q)$

$\to p \wedge \sim q$

1. The boolean expression $\sim(p \Rightarrow (\sim q))$ is equivalent to
(2019 Main, 12 April II)

(a) $p \wedge q$
(b) $q \Rightarrow \sim p$
(c) $p \vee q$
(d) $(\sim p) \Rightarrow q$

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

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

$(p \wedge q)$

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

9) The negation of the boolean expression $\sim s \vee (\sim r \wedge s)$ is equivalent to (2019 Main, 10 April II)

(a) $s \wedge r$ (b) $\sim s \wedge \sim r$

(c) $s \vee r$ (d) r

$\sim s \vee (\sim r \wedge s)$

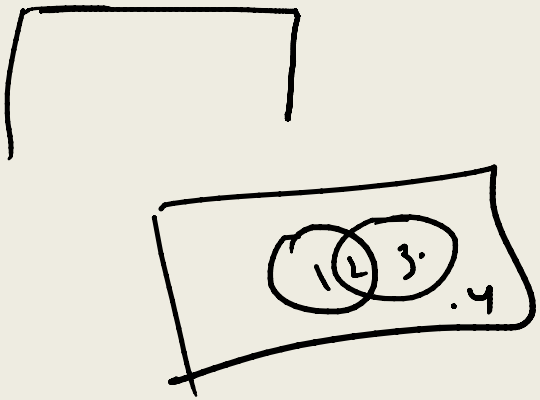
$\sim s \vee (\sim r \wedge s)$

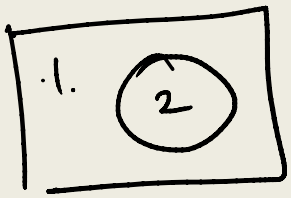
$(\sim s \vee \sim r) \wedge (\sim s \vee s)$

$(\sim s \vee \sim r) \wedge t$

$(\sim s \vee \sim r)$

$s \wedge r$





For any two statements p and q, the negation of the expression $p \vee (\sim p \wedge q)$ is **(2019 Main, 9 April I)**

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

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

(c) $p \wedge q$

(d) $p \leftrightarrow q$

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

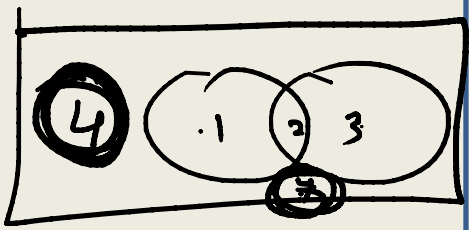
$\rightarrow \sim p \wedge \sim (\sim p \wedge q)$

$\rightarrow \sim p \wedge [p \vee \sim q]$

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

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

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



If p and q are two statements then

Let $p \Rightarrow q$ Then

(i) (Contrapositive of $p \Rightarrow q$) is $(\sim q \Rightarrow \sim p)$

(ii) (Contradiction of $p \Rightarrow q$) is $(q \Rightarrow \sim p)$

(iii) (Converse of $p \Rightarrow q$) is $(q \Rightarrow p)$

$p \rightarrow q$

(i) $\sim q \rightarrow \sim p$

Write the contrapositive of the following statement : "If Mohan is poet, then he is poor"

p : Mohan is poet

q : he is poor

If $\sim q \rightarrow \sim p$

(If Mohan is not poor) then (He is not a poet)

The contrapositive of the statement "If you are born in India, then you are a citizen of India", is

(2019 Main, 8 April I)

(a) If you are not a citizen of India, then you are not born in India.

(b) If you are a citizen of India, then you are born in India.

(c) If you are born in India, then you are not a citizen of India.

(d) If you are not born in India, then you are not a citizen of India.

$\sim q \longrightarrow \sim p$