Mathematical Reasoning

Question1

The compound statement $(\sim(P \wedge Q)) \vee ((\sim P) \wedge Q) \Rightarrow ((\sim P) \wedge (\sim Q))$ is equivalent to
[24-Jan-2023 Shift 1]

Options:

A. $((\sim P) \vee Q) \wedge ((\sim Q) \vee P)$

B. $(\sim Q) \vee P$

C. $((\sim P) \vee Q) \wedge (\sim Q)$

D. $(\sim P) \vee Q$

Answer: A

Solution:

Solution:
Let $r = (\sim(P \wedge Q)) \vee ((\sim P) \wedge Q)$; $s = ((\sim P) \wedge (\sim Q))$
Option (A) : $((\sim P) \vee Q) \wedge ((\sim Q) \vee P)$
is equivalent to (not of only P) ∧ (not of only Q)
= (Both P, Q) and (neither P nor Q)

Question2

Let p and q be two statements.
Then $\sim(p \wedge (p \Rightarrow \sim q))$ is equivalent to
[24-Jan-2023 Shift 2]

Options:

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

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

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

D. $p \vee (p \wedge q)$

Answer: C

Solution:

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

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

Question3

The statement $(p \wedge (\sim q)) \Rightarrow (p \Rightarrow (\sim q))$ is [25-Jan-2023 Shift 1]

Options:

A. equivalent to $(\sim p) \vee (\sim q)$

B. a tautology

C. equivalent to $p \vee q$

D. a contradiction

Answer: B

Solution:

Solution:
$(p \wedge \sim q) \rightarrow (p \rightarrow \sim q)$
$\equiv (\sim(p \wedge \sim q)) \vee (\sim p \vee \sim q)$
$\equiv (\sim p \vee q) \vee (\sim p \vee \sim q)$
$\equiv \sim p \vee t \equiv t$

Question4

The statement $(p \wedge (\sim q)) \Rightarrow (p \Rightarrow (\sim q))$ is [25-Jan-2023 Shift 1]

Options:

A. equivalent to $(\sim p) \vee (\sim q)$

B. a tautology

C. equivalent to $p \vee q$

D. a contradiction

Answer: B

Solution:

Solution:
$(p \wedge \sim q) \rightarrow (p \rightarrow \sim q)$
$\equiv (\sim(p \wedge \sim q)) \vee (\sim p \vee \sim q)$
$\equiv (\sim p \vee q) \vee (\sim p \vee \sim q)$
$\equiv \sim p \vee t \equiv t$

Question5

Let Δ, ∇ ∈ {∧, ∨} be such that (p → q) Δ (p∇q) is a tautology. Then [25-Jan-2023 Shift 2]

Options:

A. Δ = ∧, ∇ = ∨

B. Δ = ∨, ∇ = ∧

C. Δ = ∨, ∇ = ∨

D. Δ = ∧, ∇ = ∧

Answer: C

Solution:

Solution:
Given(p → q) Δ (p∇q)
Option I Δ = ∧, ∇ = ∨
Option 2 Δ = ∨, ∇ = ∧
Option 3 Δ = ∨, ∇ = ∨
Hence, it is tautology.
Option 4 Δ = ∧, ∇ = ∧

Question6

If p, q and r are three propositions, then which of the following combination of truth values of p, q and r makes the logical expression {(p ∨ q) ∧ ((~p) ∨ r)} → ((~q) ∨ r) false ? [29-Jan-2023 Shift 1]

Options:

A. p = T, q = F, r = T

B. p = T, q = T, r = F

C. p = F, q = T, r = F

D. p = T, q = F, r = F

Answer: C

Solution:

Solution:
Option (3) (p ∨ q) ∧ (~q ∨ r) → (~p ∨ r) will be False.

Question7

The statement B ⇒ ((~A) ∨ B) is equivalent to : [29-Jan-2023 Shift 2]

Options:

A. B ⇒ (A ⇒ B)

B. A ⇒ (A ⇔ B)

C. A ⇒ ((~A) ⇒ B)

D. B ⇒ ((~A) ⇒ B)

Answer: 0

Solution:

Solution:

A	B	~A	$\sim A \vee B$	B ⇒ ((~A) ∨ B)
T	T	F	T	T
T	F	F	F	T
F	T	T	T	T
F	F	T	T	T

$A \Rightarrow B$	~A ⇒ B	$B \Rightarrow (A \Rightarrow B)$	$A \Rightarrow ((\sim A) = B)$	B ⇒ ((~A) ⇒ B)
T	T	T	T	T
F	T	T	T	T
T	T	T	T	T
T	F	T	T	T

Question8

Among the statements:
(S1) $((p \vee q) \Rightarrow r) \Leftrightarrow (p \Rightarrow r)$
(S2) $((p \vee q) \Rightarrow r) \Leftrightarrow ((p \Rightarrow r) \vee (q \Rightarrow r))$
[30-Jan-2023 Shift 1]

Options:

A. Only (S1) is a tautology

B. Neither (S1) nor (S2) is a tautology

C. Only (S2) is a tautology

D. Both (S1) and (S2) are tautologies

Answer: B

Solution:

Solution:
$S_1 \equiv ((p \vee q) \Rightarrow r) \Leftrightarrow (p \Rightarrow r)$
$S_2 \equiv (p \vee q) \Rightarrow r \Leftrightarrow ((p \Rightarrow r) \vee (q \Rightarrow r))$
S2 → not a tautology

Question9

Consider the following statements:
P : I have fever
Q : I will not take medicine
R : I will take rest
The statement "If I have fever, then I will take medicine and I will take rest" is equivalent to:
[30-Jan-2023 Shift 2]

Options:

A. $((\sim P) \vee \sim Q) \wedge ((\sim P) \vee R)$

B. $((\sim P) \vee \sim Q) \wedge ((\sim P) \vee \sim R)$

C. $(P \vee Q) \wedge ((\sim P) \vee R)$

D. $(P \vee \sim Q) \wedge (P \vee \sim R)$

Answer: A

Solution:

Solution:
$P \rightarrow (\sim Q \wedge R)$

~ P ∨ (~Q ∧ R)
(~P ∨ ~Q) ∧ (~P ∨ R)

Question10

(S1)(p ⇒ q) ∨ (p ∧ (~q)) is a tautology
(S2)((~p) ⇒ (~q)) ∧ ((~p) ∨ q) is a Contradiction. Then
[31-Jan-2023 Shift 1]

Options:

A. only (S2) is correct

B. both (S1) and (S2) are correct

C. both (S1) and (S2) are wrong

D. only (S1) is correct

Answer: D

Solution:

p	q	p ⇒ q	~q	p ∧ ~q	(p = q) ∨ (p ∧ ~q)
T	T	T	F	F	T
T	F	F	T	T	T
F	T	T	F	F	T
F	F	T	T	F	T

~p	~q	~p⇒ ~ q	~p ∨ q	((~p) ⇒ (~q)) ∧ (~p) ∨ q)
F	F	T	T	T
F	T	T	F	F
T	F	F	T	F
T	T	T	T	T

Question11

The number of values of r ∈ {p, q, ~p, ~q} for which ((p ∧ q) ⇒ (r ∨ q)) ∧ ((p ∧ r) ⇒ q) is a tautology, is:
[31-Jan-2023 Shift 2]

Options:

A. 3

B. 2

C. 1

D. 4

Answer: B

Solution:

$((p \wedge q) \Rightarrow (r \vee q)) \wedge ((p \wedge r) \Rightarrow q)$
We know, $p \Rightarrow q$ is equivalent to
$\sim p \vee q$
$(\sim(p \wedge q) \vee (r \vee q)) \wedge (\sim(p \wedge r)) \vee q))$
$\Rightarrow (\sim p \vee \sim q \vee r \vee q) \wedge (\sim p \vee \sim r \vee q)$
$\Rightarrow (\sim p \vee r \vee t) \wedge (\sim p \vee \sim r \vee q)$
$\Rightarrow (t) \wedge (\sim p \vee \sim r \vee q)$
For this to be tautology, $(\sim p \vee \sim r \vee q)$ must be always true which follows for $r = \sim p$ or $r = q$.

Question12

The negation of the expression q ∨ ((~q) ∧ p) is equivalent to
[1-Feb-2023 Shift 1]

Options:

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

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

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

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

Answer: A

Solution:

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

Question13

Which of the following statements is a tautology ?
[1-Feb-2023 Shift 2]

Options:

A. $p \rightarrow (p \Lambda (p \rightarrow q))$

B. $(p \Lambda q) \rightarrow (\sim(p) \rightarrow q))$

C. $(p \Lambda (p \rightarrow q)) \rightarrow \sim q$

D. $p V (p \Lambda q)$

Answer: B

Solution:

Solution:
(i)p → (pΛ(p → q))
(~p)V(pΛ(~pVq))
(~p)V(fV(pΛq))
~ pV(pΛq) = (~pVp)Λ(~pVq)
= ~ pVq
(ii) (pΛq) → (~p → q)
~(pΛq)V(p ∨ q) = t
{a, b, d }V {a, b, c} = V
Tautology
(iii) (pΛ(p → q))→ ~ q
~(pΛ(~pVq))V ~ q = ~ (pΛq)V ~ q = ~ pV ~ q
Not tantology
(iv) pV (pΛq) = p
Not tautology.

Question14

Statement (P ⇒ Q) ∧ (R ⇒ Q) is logically equivalent to:
[6-Apr-2023 shift 1]

Options:

A. (P ∨ R) ⇒ Q

B. (P ⇒ R) ∨ (Q ⇒ R)

C. (P ⇒ R) ∧ (Q ⇒ R)

D. (P ∧ R) ⇒ Q

Answer: A

Solution:

Solution:
(P ⇒ Q) ∧ (R ⇒ Q)
We known that P ⇒ Q≡ ~ P ∨ Q
⇒ (~P ∨ Q) ∧ (~R ∨ Q)
⇒ (~P ∧ ~R) ∨ Q
⇒ ~ (P ∨ R) ∨ Q
⇒ (P ∨ R) ⇒ Q

Question15

Among the statements :
(S1) : (p ⇒ q) ∨ ((~p) ∧ q) is a tautology
(S2) : (q ⇒ p) ⇒ ((~p) ∧ q) is a contradiction
[6-Apr-2023 shift 2]

Options:

A. only (S2) is True

B. only (S1) is True

C. neigher (S1) and (S2) is True

D. both (S1) and (S2) are True

Answer: C

Solution:

S1

P	Q	$\sim p$	$\sim p \wedge q$	$p \Rightarrow q$	$(p \Rightarrow q) \vee (\sim p \wedge q)$
T	T	F	F	T	T
T	F	F	F	F	T
F	T	T	T	T	T
F	F	T	F	T	T

S2

P	Q	$q \Rightarrow p$	$\sim p$	$(\sim p) \wedge q$	$(q \Rightarrow p) \vee (\sim p \wedge q)$
T	T	T	F	F	F
T	F	T	F	F	F
F	T	F	T	T	T
F	F	T	T	F	T

Ans. Option 3

Question16

Negation of $(p \rightarrow q) \rightarrow (q \rightarrow p)$ is
[8-Apr-2023 shift 1]

Options:

A. $(-q) \wedge p$

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

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

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

Answer: D

Solution:

Solution:
$(p \rightarrow q) \rightarrow (q \rightarrow p)$
$\sim [\sim p \rightarrow q \wedge q \rightarrow p]$
$\Rightarrow p \rightarrow q \wedge \sim q \rightarrow p$
$\Rightarrow \sim p \vee q \wedge q \wedge \sim p$
$\Rightarrow q \wedge \sim p.$

Question17

The negation of $(p \wedge (\sim q)) \vee (\sim p)$ is equivalent to
[8-Apr-2023 shift 2]

Options:

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

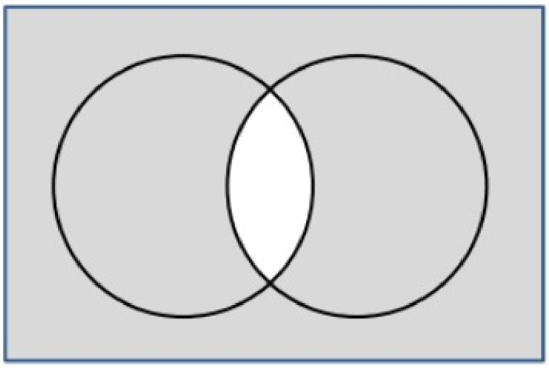
B. $p \wedge (q \wedge (\sim p))$

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

D. $p \wedge q$

Answer: D

Solution:



Question18

The negation of the statement :
(p ∨ q) ∧ (q ∨ (~r)) is
[10-Apr-2023 shift 1]

Options:

A. ((~p) ∨ r)) ∧ (~q)

B. ((~ p) ∨(~q)) ∧ (~r)

C. ((~p) ∨ (~q)) ∨ (~r)

D. (p ∨ r) ∧ (~q)

Answer: A

Solution:

(p ∨ q) ∧ (q ∨ (~r))
~ [(p ∨ q) ∧ (q ∨ (~r))]
= ~ (p ∨ q) ∧ (~q ∧ r)
= (~p ∧ ~q) ∨ (~q ∧ r)
= (~p ∨ r) ∧ (~q)

Question19

The statement ~[pV(~(p ∧ q))] is equivalent to
[10-Apr-2023 shift 2]

Options:

A. (~(p ∧ q)) ∧ q

B. ~(p ∨ q)

C. ~(p ∧ q)

D. (p ∧ q) ∧ (~p)

Answer: D

Solution:

Solution:
~ [pv(~(p ∧ q))]
~ p ∧ (p ∧ q)

Question20

The number of ordered triplets of the truth values of p, q and r such that the truth value of the statement (p ∨ q) ∧ (p ∨ r) ⇒ (q ∨ r) is True, is equal to ________.
[11-Apr-2023 shift 1]

Answer: 7

Solution:

p	q	r	Pvq	Pvr	(pvq) ∧ (pvr)	qvr	(pvq) ∧ (pvr) → qvr
T	T	T	T	T	T	T	T
T	T	F	T	T	T	T	T
T	F	T	T	T	T	T	T
T	F	F	T	T	T	F	F
F	T	T	T	T	T	T	T
F	T	F	T	F	F	T	T
F	F	T	F	T	F	T	T
F	F	F	F	F	F	F	T

Hence total no of ordered triplets are 7

Question21

The converse of ((~p) ∧ q) ⇒ r is

[11-Apr-2023 shift 2]

Options:

A. $(p \vee (\sim q)) \Rightarrow (\sim r)$

B. $((\sim p) \vee q) \Rightarrow r$

C. $(\sim r) \Rightarrow ((\sim p) \wedge q)$

D. $(\sim r) \Rightarrow p \wedge q$

Answer: A

Solution:

Solution:
$((-P) \wedge 2) \Rightarrow r$
Converse ....
$\sim ((\sim P) \wedge q) \Rightarrow (\sim r)$
$(P \vee (\sim q)) \Rightarrow (\sim r)$

Question22

Among the two statements (S1): $(p \Rightarrow q) \wedge (p \wedge (\sim q))$ is a contradiction and (S2) : $(p \wedge q) \vee ((\sim p) \wedge q) \vee (p \wedge (\sim q)) \vee ((\sim p) \wedge (\sim q))$ is a tautology [12-Apr-2023 shift 1]

Options:

A. only (S2) is true

B. only (S1) is true

C. both are true

D. both are false

Answer: C

Solution:

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

P	Q	$p \to q$	$p \wedge (\sim q)$	S1
T	T	T	F	F
T	F	F	T	F
F	T	T	F	F
F	F	T	F	F

$\Rightarrow S_1$ is Contradiction

S_2

p	q	$p \wedge q$	$(p \wedge \sim q)$	$(p \wedge \sim q)$	$(\sim p) \wedge (\sim p)$	S_2
T	T	T	F	F	F	T
T	F	F	F	T	F	T
F	T	F	T	F	F	T
F	F	F	F	F	T	T

S_2 is tautology

Question23

The negation of the statement ((A ∧ (B ∨ C)) ⇒ (A ∨ B)) ⇒ A is [13-Apr-2023 shift 1]

Options:

A. equivalent to B ∨ ~C

B. a fallacy

C. equivalent to ~C

D. equivalent to ~ A

Answer: D

Solution:

Solution:
p : ((A ∧ (B ∨ C)) ⇒ (A ∨ B)) ⇒ A
[~(A ∧ (B ∨ C)) ∨ (A ∨ B)] ⇒ A
[(A ∧ (B ∨ C)) ∧ ~(A ∨ B)] ∨ A
(f ∨ A) = A
~ p≡ ~ A

Question24

The statement (p ∧ (~q)) ∨ ((~p) ∧ q) ∨ ((~p) ∧ (~q)) is equivalent to [13-Apr-2023 shift 2]

Options:

A. (~p) ∨ (~q)

B. (~p) ∧ (~q)

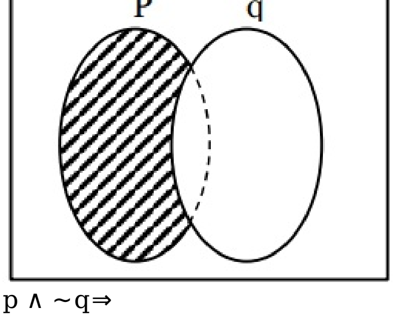
C. p ∨ (~q)

D. p ∨ q

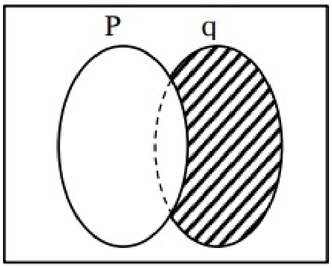
Answer: A

Solution:

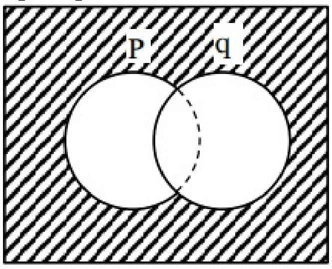
Solution:
(p ∧ ~q) ∨ (~p ∧ q) ∨ (~p ∧ ~q)



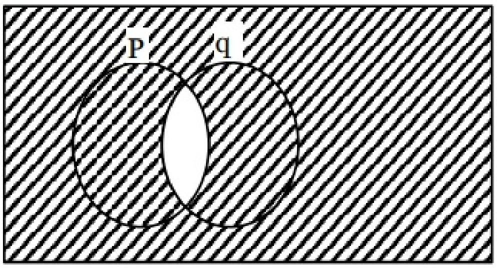
p ∧ ~q⇒



$\sim p \wedge q =$



$\sim p \wedge \sim q =$



$(p \wedge \sim q) \vee (\sim p \wedge q)(\sim p \wedge \sim q)$
(α, β)
$(\sim p) \vee (\sim q)$
Plane passing through $(0, -1, 2)$ and $(-1, 2, 1)$
then vector in plane $< -1, 3, -1 >$ vector parallel to plane is $\langle 4, 2, -6 \rangle$ normal vector to plane L_2

$$(\vec{n}) = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ -1 & 3 & -1 \\ 4 & 2 & -6 \end{vmatrix}$$

$= i(-16) - \hat{j}(10) + \hat{k}(-14)$
$\vec{n} = < 8, 5, 7 >$
Equation of plane
$8(x - 0) + 5(y + 1) + 7(z - 2) = 0$
$\Rightarrow 8x + 5y + 7z = 9$
From given options point $(-2, 5, 0)$ lies on plane.

Question25

Negation of $p \wedge (q \wedge \sim(p \wedge q))$ is [15-Apr-2023 shift 1]

Options:

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

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

C. $p \vee q$

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

Answer: D

Solution:

Solution:
~ [p ∧ (q ∧ ~(p ∧ q))]
~ p ∨ (~q ∨ (p ∧ q))
~ p ∨ ((~q ∨ p) ∧ (~q ∨ q))
~ p ∨ (~q ∨ p)
~ (p ∧ q) ∨ p

Question26

The number of choices for Δ ∈ {∧, ∨, ⇒, ⇔}, such that (p Δ q) ⇒ ((pΔ ~ q) ∨ ((~p) Δ q)) is a tautology, is : [24-Jun-2022-Shift-1]

Options:

A. 1

B. 2

C. 3

D. 4

Answer: B

Solution:

Solution:

Then $(p\Delta \sim q) \vee (\sim p \,\Delta\, q)$ becomes

$(p \vee \sim q) \vee (\sim p \vee q)$ which is always true, so x becomes a tautology.

Case-II

When Δ is same as ∧

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

If $p \wedge q$ is T, then $(p \wedge \sim q) \vee (\sim p \wedge q)$ is F

so x cannot be a tautology.

Case-III

When Δ is same as ⇒Then $(p \Rightarrow \sim q) \vee (\sim p \Rightarrow q)$ is same at $(\sim p \vee \sim q) \vee (p \vee q)$, which is always true, so x becomes a tautology.

Case-IV

When Δ is same as ⇔

Then $(p \Leftrightarrow q) \Rightarrow (p \Leftrightarrow \sim q) \vee (\sim p \Leftrightarrow q)$

$p \Leftrightarrow q$ is true when p and q have same truth values, then $p \Leftrightarrow \sim q$ and $\sim p \Leftrightarrow q$ both are false. Hence x cannot be a tautology.

Question27

Consider the following statements:
A : Rishi is a judge.
B : Rishi is honest.
C : Rishi is not arrogant.

The negation of the statement "if Rishi is a judge and he is not arrogant, then he is honest" is
[24-Jun-2022-Shift-2]

Options:

A. B → (A ∨ C)

B. (∼B) ∧ (A ∧ C)

C. B → ((∼A) ∨ (∼C))

D. B → (A ∧ C)

Answer: B

Solution:

Solution:

∵ Given statement is

$(A \wedge C) \rightarrow B$

Then its negation is

$\sim\{(A \wedge C) \rightarrow B\}$

or $\sim\{\sim(A \wedge C) \vee B\}$

$\therefore (A \wedge C) \wedge (\sim B)$

or $(\sim B) \wedge (A \wedge C)$

Question28

Consider the following two propositions:
P1 : ∼(p→ ∼ q)
P2 : (p ∧ ∼q) ∧ ((∼p) ∨ q)
If the proposition p → ((∼p) ∨ q) is evaluated as FALSE, then :
[25-Jun-2022-Shift-1]

Options:

A. P1 is TRUE and P2 is FALSE

B. P1 is FALSE and P2 is TRUE

C. Both P1 and P2 are FALSE

D. Both P1 and P2 are TRUE

Answer: C

Solution:

p	q	~p	~q	~pvq	p→(~pvq)	p→ ~q	~(p→ ~q)	p ∧ ~q	p_2
T	T	F	F	T	T	F	T	F	F
T	F	F	T	F	F	T	F	T	F
F	T	T	F	T	T	T	F	F	F
F	F	T	T	T	T	T	F	F	F

p → (∼p ∨ q) is F when p is true q is false

From table

P1 & P2 both are false

Question29

The negation of the Boolean expression ((∼q) ∧ p) ⇒ ((∼p) ∨ q) is logically equivalent to :
[25-Jun-2022-Shift-2]

Options:

A. p ⇒ q

B. q ⇒ p

C. ∼(p ⇒ q)

D. ∼(q ⇒ p)

Answer: C

Solution:

Solution:
Let S : ((∼q) ∧ p) ⇒ ((∼p) ∨ q)
⇒S : ∼((∼q) ∧ p) ∨ ((∼p) ∨ q)
⇒S : (q ∨ (∼p)) ∨ ((∼p) ∨ q)
⇒S : (∼p) ∨ q
⇒S : p ⇒ q
So, negation of S will be ∼(p ⇒ q)

Question30

Let Δ, ∇ ∈ {∧, V } be such that p∇q ⇒ ((p Δ q)∇r) is a tautology. Then (p ∇q) Δ r is logically equivalent to :
[26-Jun-2022-Shift-1]

Options:

A. (p Δ r) ∨ q

B. (p Δ r) ∧ q

C. (p ∧ r) Δ q

D. (p∇r) ∧ q

Answer: A

Solution:

Solution:

Case-I If $\Delta \equiv \nabla \equiv \wedge$

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

it can be false if r is false,

so not a tautology

Case-II If $\Delta \equiv \nabla \equiv V$

$(p \vee q) \rightarrow ((p \vee q) \vee r) \equiv$ tautology

then $(p \vee q) \vee r \equiv (p \Delta r) \vee q$

Case-III if $\Delta = \vee, \nabla = \wedge$

then $(p \wedge q) \rightarrow \{(p \vee q) \wedge r\}$

Not a tautology

(Check $p \rightarrow T, q \rightarrow T, r \rightarrow F$)

Case-IV if $\Delta = \wedge, \nabla = \vee$

$(p \wedge q) \rightarrow \{(p \wedge q) \vee r\}$

Not a tautology

Question31

Let r ∈ {p, q, ~p, ~q} be such that the logical statement
r ∨ (~p) ⇒ (p ∧ q) ∨ r
is a tautology. Then r is equal to :
[26-Jun-2022-Shift-2]

Options:

A. p

B. q

C. ~p

D. ~q

Answer: C

Solution:

Clearly r must be equal to $\sim p$

$\because \sim p \vee \sim p = \sim p$

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

$\therefore \sim p \Rightarrow p =$ tautology.

Question32

The boolean expression (~(p ∧ q)) ∨ q is equivalent to : [27-Jun-2022-Shift-1]

Options:

A. $q \rightarrow (p \wedge q)$

B. $p \rightarrow q$

C. $p \rightarrow (p \rightarrow q)$

D. $p \rightarrow (p \vee q)$

Answer: D

Solution:

p	q	$p \wedge q$	$\sim p \wedge q$	$(\sim(p \wedge q)) \vee q$	$p \vee q$	$p \rightarrow q$	$p \rightarrow (p \vee q)$
T	T	T	F	T	T	T	T
T	F	F	T	T	T	F	T
F	F	F	T	T	T	T	T
F	F	F	T	T	F	T	T
				Tautology			Tautology

Question33

Which of the following statement is a tautology?
[27-Jun-2022-Shift-2]

Options:

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

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

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

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

Answer: C

Solution:

Solution:
$\because((\sim q) \wedge p) \vee (p \vee (\sim p))$
$= (\sim q \wedge p) \vee t(t$ is tautology $)$
$\equiv t$
∴ option (C) is correct.

Question34

Let p, q, r be three logical statements. Consider the compound statements $S_1 : ((\sim p) \vee q) \vee ((\sim p) \vee r)$ and $S_2 : p \rightarrow (q \vee r)$
Then, which of the following is NOT true?
[28-Jun-2022-Shift-1]

Options:

A. If S_2 is True, then S_1 is True

B. If S_2 is False, then S_1 is False

C. If S_2 is False, then S_1 is True

D. If S_1 is False, then S_2 is False

Answer: C

Solution:

Solution:
$S_1 : (\sim p \vee q) \vee (\sim p \vee r)$
$\cong (\sim p \vee q \vee r)$
$S_2 : \sim p \vee (q \vee r)$
Both are same
So, option (C) is incorrect.

Question35

Suppose a class has 7 students. The average marks of these students in the mathematics examination is 62 , and their variance is 20. A student fails in the examination if he/she gets less than 50 marks, then in worst case, the number of students can fail is_____
[28-Jun-2022-Shift-2]

Answer: 0

Solution:

Solution:
According to given data

$$\frac{\sum_{i=1}^{7}(x_i-62)^2}{7}=20$$

$$\Rightarrow \sum_{i=1}^{7}(x_i-62)^2=140$$

So for any x_i, $(x_i-62)^2 \le 140$

$\Rightarrow x_i > 50\ \forall i = 1, 2, 3, \ldots\ldots 7$

So no student is going to score less than 50.

Question36

The maximum number of compound propositions, out of $p \vee r \vee s$, $p \vee r \vee \sim s$, $p \vee \sim q \vee s$, $\sim p \vee \sim r \vee s$, $\sim p \vee \sim r \vee \sim s$, $\sim p \vee q \vee \sim s$, $q \vee r \vee \sim s$, $q \vee \sim r \vee \sim s$, $\sim p \vee \sim q \vee \sim s$ that can be made simultaneously true by an assignment of the truth values to p, q, r and s, is equal to___
[28-Jun-2022-Shift-2]

Answer: 9

Solution:

Solution:
There are total 9 compound propositions, out of which 6 contain $\sim s$. So if we assign s as false, these 6 propositions will be true.
In remaining 3 compound propositions, two contain p and the third contains $\sim r$. So if we assign p and r as true and false respectively, these 3 propositions will also be true.
Hence maximum number of propositions that can be true are 9.

Question37

Let $\Delta \in \{\wedge, \vee, \Rightarrow, \Leftrightarrow\}$ be such that $(p \wedge q)\ \Delta\ ((p \vee q) \Rightarrow q)$ is a tautology.

Then Δ is equal to :
[29-Jun-2022-Shift-1]

Options:

A. ∧

B. V

C. ⇒

D. ⇔

Answer: C

Solution:

Solution:
p ∨ q ⇒ q
⇒ ~ (p ∨ q) ∨ q
⇒(~p ∧ ~q) ∨ q
⇒(~p ∨ q) ∧ (~q ∨ q)
⇒(~p ∨ q) ∧ t = ~ p ∨ q
Now by taking option C
(p ∧ q)⇒ ~ p ∨ q
⇒ ~ p ∨ ~q ∨ ~p ∨ q
⇒t

Question38

Negation of the Boolean statement (p ∨ q) ⇒ ((~r) ∨ p) is equivalent to
[29-Jun-2022-Shift-2]

Options:

A. p ∧ (~q) ∧ r

B. (~p) ∧ (~q) ∧ r

C. (~p) ∧ q ∧ r

D. p ∧ q ∧ (~r)

Answer: C

Solution:

Solution:
Given,
(p ∨ q) ⇒ ((~r) ∨ p)
Negation is
~((p ∨ q) ⇒ (~r) ∨ p))
= (p ∨ q) ∧ ~((~r) ∨ p)
= (p ∨ q) ∧ (r ∧ ~p)
[(p ∧ ~p) ∨ (q ∧ ~p)] ∧ r
= q ∧ ~p ∧ r

Question39

Which of the following statements is a tautology?
[25-Jul-2022-Shift-1]

Options:

A. $((\sim p) \vee q) \Rightarrow p$

B. $p \Rightarrow ((\sim p) \vee q)$

C. $((\sim p) \vee q) \Rightarrow q$

D. $q \Rightarrow ((\sim p) \vee q)$

Answer: D

Solution:

Solution:

Question40

Consider the following statements:
P : Ramu is intelligent.
Q : Ramu is rich.
R : Ramu is not honest.
The negation of the statement "Ramu is intelligent and honest if and only if Ramu is not rich" can be expressed as:
[25-Jul-2022-Shift-2]

Options:

A. $((P \wedge (\sim R)) \wedge Q) \wedge ((\sim Q) \wedge ((\sim P) \vee R))$

B. $((P \wedge R) \wedge Q) \vee ((\sim Q) \wedge ((\sim P) \vee (\sim R)))$

C. $((P \wedge R) \wedge Q) \wedge ((\sim Q) \wedge ((\sim P) \vee (\sim R)))$

D. $((P \wedge (\sim R)) \wedge Q) \vee ((\sim Q) \wedge ((\sim P) \vee R))$

Answer: D

Solution:

Solution:
P: Ramu is intelligent
Q: Ramu is rich
R : Ramu is not honest
Given statement, "Ramu is intelligent and honest if and only if Ramu is not rich" $= (P \wedge \sim R) \Leftrightarrow \sim Q$
So, negation of the statement is
$\sim[(P \wedge \sim R) \Leftrightarrow \sim Q]$
$= \sim[\{\sim(P \wedge \sim R) \vee \sim Q\} \wedge \{Q \vee (P \wedge \sim R)\}]$
$= ((P \wedge \sim R) \wedge Q) \vee (\sim Q \wedge (\sim P \vee R))$

Question41

The statement $(\sim(p \Leftrightarrow \sim q)) \wedge q$ is : [26-Jul-2022-Shift-1]

Options:

A. a tautology

B. a contradiction

C. equivalent to $(p \Rightarrow q) \wedge q$

D. equivalent to $(p \Rightarrow q) \wedge p$

Answer: D

Solution:

Solution:
$\sim(p \Leftrightarrow \sim q) \wedge q$
$= (p \Leftrightarrow q) \wedge q$

p	q	$p \leftrightarrow q$	$(p \rightarrow q) \wedge q$	$(p \rightarrow q)$	$(p \rightarrow q) \wedge q$	$(p \rightarrow q) \wedge p$
T	T	T	T	T	T	T
T	F	F	F	F	F	F
F	T	F	F	T	T	F
F	F	T	F	T	F	F

$\therefore (\sim(p \Leftrightarrow \sim q)) \wedge q$ is equivalent to $(p \Rightarrow q) \wedge p$.

Question42

Negation of the Boolean expression $p \Leftrightarrow (q \Rightarrow p)$ is [26-Jul-2022-Shift-2]

Options:

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

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

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

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

Answer: D

Solution:

p ⇔ (q ⇒ p)
~(p ⇔ (q ⇔ p))
≡p⇔ ~ (q ⇒ p)
≡p ⇔ (q ∧ ~p)
≡(p ⇒ (q ∧ ~p)) ∧ ((q ∧ ~p) ⇒ p))
≡(~p ∨ (q ∧ ~p)) ∧ ((~q ∨ p) ∨ p))
≡((~p ∨ q) ∧ ~p) ∧ (~q ∨ p)
≡ ~ p ∧ (~q ∨ p)

≡(~p ∧ ~q) ∨ (~p ∧ p)
≡(~p ∧ ~q) ∨ c
≡(~p ∧ ~q)

Question43

(p ∧ r) ⇔ (p ∧ (~q)) is equivalent to (~p) when r is [27-Jul-2022-Shift-1]

Options:

A. p

B. ~p

C. q

D. ~q

Answer: C

Solution:

Solution:

p	q	~p	~q	p∧q	p∧~q	p∧q ⇔ p∧~q
T	T	F	F	T	F	F
T	F	F	T	F	T	F
F	T	T	F	F	F	T
F	F	T	T	F	F	T

Clearly p ∧ q ⇔ p ∧ ~q≡ ~ p
∴r = q

Question44

If the truth value of the statement (P ∧ (~R)) → ((~R) ∧ Q) is F, then the truth value of which of the following is F ? [27-Jul-2022-Shift-2]

Options:

A. P ∨ Q→ ~ R

B. R ∨ Q→ ~ P

C. $\sim(P \vee Q) \rightarrow \sim R$

D. $\sim(R \vee Q) \rightarrow \sim P$

Answer: D

Solution:

Solution:
$X \Rightarrow Y$ is a false
when X is true and Y is false
So, $P \rightarrow T, Q \rightarrow F, R \rightarrow F$
(A) $P \vee Q \rightarrow \sim R$ is T
(B) $R \vee Q \rightarrow \sim P$ is T
(C) $\sim(P \vee Q) \rightarrow \sim R$ is T
(D) $\sim(R \vee Q) \rightarrow \sim P$ is F

Question45

Let the operations $*, \odot \in \{\wedge, \vee\}$. If $(p * q) \odot (p \odot \sim q)$ is a tautology, then the ordered pair $(*, \odot)$ is: [28-Jul-2022-Shift-1]

Options:

A. $(\vee, \wedge)$

B. (V, V)

C. $(\wedge, \wedge)$

D. $(\wedge, \vee)$

Answer: B

Solution:

Solution:
$*, \odot \in \{\wedge, \vee\}$
Now for $(p * q) \odot (p \odot \sim q)$ is tautology
(A) $(\vee, \wedge)$: $(p \vee q) \wedge (p \wedge \sim q)$ not a tautology
(B) $(\vee, \vee)$: $(p \vee q) \vee (p \vee \sim q)$
 $= P \vee T$ is tautology
(C) $(\wedge, \wedge)$: $(p \wedge q) \wedge (p \wedge \sim q)$
 $= (p \wedge p) \wedge (q \wedge \sim q) = p \wedge F$ not a tautology (Fallasy)
(D) $(\wedge, \vee)$: $(p \wedge q) \vee (p \vee \sim q)$ not a tautology

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Question46

Let
p : Ramesh listens to music.
q : Ramesh is out of his village.
r : It is Sunday.
s : It is Saturday.

Then the statement "Ramesh listens to music only if he is in his village and it is Sunday or Saturday" can be expressed as [28-Jul-2022-Shift-2]

Options:

A. $((\sim q) \wedge (r \vee s)) \Rightarrow p$

B. $(q \wedge (r \vee s)) \Rightarrow p$

C. $p \Rightarrow (q \wedge (r \vee s))$

D. $p \Rightarrow ((\sim q) \wedge (r \vee s))$

Answer: D

Solution:

Solution:
p : Ramesh listens to music
q : Ramesh is out of his village
r : It is Sunday
s : It is Saturday
$p \rightarrow q$ conveys the same p only if q
Statement "Ramesh listens to music only if he is in his village and it is Sunday or Saturday"
$p \Rightarrow ((\sim q) \wedge (r \vee s))$

Question47

The statement $(p \wedge q) \Rightarrow (p \wedge r)$ is equivalent to : [29-Jul-2022-Shift-1]

Options:

A. $q \Rightarrow (p \wedge r)$

B. $p \Rightarrow (p \wedge r)$

C. $(p \wedge r) \Rightarrow (p \wedge q)$

D. $(p \wedge q) \Rightarrow r$

Answer: D

Solution:

Solution:
$(p \wedge q) \Rightarrow (p \wedge r)$ is equivalent to $(p \wedge q) \Rightarrow r$

Question48

The statement $(p \Rightarrow q) \vee (p \Rightarrow r)$ is NOT equivalent to [29-Jul-2022-Shift-2]

Options:

A. $(p \wedge (\sim r)) \Rightarrow q$

B. $(\sim q) \Rightarrow ((\sim r) \vee p)$

C. $p \Rightarrow (q \vee r)$

D. $(p \wedge (\sim q)) \Rightarrow r$

Answer: B

Solution:

Solution:
(A) $(p \wedge (\sim r)) \Rightarrow q$
$\sim(p \wedge \sim r) \vee q$
$\equiv(\sim p \vee r) \vee q$
$\equiv \sim p \vee (r \vee q)$
$\equiv p \rightarrow (q \vee r)$
$\equiv(p \Rightarrow q) \vee (p \Rightarrow r)$
(C) $p \Rightarrow (q \vee r)$
$\equiv \sim p \vee (q \vee r)$
$\equiv(\sim p \vee q) \vee (\sim p \vee r)$
$\equiv(p \rightarrow q) \vee (p \rightarrow r)$
(D) $(p \wedge \sim q) \Rightarrow r$
$\equiv p \Rightarrow (q \vee r)$
$\equiv(p \Rightarrow q) \vee (p \Rightarrow r)$

Question49

The contrapositive of the statement; "If you will work, you will earn money" is
[2021, 25 Feb. Shift-II]

Options:

A. to earn money, you need to work

B. you will earn money, if you will not work

C. if you will not earn money, you will not work

D. if you will earn money, you will work

Answer: C

Solution:

Solution:
Contrapositive of $p \rightarrow q$ is $\sim \rightarrow \sim p$
p: you will work
⇒ p:you will not work
q: you will earn money ⇒∼
q:you will not earn money
Then,
∼q→∼ : if you will not earn money, you will not work.

Question50

Let $F_1(A, B, C) = (A \wedge \sim B) \vee [\sim C \wedge (A \vee B)] \vee \sim A$ and $F_2(A, B) = (A \vee B) \vee (B \rightarrow \sim A)$ be two logical expressions. Then, [2021, 26 Feb. Shift-II]

Options:

A. F_1 and F_2 both are tautologies

B. F_1 is a tautology but F_2 is not a tautology

C. F_1 is not tautology but F_2 is a tautology

D. Both F_1 and F_2 are not tautologies

Answer: C

Solution:

Solution:
$F_1(A, B, C) = (A \wedge \sim B) \vee [\sim C \wedge (A \vee B)] \vee \sim A$
$\equiv \{ (A \wedge \sim B) \vee [\sim C \wedge (A \vee B)]$ (Associative law)
$\equiv \{(A \vee \sim A) \wedge (\sim B \vee \sim A)\} \vee [(A \vee B) \wedge C]$ (distributive law)
$\equiv (\sim B \vee \sim A) \vee [(A \vee B) \wedge \sim C]$
$\equiv [(\sim A \sim B) \vee (A \vee B)] \wedge [(\sim A \vee \sim B) \vee \sim C]$
$\equiv T \wedge (\sim A \vee \sim B) \vee \sim C$
$\equiv (\sim A \vee \sim B) \vee \sim C$
Which is not a tautology.
Now, $F_2(A, B) = (A \vee B) \vee (B \rightarrow \sim A)$
$\equiv (A \vee B) \vee (\sim B \vee \sim A)$
Hence, F_2 is a tautology.

Question51

The statement $A \rightarrow (B \rightarrow A)$ is equivalent to [2021, 25 Feb. Shift-1]

Options:

A. $A \rightarrow (A \wedge B)$

B. $A \rightarrow (A \rightarrow B)$

C. $A \rightarrow (A \leftrightarrow B)$

D. $A \rightarrow (A \vee B)$

Answer: D

Solution:

Solution:
Given, statement $A \rightarrow (B \rightarrow A)$

≡ A → (∼B ∨ A)
≡ ∼ A ∨ (∼B ∨ A)
≡ (∼A ∨ A) ∨ ∼B
≡ T ∨ ∼B ≡ T
∴T ∨ B = T ≡ (∼A ∨ A) ∨ B
≡ ∼ A ∨ (A ∨ B)
≡ A → (A ∨ B)

Question52

For the statements p and q, consider the following compound statements
A. [∼q ∧ (p → q)]→ ∼ p
B. [(p ∨ q) ∧ ∼p] → q
Then, which of the following statement(s) is/are correct?
[2021, 24 Feb. Shift-II]

Options:

A. (A) and (B) both are not tautologies.

B. (A) and (B) both are tautologies.

C. (A) is a tautology but not (B).

D. (B) is a tautology but not (A).

Answer: B

Solution:

Given statements,
(A) [∼q ∧ (p → q]→ ∼ p
(B) [(p ∨ q) ∧ ∼p] → q
For statement (A),

$p \rightarrow q$	$\sim q \wedge (p \rightarrow q)$	$[\sim q \wedge (p \rightarrow q)\} \rightarrow \sim p$
T	F	T
F	F	T
T	F	T
T	T	T

∴ Statement (A) is tautology.
For statement (B),

$p \vee q$	$(p \vee q) \wedge \sim p$	$[(p \vee q) \wedge \sim p] \rightarrow q$
T	F	T
T	F	T
T	T	T
F	T	T

∴ Statement (B) is tautology.
∴(A) and (B) both are tautologies.

Question53

The negative of the statement ~p ∧ (p ∨ q) is [2021, 24 Feb. Shift-II]

Options:

A. p ∨ q

B. p ∨ ~q

C. p ∧ q

D. p ∧ ~q

Answer: B

Solution:

Solution:
Given, statement [~p ∧ (p ∨ q]
Negative of given statement ~[~p ∧ (p ∨ q)
= p ∨ ~[p ∨ q) [By De morgan's law]
= p ∨ (~p ∧ ~q) [By De Morgani law]
= (p ∨ ~p) ∧ (p ∨ ~q) [Using Distribution property]

Question54

The statement among the following that is a tautology is [2021, 24 Feb. Shift-1]

Options:

A. A ∧ (A ∨ B)

B. A ∨ (A ∧ B)

C. [A ∧ (A → B)] → B

D. B → [A ∧ (A → B)]

Answer: C

Solution:

Solution:
Given, $[A \wedge (A \rightarrow B)] \rightarrow B$
$= A \wedge (\sim A \vee B) \rightarrow B$
$= [(A \wedge \sim A) \vee (A \wedge B)] \rightarrow B$
$= (A \wedge B) \rightarrow B$
$= \sim A \vee \sim B \vee B = t$
Hence, $[A \wedge (A \rightarrow B)] \rightarrow B$ is a tautology.

Question55

The statement among the following that is a tautology is:
24 Feb 2021 Shift 1

Options:

A. $A \vee (A \wedge B)$

B. $A \wedge (A \vee B)$

C. $B \rightarrow [A \wedge (A \rightarrow B)]$

D. $[A \wedge (A \rightarrow B)] \rightarrow B$

Answer: D

Solution:

Solution:
$(A \wedge (A \rightarrow B)) \rightarrow B$
$= (A \wedge (\sim A \vee B)) \rightarrow B$
$= ((A \wedge \sim A) \vee (A \wedge B)) \rightarrow B$
$= (A \wedge B) \rightarrow B$
$= \sim (A \wedge B) \vee B$
$= (\sim A \vee \sim B) \vee B$
$= T$

Question56

If p and q are two statements, then which of the following compound statement is a tautology?
[2021, 18 March Shift-II]

Options:

A. $(p \Rightarrow q) \wedge \sim q] \Rightarrow 0$

B. $(p \Rightarrow q) \wedge \sim q] \Rightarrow \sim p$

C. $(p \Rightarrow q) \wedge \sim q] \Rightarrow p$

D. $(p \Rightarrow q) \wedge \sim q] \Rightarrow (p \wedge q)$

Answer: B

Solution:

Solution:
To check options one by one,
(a) $[(p \rightarrow q) \wedge \sim q] \rightarrow q$
$\equiv (\sim p \wedge \sim q) \rightarrow q$
$\equiv (p \vee q) \vee q \equiv p \vee q$
(b) $[(p \rightarrow q) \wedge \sim q] \rightarrow \sim p$
$\equiv (p \vee q) \vee \sim p$
$\equiv t$
(c) $[(p \rightarrow q) \wedge \sim q] \rightarrow p$
$\equiv [(\sim p \vee q) \wedge \sim q] \rightarrow p$
$\equiv (\sim p \wedge \sim q) \rightarrow p$
$\equiv (p \vee q) \vee p \equiv (p \vee q)$
(d) $[(p \rightarrow q) \wedge \sim q] \rightarrow p \wedge q$
$\equiv (p \vee q) \vee (p \wedge q)$
$\equiv [(p \vee q) \vee p] \wedge [(p \vee q) \vee q]$
$\equiv (p \vee q) \wedge (p \vee q) \equiv (p \vee q)$

Question57

If the Boolean expression $(p \Rightarrow q) \Leftrightarrow (q^*(\sim p))$ is a tautology, then the Boolean expression $(p^*(\sim q))$ is equivalent to [2021, 17 March Shift-1]

Options:

A. $q \Rightarrow p$

B. $q \Rightarrow p$

C. $p \Rightarrow \sim q$

D. $p \Rightarrow q$

Answer: A

Solution:

Solution:
The Boolean expression
$(p \Rightarrow q) \Leftrightarrow (q^*(\sim p))$ is a tautology.
Making the truth table for this

p	q	$p \rightarrow q$	$q^* \sim p$	$\sim q$	$-q \wedge p$	$-(\sim q \wedge p)$
T	T	T	T	F	F	T
T	F	F	F	T	T	F
F	T	T	T	F	F	T
F	F	T	T	T	F	T

$\therefore \sim (\sim q \wedge p) = q \vee \sim p = \sim p \vee q$
$\therefore {}^*$ is equivalent to V .

$p^* \sim q \ = p \vee \sim q$
$= \ \sim q \vee p$
$= q \Rightarrow p$

Question58

If the Boolean expression $(p \wedge q)^*(p \otimes q)$ is a tautology, then * and $\otimes$ are respectively, given by
[2021, 17 March Shift-II]

Options:

A. →, →

B. ∧ ∨

C. v_1→

D. ∧→

Answer: A

Solution:

Solution:

p	q	p ∧ q	$p \overrightarrow{\otimes} q$	$(p \wedge q) \overrightarrow{\star} (p \overrightarrow{\otimes} q)$
T	T	T	T	T
T	F	F	F	T
F	T	F	T	T
F	F	F	T	T

Clearly * and ⊗ are →, → respectively for tautology.

Question59

Which of the following Boolean expression is a tautology?
[2021, 16 March Shift-1]

Options:

A. (p ∧ q) ∨ (p ∨ q)

B. (p ∧ q) ∨ (p → q)

C. (p ∧ q) ∧ (p → q)

D. (p ∧ q) → (p → q)

Answer: D

Solution:

Solution:
Let p and q are two statements.
Let's make the truth table and see (p ∧ q) implies (p ∨ q) or not.

p	q	p ∧ q	p ∨ q	p → q	(p ∧ q)→(p→q)
T	T	T	T	T	T
F	T	F	T	T	T
T	F	F	T	F	T
F	F	F	F	T	T

Since, last column of the truth table for (p ∧ q) → (p → q) contains T sonly.
So, (p ∧ q) → (p → q) is a tautology.

Question60

Which of the following is the negation of the statement "for all M > 0, there exist x ∈ S such that x ≥ M "?
[2021, 27 July Shift-II]

Options:

A. there exists M > 0, such that x < M for all x ∈ S

B. there exists M > 0, there exists x ∈ S such that x ≥ M

C. there exists M > 0, there exists x ∈ S such that x < M

D. there exists M > 0, such that x ≥ M for all x ∈ S

Answer: A

Solution:

Solution:
Let P : for all M > 0, there exists x ∈ S such that x ≥ M
~P :there exists M > 0, for all x ∈ S such that x < M
(∵ negation of 'there exists' is 'for all')

Question61

Consider the statement "The match will be played only if the weather is good and ground is not wet".
Select the correct negation from the following
[2021,25 July Shift-II]

Options:

A. The match will not be played andweather is not good and ground is wet.

B. If the match will not be played, then either weather is not good or ground is wet.

C. The match will be played and weather is not good or ground is wet.

D. The match will not be played or weather is good and ground is not wet.

Answer: C

Solution:

Solution:
Let p: The match will be played
q :weather is good
r : ground is not wet
$\sim[p \rightarrow (q \wedge r)] = p \wedge \sim(q \wedge r) = p \wedge (\sim q \vee \sim r)$
The match will be played and weather is not good or ground is wet.

Question62

Consider the following three statements,
(A) If 3 + 3 = 7, then 4 + 3 = 8
(B) If 5 + 3 = 8, then earth is flat
(C) If both (A) and (B) are true, then 5 + 6 = 17
Then, which of the following statements is correct
[2021, 20 July Shift II]

Options:

A. (A) is false, but (B) and (C) are true

B. (A) and (C) are true while (B) is false

C. (A) is true while (B) and (C) are false

D. (A) and (B) are false while (C) is true

Answer: B

Solution:

Solution:
To solve this, let's construct a truth table for $p \rightarrow q$

P	q	$p \rightarrow q$
T	T	T
T	F	F
F	T	T
F	F	T

For (A), statements pandqare as follows,

$p : 3 + 3 = 7$
$q : 4 + 3 = 8$
Since, pis false, then $p \rightarrow q$ is true.
Hence, (A) is true.
For (B), statements pand qare as follows,
$p : 5 + 3 = 8$
q : Earth is flat
Here, p is true and q is false.
$\therefore$ $p \rightarrow$ q is false.
Hence, (b) is false.
For (c), statements pandqare as follows,
p: Both (A) and (B) are true.
$q : 5 + 6 = 17$
Here ' p ' is false because (B) is not true, then
$p \rightarrow q$ is true.
Hence, (c) is true.

Question63

The compound statement $(P \vee Q) \wedge (\sim P) \Rightarrow Q$ is equivalent to [2021, 27 July Shift-1]

Options:

A. $P \vee Q$

B. $P \wedge \sim Q$

C. $\sim(P \Rightarrow Q)$

D. $\sim(P \Rightarrow Q) \Leftrightarrow P \wedge \sim Q$

Answer: D

Solution:

P	Q	PVQ	~P	(PVQ)ΛP	(PVQ)Λ~P→Q
T	T	T	F	F	T
T	F	T	F	F	T
F	T	T	T	T	T
F	F	F	T	F	T

P	Q	~Q	PΛ~Q	P→Q	~(P→Q)
T	T	F	F	T	F
T	F	T	T	F	T
F	T	F	F	T	F
F	F	T	F	T	F

~(P→Q)	P∧~Q	~(P→Q) ⇔ P∧~Q
F	F	T
T	T	T
F	F	T
F	F	T

Question64

The Boolean expression (p ⇒ q) ∧ (q⇒ ~ p) is equivalent to [2021, 25 July Shift-1]

Options:

A. ~q

B. q

C. p

D. p

Answer: D

Solution:

(p → q) ∧ (q→ ~ p)
(~p ∨ q) ∧ (~q ∨ ~p) [∵p → q≡ ~ p ∨ q]
⇒(~p ∨ q) ∧ (~p ∨ ~q)   [commutative property]
⇒ ~ p ∨ (q ∧ ~q)   (distributive property)
⇒ ~ p

Question65

Which of the following Boolean expression is not a tautology ? [2021, 22 July Shift-II]

Options:

A. $(p \Rightarrow q) \vee (\sim q \Rightarrow p)$

B. $(q \Rightarrow p) \vee (\sim q \Rightarrow p)$

C. $(p \Rightarrow \sim q) \vee (\sim q \Rightarrow p)$

D. $(\sim p \Rightarrow q) \vee (\sim q \Rightarrow p)$

Answer: D

Solution:

(i) $(p \rightarrow q) \vee (\sim p \rightarrow p)$
$= (\sim p \vee q) \vee (q \vee p)$
$= (\sim p \vee q) \vee q = t \vee q = t$
(ii) $(q \rightarrow p) \vee (\sim q \rightarrow p)$
$= (\sim q \vee p) \vee (q \vee p)$
$= (\sim q \vee q) \vee p = t \vee p =$ True
(iii) $(p \rightarrow \sim q) \vee (\sim q \rightarrow p)$
$= (\sim p \vee \sim q) \vee (q \vee p)$
$= (\sim p \vee q) \vee (\sim q \vee q) = T \vee T = T$
(iv) $(\sim q \rightarrow q) \vee (\sim q \rightarrow p)$
$= p \vee q \vee q \vee p = p \vee p \vee q \vee q$
$= p \vee q$
Not a tautology.

Question66

The Boolean expression $(p \wedge \sim q) \Rightarrow (q \vee \sim p)$ is equivalent to [2021, 20 July Shift-1]

Options:

A. $q \Rightarrow p$

B. $p \Rightarrow q$

C. $q \Rightarrow p$

D. $p \Rightarrow \sim q$

Answer: B

Solution:

Solution:
$(p \wedge \sim q) \Rightarrow (q \vee \sim p)$

p	q	~ p	~ q	p ∧ ~ q	q ∨ ~ p	p ∧ ~ q ⇒ q ∨ ~ p
T	T	F	F	F	T	T
T	F	F	T	T	F	F
F	T	T	F	F	T	T
F	F	T	T	F	T	T

p	q	q → p	p → q	~ q → p	p → ~ q
T	T	T	T	T	F
T	F	T	F	T	F
F	T	F	T	T	T
F	F	T	T	F	T

So, option (b) is correct.

Question67

Let *, square, in{wedge, v} be such that the Boolean expression left(p* sim q right) Rightarrow(pq) is a tautology. Then [2021,31 Aug. Shift-I]

Options:

A. $^{*} = v_1 = v$

B. $^{*} = \wedge_1 = \wedge$

C. $^{*} = \Lambda' = \vee$

D. $^{*} = v_1 = \wedge$

Answer: C

Solution:

Solution:

p	q	~q	p ∧ ~q	p ∨ q	(p ∧ ~q) → (p ∨ q)
T	T	F	F	T	T
T	F	T	T	T	T
F	T	F	F	T	T
F	F	T	F	F	T

∴(p ∧ ~q) → (p ∨ q) is tautology.

Question68

Negation of the statement (p ∨ q) ⇒ (q ∨ r) is [2021, 31 Aug. Shift-II]

Options:

A. p ∧ ~q ∧ ~r

B. ~p ∧ q ∧ ~r

C. ~p∧ ∧ r

D. p ∧ q ∧ r

Answer: A

Solution:

Solution:
Negative of (p ∨ r) ⇒ (q ∨ r)
≡ ~ ((p ∨ r) ⇒ (q ∨ r))
≡(p ∨ r) ∧ (~(q ∨ r))
≡(p ∨ r) ∧ (~q ∧ ~r)
≡(p ∨ r) ∧ ~r) ∧ ~q
≡((p ∧ ~r)) ∨ (r ∧ ~r) ∧ ~q
≡(p ∧ ~r) ∧ f) ∧ ~q
≡(p ∧ ~r) ∧ (~q)
≡p ∧ ~q ∧ ~r

Question69

The statement $(p \wedge (p \rightarrow q) \wedge (q \rightarrow r)) \rightarrow r$ is [2021, 27 Aug. Shift-1]

Options:

A. a tautology

B. equivalent to $p \rightarrow \sim r$

C. a fallacy

D. equivalent to $\rightarrow \rightarrow r$

Answer: A

Solution:

Solution:
Taking True $= 1$, False $= 0$

(1) p	(2) q	(3) r	(4) $p \rightarrow q$	(5) $q \rightarrow r$	(6) $(1) \wedge (4) \wedge (5)$	(7) $(6) \rightarrow (3)$
0	0	0	1	1	0	1
0	0	1	1	1	0	1
0	1	0	1	0	0	1
0	1	1	1	1	0	1
1	0	0	0	1	0	1
1	0	1	0	1	0	1
1	1	0	1	0	0	1
1	1	1	1	1	1	1

Column (7) gives true (1) in each case.
Hence, $(p \wedge (p \rightarrow q) \wedge (q \rightarrow r)) \rightarrow r$ is a tautology.

Question70

The Boolean expression $(p \wedge q) \Rightarrow ((r \wedge q) \wedge p)$ is equivalent to [2021,27 Aug. Shift-11]

Options:

A. $(p \wedge q) \Rightarrow (r \wedge q)$

B. $(q \wedge r) \Rightarrow (p \wedge q)$

C. $(p \wedge q) \Rightarrow (tr \vee q)$

D. $(p \wedge r) \Rightarrow (p \wedge q)$

Answer: A

Solution:

Given, $(p \wedge q) \Rightarrow ((r \wedge q) \wedge p)$
$\Leftrightarrow \sim (p \wedge q) \vee ((r \wedge q) \wedge p)$
$\Leftrightarrow \sim (p \wedge q) \vee ((r \wedge q) \wedge (p \wedge q))$
$\Leftrightarrow [\sim(p \wedge q) \vee (p \wedge q)] \wedge [\sim(p \wedge q) \vee (r \wedge q)]$
$\Leftrightarrow t \wedge [\sim(p \wedge q) \vee (r \wedge q)]$
$\Leftrightarrow \sim (p \wedge q) \vee (r \wedge q)$
$\Leftrightarrow (p \wedge q) \Rightarrow (r \wedge q)$

Question71

If the truth value of the Boolean expression $((p \vee q) \wedge (q \rightarrow r) \wedge (\sim r) \rightarrow (p \wedge q)$ is false, then the truth values of the statements, p, q and r respectively can be [2021, 26 Aug. Shift-1]

Options:

A. T F T

B. FFT

C. TFF

D. FTF

Answer: C

Solution:

	p	q	r	p ∨ q	q → r	~	X	p ∧ q	Y
(A)	T	F	T	T	T	F	F	F	T
(B)	F	F	T	F	T	F	F	F	T
(C)	T	F	F	T	T	T	T	F	F
(D)	F	T	F	T	F	T	F	F	T

$X = (p \vee q) \wedge (q \rightarrow r) \wedge (\sim r)$
$Y = X \rightarrow (p \wedge q)$

Question72

Consider the two statements :
(S_1) : $(p \rightarrow q) \vee (\sim q \rightarrow p)$ is a tautology (S_2) : $(p \wedge \sim q) \wedge (\sim p \vee q)$ is a fallacy Then,

[2021, 26 Aug. Shift-11]

Options:

A. only (S_1) is true

B. both (S_1) and (S_2) are false

C. both (S_1) and (S_2) are true

D. only (S_2) is true

Answer: C

Solution:

Solution:
$S_1 : (\sim p \vee q) \vee (q \vee p) = (q \vee \sim p) \vee (q \vee p)$
$S_1 = q \vee (\sim p \vee p) = q \vee (\text{ true })$
$S_1 = (\text{ Always true })$
$S_2 : (p \wedge \sim q) \wedge (\sim p \vee q)$
$= (p \wedge \sim q) \wedge (p \wedge \sim q) = \text{ fallacy}$

Question73

Which of the following is equivalent to the Boolean expression $p \wedge \backsim q$? [1 Sep 2021 Shift 2]

Options:

A. $\backsim (q \rightarrow p)$

B. $\backsim p \rightarrow \backsim q$

C. $\backsim (p \rightarrow \backsim q)$

D. $\backsim (p \rightarrow q)$

Answer: D

Solution:

Solution:
$\backsim (p \rightarrow q)$
$\Rightarrow \backsim (\backsim p \vee q)$
$\Rightarrow p \wedge \backsim q$

Question74

Let A, B, C and D be four non-empty sets. The contrapositive statement of "If A ⊆ B and B ⊆ D, then A ⊆ C" is: [Jan. 7, 2020 (II)]

Options:

A. If $A \nsubseteq C$, then $A \subseteq B$ and $B \subseteq D$

B. If $A \subseteq C$, then $B \subset A$ or $D \subset B$

C. If $A \nsubseteq\ = C$, then $A \nsubseteq B$ and $B \subseteq D$

D. If $A \nsubseteq C$, then $A \nsubseteq B$ or $B \nsubseteq D$

Answer: D

Solution:

Let $P = A \subseteq B$, $Q = B \subseteq D$, $R = A \subseteq C$
Contrapositive of $(P \wedge Q) \rightarrow R$ is $\wedge R \rightarrow \wedge (P \wedge Q)$
$\wedge R \rightarrow \wedge P \vee \wedge Q$

Question75

Negation of the statement:
$\sqrt{5}$ is an integer of 5 is irrational is:
[Jan. 9, 2020 (I)]

Options:

A. $\sqrt{5}$ is not an integer or 5 is not irrational

B. $\sqrt{5}$ is not an integer and 5 is not irrational

C. $\sqrt{5}$ is irrational or 5 is an integer.

D. $\sqrt{5}$ is an integer and 5 is irrational

Answer: B

Solution:

Solution:
Let p and q the statements such that $p = \sqrt{5}$ is aninteger $q = 5$ is an irrational number.
Then, negation of the given statement
$\sqrt{5}$ is not an integer and 5 is not an irrational Number
$\sim(p \vee q) = \sim p \wedge \sim q$

Question76

If $p \rightarrow (p \wedge \sim q)$ is false, then the truth values of p and q are respectively:
[Jan. 9, 2020 (II)]

Options:

A. F, F

B. T, F

C. T, T

D. F, T

Answer: C

Solution:

p	q	~q	p∧ ~ q	p → (p∧~ q)
T	T	F	F	F
T	F	T	T	T
F	T	F	F	T
F	F	T	F	T

Question77

Which one of the following is a tautology? [Jan. 8, 2020 (I)]

Options:

A. $(p \wedge (p \rightarrow q)) \rightarrow q$

B. $q \rightarrow (p \wedge (p \rightarrow q))$

C. $p \wedge (p \vee q)$

D. $p \vee (p \wedge q)$

Answer: A

Solution:

p	q	p→q	p∧(p→q)	(p∧(p→q))→q	q→p∧(p→q)	p∧q	p∨(p∧q)	p∨q	p∧(p∨q)
T	T	T	T	T	T	T	T	T	T
T	F	F	F	T	T	F	T	T	T
F	T	T	F	T	F	F	F	T	F
F	F	T	F	T	T	F	F	F	F

Question78

Which of the following statements is a tautology? [Jan. 8, 2020 (II)]

Options:

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

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

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

D. $\sim(p \vee \sim q) \rightarrow p \vee q$

Answer: D

Solution:

Solution:
$(\sim p \wedge q) \rightarrow (p \vee q)$
$\Rightarrow \sim \{(\sim p \wedge q) \wedge (\sim p \wedge \sim q)\}$
$\Rightarrow \sim \{\sim p \wedge f\}$

Question79

The logical statement $(p \Rightarrow q) \wedge (q \Rightarrow \sim p)$ is equivalent to: [Jan. 7, 2020 (I)]

Options:

A. p

B. q

C. $\sim p$

D. $\sim q$

Answer: C

Solution:

p	q	p⇒q	~p	q⇒~p	(p⇒q)∧(p⇒~q)
T	T	T	F	F	F
T	F	F	F	T	F
F	T	T	T	T	T
F	F	T	T	T	T

Clearly $(p \Rightarrow q) \wedge (q \Rightarrow \sim p)$ is equivalent to $\sim p$

Question80

The negation of the Boolean expression $p \vee (\sim p \wedge q)$ is equivalent to : [Sep. 06, 2020 (I)]

Options:

A. $p \wedge \sim q$

B. $\sim p \wedge \sim q$

C. $\sim p \vee \sim q$

D. $\sim p \vee q$

Answer: B

Solution:

Solution:
Negation of given statement $= \sim (p \vee (\sim p \wedge q))$
$= \sim p \wedge \sim(\sim p \wedge q) = \sim p \wedge (p \vee \sim q)$
$= (\sim p \wedge q) \vee (\sim p \wedge \sim q)$
$= F \vee (\sim p \wedge \sim q) = \sim p \wedge \sim q$

Question81

The negation of the Boolean expression $x \leftrightarrow \sim y$ is equivalent to: [Sep. 05, 2020 (I)]

Options:

A. $(x \wedge y) \vee (\sim x \wedge \sim y)$

B. $(x \wedge y) \wedge (\sim x \vee \sim y)$

C. $(x \wedge \sim y) \vee (\sim x \wedge y)$

D. $(\sim x \wedge y) \vee (\sim x \wedge \sim y)$

Answer: A

Solution:

Solution:
$p : x \leftrightarrow \sim y = (x \rightarrow \sim y) \wedge (\sim y \rightarrow x)$
$= (\sim x \vee \sim y) \wedge (y \vee x)$
$= \sim (x \wedge y) \wedge (x \vee y)$ $(\because \sim(x \wedge y) = \sim x \vee \sim y)$
Negation of p is
$\sim p = (x \wedge y) \vee \sim(x \vee y) = (x \wedge y) \vee (\sim x \wedge \sim y)$

Question82

Given the following two statements:
$(S_1) : (q \vee p) \rightarrow (p \leftrightarrow \sim q)$ is a tautology.
$(S_2) : \sim q \wedge (\sim p \leftrightarrow q)$ is a fallacy. Then :
[Sep. 04, 2020 (I)]

Options:

A. both (S_1) and (S_2) are correct

B. only (S_1) is correct

C. only (S_2) is correct

D. both (S_1) and (S_2) are not correct

Answer: D

Solution:

Solution:
The truth table of both the statements is

p	q	$\sim p$	$\sim q$	$q \vee p$	$p \leftrightarrow \sim q$	(S_1)	$\sim p \leftrightarrow q$	(S_2)
T	T	F	F	T	F	F	F	F
T	F	F	T	T	T	T	T	T
F	T	T	F	T	T	T	T	F
F	F	T	T	F	F	T	F	F

∴S_1 is not tautology and S_2 is not fallacy.
Hence, both the statements (S_1) and (S_2) are not correct.

Question83

The proposition p→ ~ (p ∧ ~q) is equivalent to : [Sep. 03, 2020 (I)]

Options:

A. q

B. (~p) ∨ q

C. (~p) ∧ q

D. (~p) ∨ (~q)

Answer: B

Solution:

Solution:

p	q	~q	p∧ ~ q	~p	p → ~(p∧~ q)	~ p ∨ q
T	T	F	F	F	T	T
T	F	T	T	F	F	F
F	T	F	F	T	T	T
F	F	T	F	T	T	T

∴p→ ~ (p ∧ ~q) is equivalent to ~p ∨ q

Question84

Let p, q, r be three statements such that the truth value of (p ∧ q) → (~q ∨ r) is F . Then the truth values of p, q, r are respectively: [Sep. 03, 2020 (II)]

Options:

A. T, F, T

B. T, T, T

C. F, T, F

D. T, T, F

Answer: D

Solution:

Solution:
$(p \wedge q) \to (\sim q \vee r)$
$= \sim(p \wedge q) \vee (\sim q \vee r)$
$= (\sim p \vee \sim q) \vee (\sim q \vee r)$
$= (\sim p \vee \sim q \vee r)$
$\because (\sim p \vee \sim q \vee r)$ is false, then $\sim p$, $\sim q$ and r all these must be false.
$\Rightarrow p$ is true, q is true and r is false.

Question85

Consider the statement: "For an integer n, if $n_3 - 1$ is even, then n is odd." The contrapositive statement of this statement is: [Sep. 06, 2020 (II)]

Options:

A. For an integer n, if n is even, then $n^3 - 1$ is odd.

B. For an intetger n, if $n^3 - 1$ is not even, then n is not odd.

C. For an integer n, if n is even, then $n^3 - 1$ is even.

D. For an integer n, if n is odd, then $n^3 - 1$ is even.

Answer: A

Solution:

Solution:
Contrapositive statement will be "For an integer n, if n is not odd then $n^3 - 1$ is not even".
Or
"For an integer n, if n is even then $n^3 - 1$ is odd".

Question86

The statement $(p \to (q \to p)) \to (p \to (p \vee q))$ is : [Sep. 05,2020 (II)]

Options:

A. equivalent to $(p \wedge q) \vee (\sim q)$

B. a contradiction

C. equivalent to $(p \vee q) \wedge (\sim p)$

D. a tautology

Answer: D

Solution:

Solution:
The truth table of (p → (q → p)) → (p → (p ∨ q)) is

p	q	pvq	p→(pvq)	q→p	p→(q→p)	(p→(q→p))→(p→(pvq))
T	T	O	T	T	T	T
T	F	T	T	T	T	T
F	T	T	T	F	T	T
F	F	F	T	T	T	T

Hence, the statement is tautology.

Question87

Contrapositive of the statement :
'If a function f is differentiable at a, then it is also continuous at a', is :
[Sep. 04, 2020 (II)]

Options:

A. If a function f is continuous at a, then it is not differentiable at a.

B. If a function f is not continuous at a, then it is not differentiable at a.

C. If a function f is not continuous at a, then it is differentiable at a

D. If a function f is continuous at a, then it is differentiable at a

Answer: B

Solution:

Solution:
Contrapositive statement will be "If a function is not continuous at 'a', then it is not differentiable at 'a'.

Question88

The contrapositive of the statement "If I reach the station in time, then I will catch the train" is :
[Sep. 02, 2020 (I)]

Options:

A. If I do not reach the station in time, then I will catch the train.

B. If I do not reach the station in time, then I will not catch the train.

C. If I will catch the train, then I reach the station in time.

D. If I will not catch the train, then I do not reach the station in time.

Answer: D

Solution:

Solution:
Contrapositive of $p \to q$ is $\sim q \to \sim p$
i.e. contrapositive of 'if p then q' is 'if not q then not p'.

Question89

The Boolean expression$((p \wedge q) \vee (p \vee \sim q)) \wedge (\sim p \wedge \sim q)$ is equivalent to :
[Jan. 12, 2019 (I)]

Options:

A. $p \wedge q$

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

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

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

Answer: C

Solution:

Solution:
Consider the Boolean expression
$((p \wedge q) \vee (p \vee \sim q)) \wedge (\sim p \wedge \sim q)$
$= (p \vee \sim q) \wedge (\sim p \wedge \sim q)$
$= ((p \vee \sim q) \wedge \sim p) \wedge ((p \vee \sim q) \wedge \sim q)$
$= ((p \wedge \sim p) \vee (\sim q \wedge \sim p)) \wedge \sim q$
$= (\sim p \wedge \sim q) \wedge \sim q = (\sim p \wedge \sim q)$

Question90

The expression $\sim(\sim p \to q)$ is logically equivalent to:
[Jan. 12,2019 (II)]

Options:

A. $\sim p \wedge \sim q$

B. $p \wedge \sim q$

C. $\sim p \wedge q$

D. $p \wedge q$

Answer: A

Solution:

Solution:
$\sim(\sim p \to Q) \equiv \sim (p \vee q) \equiv \sim p \wedge \sim q$

Question91

If q is false and $p \wedge q \leftrightarrow r$ is true, then which one of the following statements is a tautology?
[Jan. 11, 2019 (I)]

Options:

A. $(p \vee r) \to (p \wedge r)$

B. $(p \wedge r) \to (p \vee r)$

C. $p \wedge r$

D. $p \vee r$

Answer: B

Solution:

Solution:
q is false and $[(p \wedge q) \leftrightarrow r]$ is true
As $(p \wedge q)$ is false
[False $\leftrightarrow r$] is true
Hence r is false
Option (a): says $p \vee r$,
Since r is false
Hence $(p \vee r)$ can either be true or false
Option (b): says $(p \wedge r) \to (p \vee r)$
$(p \wedge r)$ is false
Since, $F \to T$ is true and
$F \to F$ is also true
Hence, it is a tautology
Option (c): $(p \vee r) \to (p \wedge r)$
i.e. $(p \vee r) \to F$
It can either be true or false
Option (d): $(p \wedge r)$,
Since, r is false
Hence, $(p \wedge r)$ is false.

Question92

Consider the following three statements:
P : 5 is a prime number.
Q : 7 is a factor of 192.
R : L.C.M. of 5 and 7 is 35 .

Then the truth value of which one of the following statements is true? [Jan. 10, 2019 (II)]

Options:

A. $(\sim P) \vee (Q \wedge R)$

B. $(P \wedge Q) \vee (\sim R)$

C. $(\sim P) \wedge (\sim Q \wedge R)$

D. $P \vee (\sim Q \wedge R)$

Answer: D

Solution:

Solution:
(d) P is True, Q is False and R is True
(a) $(\sim P) \vee (Q \wedge R) \equiv F \vee (F \wedge T) \equiv F \vee F = F$
(b) $(P \wedge Q) \vee (\sim R) \equiv (T \wedge F) \vee (F) \equiv F \vee F = F$
(c) $(\sim P) \wedge (\sim Q \wedge R) \equiv F \wedge (T \wedge T) \equiv F \wedge T = F$
(d) $P \vee (\sim Q \wedge R) \equiv T \vee (T \wedge T) \equiv T \vee T = T$

Question93

If the Boolean expression $(p \oplus q) \wedge (\sim p \circledcirc q)$ is equivalent to $p \wedge q$, where $\oplus, \circledcirc \in \{\wedge, \vee\}$ then the ordered pair $(\oplus, \circledcirc)$ is: [Jan. 09, 2019 (I)]

Options:

A. $(\vee, \wedge)$

B. $(\vee, \vee)$

C. $(\wedge, \vee)$

D. $(\wedge, \wedge)$

Answer: C

Solution:

Solution:
Check each option
(a) $(p \vee q) \wedge (\sim p \wedge q) = (\sim p \wedge q)$
(b) $(p \vee q) \wedge (\sim p \vee q) = q$
(c) $(p \wedge q) \wedge (\sim p \vee q) = p \wedge q$
(d) $(p \wedge q) \wedge (\sim p \wedge q) = F$

Question94

The logical statement $[\sim(\sim p \vee q) \vee (p \wedge r)] \wedge (\sim p \wedge r)$ is equivalent to:

[Jan. 09, 2019 (II)]

Options:

A. (~p ∧ ~q) ∧ r

B. ~p ∨ r

C. (p ∧ r) ∧ ~q

D. (p ∧ ~q) ∨ r

Answer: C

Solution:

Solution:
Logical statement,
= [~(~p ∨ q) ∨ (p ∧ r)] ∧ (~q ∧ r)
= [(p ∧ ~q) ∨ (p ∧ r)] ∧ (~q ∧ r)
= [(p ∧ ~q) ∧ (~q ∧ r)] ∨ [(p ∧ r) ∧(~q ∧ r)]
= [p ∧ ~q ∧ r] ∨ [p ∧ r ∧ ~q]
= (p ∧ ~q) ∧ r
= (p ∧ r) ∧ ~q

Question95

Contrapositive of the statement “If two numbers are not equal, then their squares are not equal”. is : [Jan. 11, 2019 (II)]

Options:

A. If the squares of two numbers are not equal, then the numbers are equal.

B. If the squares of two numbers are equal, then the numbers are not equal .

C. If the squares of two numbers are equal, then the numbers are equal.

D. If the squares of two numbers are not equal, then the numbers are not equal.

Answer: C

Solution:

Solution:
Contrapositive of “If A then B” is “If ~B then ~A”. Hence contrapositive of “If two numbers are not equal, then their squares are not equal” is “If squares of two numbers are equal, then the two numbers are equal”.

Question96

If the truth value of the statement p → (~q ∨ r) is false (F), then the truth values of the statements p, q, r arerespectively. [April 12, 2019 (I)]

Options:

A. T, T, F

B. T, F, F

C. T, F, T

D. F, T, T

Answer: A

Solution:

Solution:
Given statement $p \rightarrow (\sim q \vee r)$ is False.
$\Rightarrow p$ is True and $\sim q \vee r$ is False
$\Rightarrow p$ is True and $\sim q$ is False and r is False
$\therefore$ truth values of p, q, r are T, T, F respectively.

Question97

The Boolean expression ~(p ⇒ (~q)) is equivalent to: [April 12, 2019 (II)]

Options:

A. $p \wedge q$

B. $q \Rightarrow \sim p$

C. $p \vee q$

D. $(\sim p) \Rightarrow q$

Answer: A

Solution:

Solution:
Given Boolean expression is,
$\sim(p \Rightarrow (\sim q))$ $\{\because p \Rightarrow q$ is same as $\sim p \vee q\}$
$\equiv \sim((\sim p) \vee (\sim q)) \equiv p \wedge q$

Question98

Which one of the following Boolean expressions is a tautology ? [April 10, 2019 (I)]

Options:

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

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

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

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

Answer: B

Solution:

Solution:
$(p \vee q) \vee (p \vee \sim q) = p \vee (q \vee p) \vee \sim q$
$= (p \vee p) \vee (q \vee \sim q) = p \vee T = T$
Hence first statement is tautology.

Question99

If $p \Rightarrow (q \vee r)$ is false, then the truth values of p, q, r are respectively: [April 09, 2019 (II)]

Options:

A. F, T, T

B. T, F, F

C. T, T, F

D. F, F, F

Answer: B

Solution:

Solution:
For $p \Rightarrow q \vee r$ to be F.
r should be F and $p \Rightarrow q$ should be F
for $p \Rightarrow q$ to be F, $p \Rightarrow T$ and $q \Rightarrow F$
$p, q, r \equiv T, F, F$

Question100

Which one of the following statements is not a tautology? [April 08, 2019(II)]

Options:

A. $(p \vee q) \rightarrow (p \vee (\sim q))$

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

C. $p \rightarrow (p \vee q)$

D. $(p \wedge q) \rightarrow p$

Answer: A

Solution:

Solution:
By truth table :

p	q	~q	pv~q	~p	p∧~q	pvq	p→pq	p∧q	(p∧q)→p	~pvq	(p∧q)→(~p)vq	(pvq)→(pv(~q))
T	T	F	T	F	F	T	T	T	T	T	T	T
T	F	T	T	F	T	T	T	F	T	F	T	T
F	T	F	F	T	F	T	T	F	T	T	T	F
F	F	T	T	T	F	F	T	F	T	T	T	T

Question101

The negation of the Boolean expression ~s ∨ (~r ∧ s) is equivalent to : [April 10, 2019 (II)]

Options:

A. ~s ∧ ~r

B. r

C. s ∨ r

D. s ∧ r

Answer: D

Solution:

Solution:
~s ∨ (~r ∧ s) ≡ (~s ∨ ~r) ∧ (~s ∨ s)
≡(~s ∨ ~r)   (∵ ~s ∨ s) is tautology)
≡ ~ (s ∧ r)
Hence, its negation is s ∧ r.

Question102

For any two statements p and q, the negation of the expression p ∨ (~p ∧ q) is:
[April 9, 2019 (I)]

Options:

A. ~p ∧ ~q

B. p ∧ q

C. p ↔ q

D. $\sim p \vee \sim q$

Answer: D

Solution:

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

Question103

The contrapositive of the statement "If you are born in India, then you are a citizen of India", is : [April 8, 2019 (I)]

Options:

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.

Answer: A

Solution:

Solution:
S: ‘’If you are born in India, then you are a citizen of India.’’
Contrapositive of $p \rightarrow q$ is $\sim q \rightarrow \sim p$
So contrapositive of statement S will be :
‘’If you are not a citien of India, then you are not born in India.’’

Question104

If $p \rightarrow (\sim p \vee \sim q)$ is false, then the truth values of p and q are respectively. [Online April 16, 2018]

Options:

A. T, F

B. F, F

C. F, T

D. T,T

Answer: D

Solution:

Solution:

p	q	~p	~q	~p v ~q	p→(~p v ~q)
T	T	F	F	F	F
T	F	F	T	T	T
F	T	T	F	T	T
F	F	T	T	T	T

From the truth table,
p → (∼p ∨ ∼q) is false only when p and q both are true.

Question105

The Boolean expression∼(p ∨ q) ∨ (∼p ∧ q) is equivalent to [2018]

Options:

A. p

B. q

C. ∼q

D. ∼p

Answer: D

Solution:

Solution:
∼(p ∨ q) ∨ (∼p ∧ q)
⇒(∼p ∧ ∼q) ∨ (∼p ∧ q)
⇒ ∼ p ∧ (∼q ∨ q)
⇒ ∼ p ∧ t≡ ∼ p

Question106

If (p ∧ ∼q) ∧ (p ∧ r)→ ∼ p ∨ q is false, then the truth values of p, q and r are respectively [Online April 15, 2018]

Options:

A. F, T, F

B. T, F, T

C. F, F, F

D. T, T, T

Answer: B

Solution:

Solution:
As the truth table for the $(p \wedge \sim q) \wedge (p \wedge r) \rightarrow \sim p \vee q$ is false, then only possible values of (p, q, r) is (T, F, T)

p	q	r	~q	p∧~q	p∧r	~p	~pvq	(p∧~q)∧(p∧r)	(p∧~q)∧(p∧r)→~pvq
T	T	T	F	F	T	F	T	F	T
T	F	T	T	T	T	F	F	T	F
T	T	F	F	F	F	F	T	F	T
F	T	T	F	F	F	T	T	F	T
F	F	T	T	F	F	T	T	F	T
F	T	F	F	F	F	T	T	F	T
T	F	F	T	T	F	F	F	F	T
F	F	F	T	F	F	T	T	F	T

Question107

Consider the following two statements.
Statement p:
The value of sin 120° can be divided by taking θ = 240° in the equation $2\sin\frac{\theta}{2} = \sqrt{1+\sin\theta} - \sqrt{1-\sin\theta}$.
Statement q: The angles A, B, C and D ofany quadrilateral ABCD satisfy the equation $\cos\left(\frac{1}{2}(A+C)\right) + \cos\left(\frac{1}{2}(B+D)\right) = 0$
Then the truth values of p and q are respectively.
[Online April 15, 2018]

Options:

A. F, T

B. T, T

C. F, F

D. T, F

Answer: A

Solution:

Solution:
Statement p:
$\sin 120° = \cos 30° = \frac{\sqrt{3}}{2} \Rightarrow 2\sin 120° = \sqrt{3}$
So, $\sqrt{1+\sin 240°} - \sqrt{1-\sin 240°}$
$= \sqrt{\frac{1-\sqrt{3}}{2}} - \sqrt{\frac{1+\sqrt{3}}{2}} \neq \sqrt{3}$
Statement q:
So, $A + B + C + D = 2\pi \Rightarrow \frac{A+C}{2} + \frac{B+D}{2} = \pi$
$\Rightarrow \cos\left(\frac{A+C}{2}\right) + \cos\left(\frac{B+D}{2}\right)$
$= \cos\left(\frac{A+C}{2}\right) - \cos\left(\frac{A+C}{2}\right) = 0$
Therefore, statement p is false and statement q is true.

Question108

Which of the following is a tautology? [2017]

Options:

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

B. $(q \rightarrow p) \vee \sim(p \rightarrow q)$

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

D. $(p \rightarrow q) \wedge (q \rightarrow p)$

Answer: A

Solution:

Solution:
Truth table

p	q	~p	pvq	(~p)∧(pvq)	(~p)∧(pvq)→q
T	T	F	T	F	T
T	F	F	T	F	T
F	T	T	T	T	T
F	F	T	F	F	T

∴(a) $\sim p \wedge (p \vee q) \rightarrow q$ be a tautology
Other options are not tautology.

Question109

The following statement (p → q) → [(~p → q) → q] is [2017]

Options:

A. a fallacy

B. a tautology

C. equivalent to ~p → q

D. equivalent to p→ ~ q

Answer: B

Solution:

Solution:
We have

p	q	~p	p→q	~p→q	(~p→q)→q	(p→q)→((~p→q)→q)
T	F	F	F	T	F	T
T	T	F	T	T	T	T
F	F	T	T	F	T	T
F	T	T	T	T	T	T

∴ It is tautology

Question110

The proposition (~p) ∨ (p ∧ ~q) [Online April 8, 2017]

Options:

A. p→ ~ q

B. p ∧ (~q)

C. q → p

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

Answer: B

Solution:

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

p	q	~p	~q	p∧~q	(~p)∨(p∧~q)
T	T	F	F	F	F
T	F	F	T	T	T
F	T	T	F	F	F
F	F	T	T	F	F

Question111

Contraposittive of the statement
'If two numbers are not equal, then their squares are not equal', is : [Online April 9, 2017]

Options:

A. If the squares of two numbers are equal, then the numbers are equal.

B. If the squares of two numbers are equal, then the numbers are not equal.

C. If the squares of two numbers are not equal, then the numbers are not equal.

D. If the squares of two numbers are not equal, then the numbers are equal.

Answer: A

Solution:

Solution:
$p \rightarrow q$
then $\sim q \rightarrow \sim p$
∴ If the square of two numbers are equal, then the numbers are equal.

Question112

The Boolean Expression $(p \wedge \sim q) \vee q \vee (\sim p \wedge q)$ is equivalent to: [2016]

Options:

A. $p \vee q$

B. $p \vee \sim q$

C. $\sim p \wedge q$

D. $p \wedge q$

Answer: A

Solution:

Solution:
$(p \wedge \sim q) \vee q \vee (\sim p \wedge q)$
$\Rightarrow \{(p \vee q) \wedge (\sim q \vee q)\} \vee (\sim p \wedge q)$
$\Rightarrow \{(p \vee q) \wedge T\} \vee (\sim p \wedge q)$
$\Rightarrow (p \vee q) \vee (\sim p \wedge q)$
$\Rightarrow \{(p \vee q) \vee \sim p\} \wedge (p \vee q \vee q)$
$\Rightarrow T \wedge (p \vee q)$
$\Rightarrow p \vee q$

Question113

The contrapositive of the following statement, "If the side of a square doubles, then its area increases four times", is : [Online April 10, 2016]

Options:

A. If the area of a square increases four times, then its side is not doubled.

B. If the area of a square increases four times, then its side is doubled.

C. If the area of a square does not increases four times, then its side is not doubled.

D. If the side of a square is not doubled, then its area does not increase four times.

Answer: C

Solution:

Solution:
Contrapositive of $p \rightarrow q$ is given by $\sim q \rightarrow \sim p$
So (c) is the right option.

Question114

Consider the following two statements: P: If 7 is an odd number, then 7 is divisible by 2 . Q: If 7 is a prime number, then 7 is an odd number. If V_1 is the truth value of the contrapositive of P and V_2 is the truth value of contrapositive of Q, then the ordered pair (V_1, V_2) equals: [Online April 9, 2016]

Options:

A. (F , F)

B. (F , T)

C. (T , F)

D. (T , T)

Answer: A

Solution:

Solution:
Contrapositive of P :
T is not divisible by 2 ⇒ T is not odd number
T ⇒ F : F (V_1)
Contra positive Q :
T is not odd number ⇒ T is not a prime number
F ⇒ F : T (V_2)

Question115

The negation of ~s ∨ (~r ∧ s) is equivalent to : [2015]

Options:

A. s ∨ (r ∨ ~s)

B. s ∧ r

C. S ∧ ~r

D. S ∧ (r ∧ ~s)

Answer: B

Solution:

Solution:
~[~S ∨ (~r ∧ s)]
= s ∧ ~(~r ∧ s)
= s ∧ (r ∨ ~s)
= (s ∧ r) ∨ (s ∧ ~s)
= (s ∧ r) ∨ f
= s ∧ r

Question116

Consider the following statements :
P: Suman is brilliant
Q: Suman is rich.
R: Suman is honest
the negation of the statement

"Suman is brilliant and dishonest if and only if suman is rich" can be equivalently expressed as :
[Online April 11, 2015]

Options:

A. $\sim Q \leftrightarrow \sim P \vee R$

B. $\sim Q \leftrightarrow \sim P \wedge R$

C. $\sim Q \leftrightarrow P \vee \sim R$

D. $\sim Q \leftrightarrow P \wedge \sim R$

Answer: D

Solution:

Solution:
Suman is brilliant and dishonest can be expressed as $P \wedge \sim R$
therefore given statement is equal to $(P \wedge \sim R) \leftrightarrow Q$
Negation of the above statement is $\sim Q \leftrightarrow P \wedge \sim R$

Question117

The contrapositive of the statement "If it is raining, then I will not come", is :
[Online April 10, 2015]

Options:

A. If I will not come, then it is raining.

B. If I will not come, then it is not raining.

C. If I will come, then it is raining.

D. If I will come, then it is not raining.

Answer: D

Solution:

Solution:
The centre positive of the statement is "If i will come, then it is not raining".

Question118

The statement $\sim(p \leftrightarrow \sim q)$ is:
[2014]

Options:

A. a tautology

B. a fallacy

C. eqivalent to $p \leftrightarrow q$

D. equivalent to $\sim p \leftrightarrow q$

Answer: C

Solution:

Solution:

p	q	~q	p↔~q	~(p↔~q)	p↔q
F	F	T	F	T	T
F	T	F	T	F	F
T	F	T	T	F	F
T	T	F	F	T	T

From column (i) and (ii) are equivalent.
Clearly equivalent to p↔q

Question119

Let p, q, r denote arbitrary statements. Then the logically equivalent of the statement $p \Rightarrow (q \vee r)$ is:
[Online April 12, 2014]

Options:

A. $(p \vee q) \Rightarrow r$

B. $(p \Rightarrow q) \vee (p \Rightarrow r)$

C. $(p \Rightarrow \sim q) \wedge (p \Rightarrow r)$

D. $(p \Rightarrow q) \wedge (p \Rightarrow \sim r)$

Answer: B

Solution:

Solution:
Given statement is
$p \Rightarrow (q \vee r)$ which is equivalent to
$(p \Rightarrow q) \vee (p \Rightarrow r)$

Question120

The proposition $\sim(p \vee \sim q) \vee \sim(p \vee q)$ is logically equivalent to: [Online April 11, 2014]

Options:

A. p

B. q

C. ~p

D. ~q

Answer: C

Solution:

Solution:
Given $\sim(p \vee \sim q) \vee \sim(p \vee q)$
$\equiv(\sim p \vee q) \vee (\sim p \vee \sim q)$
$\equiv \sim p \vee (q \vee \sim q)$
$\equiv \sim p$

Question121

The contrapositive of the statement "if I am not feeling well, then I will go to the doctor" is
[Online April 19, 2014]

Options:

A. If I am feeling well, then I will not go to the doctor

B. If I will go to the doctor, then I am feeling well

C. If I will not go to the doctor, then I am feeling well

D. If I will go to the doctor, then I am not feeling well.

Answer: C

Solution:

Solution:
Given statement can be written in implication form as
I am not feeling well ⇒ I will go to the doctor.
Contrapositive form :
I will not go to the doctor ⇒ I am feeling well.
i.e. If I will not go to the doctor, then I am feeling well.

Question122

The contrapositive of the statement "I go to school if it does not rain" is
[Online April 9, 2014]

Options:

A. If it rains, I do not go to school.

B. If I do not go to school, it rains.

C. If it rains, I go to school.

D. If I go to school, it rains.

Answer: B

Solution:

Solution:
let $p =$ If it does not rain
$q =$ I go to school
According to law of contrapositive
$p \Rightarrow q \equiv \sim q \Rightarrow \sim p$
i.e. $\sim q =$ I do not go to school
$\sim p =$ It rains
$\sim q \Rightarrow \sim p$ is If I do not go to school, it rains.

Question123

Consider
Statement-1 : $(p \wedge \sim q) \wedge (\sim p \wedge q)$ is a fallacy.
Statement- 2: $(p \rightarrow q) \leftrightarrow (\sim q \rightarrow \sim p)$ is a tautology.
[2013]

Options:

A. Statement-1 is true; Statement-2 is true;
Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is true; Statement-2 is true; Statement-2 is not a correct explanation for Statement-1.

C. Statement-1 is true; Statement-2 is false.

D. Statement-1 is false; Statement-2 is true.

Answer: B

Solution:

Solution:
Statement-2 : $(p \rightarrow q) \leftrightarrow (\sim q \rightarrow \sim p)$
$\equiv (p \rightarrow q) \leftrightarrow (p \rightarrow q)$
which is always true.
So, statement 2 is true
Statement-1: $(p \wedge \sim q) \wedge (\sim p \wedge q)$
$= p \wedge \sim q \wedge \sim p \wedge q$
$= p \wedge \sim p \wedge \sim q \wedge q$
$= f \wedge f = f$
So statement- 1 is true

Question124

Let p and q be any two logical statements andr : $p \to (\sim p \vee q)$. If r has a truth value F , then the truth values of p and q are respectively: [Online April 25, 2013]

Options:

A. F, F

B. T, T

C. T, F

D. F, T

Answer: C

Solution:

Solution:
$p \to (\sim p \vee q)$ has truth value F .
It means $p \to (\sim p \vee q)$ is false.
It means p is true and $\sim p \vee q$ is false.
$\Rightarrow p$ is true and both $\sim p$ and q are false.
$\Rightarrow p$ is true and q is false.

Question125

For integers m and n, both greater than 1, consider the following three statements:
P : m divides n
Q : m divides n^2
R : m is prime,
then
[Online April 23, 2013]

Options:

A. $Q \wedge R \to P$

B. $P \wedge Q \to R$

C. $Q \to R$

D. $Q \to P$

Answer: A

Solution:

Solution:
(b) $\frac{8}{4} = 2, \frac{64}{4} = 16$; but 4 is not prime.
Hence $P \wedge Q \to R$, false

(c) $\frac{(6)^2}{12} = \frac{36}{12} = 3$; but 12 is not prime
Hence Q → R, false
(d) $\frac{(4)^2}{8} = \frac{16}{8} = 2$; $\frac{4}{8}$ is not an integer
Hence Q → P, false

Question126

The statement p → (q → p) is equivalent to :
[Online April 22, 2013]

Options:

A. p → q

B. p → (p ∨ q)

C. p → (p → q)

D. p → (p ∧ q)

Answer: B

Solution:

Solution:

q	p	q→p	p→(q→p)	pvq	p→(pvq)
T	T	T	T	T	T
T	F	F	T	T	T
F	T	T	T	T	T
F	F	T	T	F	T

Since truth value of p → (q → p) and p → (p ∨ q) are same, hence p → (q → p) is equivalent to p → (p ∨ q)

Question127

Statement-1: The statement A → (B → A) is equivalent to A → (A ∨ B).
Statement-2: The statement ~[(A ∧ B) → (~A ∨ B)] is a Tautology.
[Online April 9, 2013]

Options:

A. Statement-1 is false; Statement-2 is true.

B. Statement-1 is true; Statement-2 is true; Statement- 2 is not correct explanation for Statement-1.

C. Statement-1 is true; Statement-2 is false.

D. Statement-1 is true; Statement-2 is true; Statement- 2 is the correct explanation for Statement-1.

Answer: C

Solution:

A	B	~A	A∧B	~A∨B	(A∧B)→(~A∨B)	~[(A∧B)→(~A∨B)]
T	T	F	T	T	T	F
T	F	F	F	F	T	F
F	T	T	F	T	T	F
F	F	T	F	T	T	F

Question128

Let p and q be two Statements. Amongst the following, the Statement that is equivalent to p → q is
[Online May 19, 2012]

Options:

A. $p \wedge \sim q$

B. $\sim p \vee q$

C. $\sim p \wedge q$

D. $p \vee \sim q$

Answer: B

Solution:

Solution:
Let p and q be two statements.
$p \rightarrow q$ is equivalent to $\sim p \vee q$

Question129

The logically equivalent preposition of $p \Leftrightarrow q$ is
[Online May 12, 2012]

Options:

A. $(p \Rightarrow q) \wedge (q \Rightarrow p)$

B. $p \wedge q$

C. $(p \wedge q) \vee (q \Rightarrow p)$

D. $(p \wedge q) \Rightarrow (q \vee p)$

Answer: A

Solution:

Solution:
$(p \Rightarrow q) \wedge (q \Rightarrow p)$ means $p \Leftrightarrow q$

Question130

The negation of the statement
"If I become a teacher, then I will open a school", is :
[2012]

Options:

A. I will become a teacher and I will not open a school.

B. Either I will not become a teacher or I will not open a school.

C. Neither I will become a teacher nor I will open a school.

D. I will not become a teacher or I will open a school.

Answer: A

Solution:

Solution:
Let p: I become a teacher.
q: I will open a school
Negation of $p \rightarrow q$ is $\sim(p \rightarrow q) = p \wedge \sim q$
i.e. I will become a teacher and I will not open a school.

Question131

Let p and q denote the following statements
p : The sun is shining
q: I shall play tennis in the afternoon
The negation of the statement “If the sun is shining then I shall play tennis in the afternoon”, is

[Online May 26, 2012]

Options:

A. $q \Rightarrow \sim p$

B. $q \wedge \sim p$

C. $p \wedge \sim q$

D. $\sim q \Rightarrow \sim p$

Answer: C

Solution:

Solution:
Let p : The sun is shining.
q : I shall play tennis in the afternoon.
Negation of $p \to q$ is $\sim(p \to q) = p \wedge \sim q$

Question132

The Statement that is TRUE among the following is [Online May 7,2012]

Options:

A. The contrapositive of $3x + 2 = 8 \Rightarrow x = 2$ is $x \neq 2 \Rightarrow 3x + 2 \neq 8$

B. The converse of $\tan x = 0 \Rightarrow x = 0$ is $x \neq 0 \Rightarrow \tan x = 0$.

C. $p \Rightarrow q$ is equivalent to $p \vee \sim q$.

D. $p \vee q$ and $p \wedge q$ have the same truth table.

Answer: A

Solution:

Solution:
Only statement given in option
(a) is true.
(b) The converse of $\tan x = 0 \Rightarrow x = 0$ is
$x = 0 \Rightarrow \tan x = 0$
∴ Statement (b) is false
(c) $\sim(p \Rightarrow q)$ is equivalent to $p \wedge \sim q$
∴ Statement given in option (c) is false.
(d) No, $p \vee q$ and $p \wedge q$ does not have the same truthvalue.

Question133

The only statement among the following that is a tautology is [2011 RS]

Options:

A. $A \wedge (A \vee B)$

B. $A \vee (A \wedge B)$

C. $[A \wedge (A \rightarrow B)] \rightarrow B$

D. $B \rightarrow [A \wedge (A \rightarrow B)]$

Answer: C

Solution:

Solution:
Truth table of all options is as follows.

A	B	AvB	A∧B	A∧(A∧B)	Av(A∧B)	A→B	A∧(A→B)	[A∧(A→B)→B]	[B→A∧(A→B)]
T	F	T	F	T	T	F	F	T	T
F	T	T	F	F	F	T	F	T	F
T	T	T	T	T	T	T	T	T	T
F	F	F	F	F	F	T	F	T	T

∴ It is tautology

Question134

Let S be a non-empty subset of R. Consider the following statement: P: There is a rational number x ∈ S such that x > 0. Which of the following statements is the negation of the statement P? [2010]

Options:

A. There is no rational number $x \in S$ such than $x \leq 0$.

B. Every rational number $x \in S$ satisfies $x \leq 0$.

C. $x \in S$ and $x \leq 0 \Rightarrow x$ is not rational.

D. There is a rational number $x \in S$ such that $x \leq 0$.

Answer: B

Solution:

Solution:
Given that P: there is a rational number $x \in S$ such that $x > 0$.
~P: Every rational number $x \in S$ satisfies $x \leq 0$.

Question135

Statement-1: ~(p↔ ~ q) is equivalent to p ↔ q.
Statement- 2: ~(p↔ ~ q) is a tantology
[2009]

Options:

A. Statement-1 is true, Statement-2 is true;
Statement-2 is not a correct explanation for Statement-1.

B. Statement-1 is true, Statement-2 is false.

C. Statement-1 is false, Statement-2 is true.

D. Statement-1 is true, Statement-2 is true,
Statement-2 is a correct explanation for statement -1

Answer: B

Solution:

Solution:
The truth table for the logical statements, involved in statement 1, is as follows :

p	q	~q	p↔~q	(p↔~q)	p↔q
T	T	F	F	T	T
T	F	T	T	F	F
F	T	F	T	F	F
F	F	T	F	T	T

We observe the columns (i) and (ii) are identical, therefore $\sim(p \leftrightarrow \sim q)$ is equivalent to $p \leftrightarrow q$
But $\sim(p \leftrightarrow \sim q)$ is not a tautology as all entries in its column are not T .
∴ Statement- 1 is true but statement- 2 is false.

Question136

The statement p → (q → p) is equivalent to
[2008]

Options:

A. $p \to (p \to q)$

B. $p \to (p \vee q)$

C. $p \to (p \wedge q)$

D. $p \to (p \leftrightarrow q)$

Answer: B

Solution:

Solution:
The truth table for the given statements, as follows :

p	q	pvq	q→p	p→(q→p)	p→(pvq)
T	T	T	T	T	T
T	F	T	T	T	T
F	T	T	F	T	T
F	F	F	T	T	T

From table we observe that
$p \to (q \to p)$ is equivalent to $p \to (p \vee q)$

Question137

Let p be the statement “x is an irrational number”, q be the statement “y is a transcendental number”, and r be the statement “ x is a rational number iff y is a transcendental number”.
Statement-1 : r is equivalent to either q or p
Statement-2 : r is equivalent to $\sim(p \leftrightarrow \sim q)$.
[2008]

Options:

A. Statement -1 is false, Statement-2 is true

B. Statement -1 is true, Statement-2 is true; Statement -2 is a correct explanation for Statement-1

C. Statement -1 is true, Statement-2 is true; Statement -2 is not a correct explanation for Statement-1

D. None

Answer: D

Solution:

Solution:
Given that
p : x is an irrational number
q : y is a transcendental number
r : x is a rational number iff y is a transcendental number.
clearly $r : \sim p \leftrightarrow q$
Truth table to check the equivalence of ' r ' and ' q or p '; ' r and $\sim(p \leftrightarrow \sim q)$

p	q	~p	~q	~p↔q	q or p	p↔~q	~(p↔~q)
T	T	F	F	F	T	F	T
T	F	F	T	T	T	T	F
F	T	T	F	T	T	T	F
F	F	T	T	F	F	F	T

From columns (i), (ii) and (iii), we observe, that none of the these statements are equivalent to each other.
∴ Statement 1as well as statement 2 both are false.
∴ None of the options is correct.
