Question 1

Which of the following compound propositions is/are a tautology?

A. $[p \wedge (p \to q)] \to q$
B. $[q \wedge (p \to q)] \to p$
C. $[(p \vee q) \wedge (r \to p) \wedge (r \to q)] \to r$
D. $[(p \vee q) \wedge (p \to r) \wedge (q \to r)] \to r$

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Answer 1

A. Argument is of the form Modus Ponens. So, It is Tautology

B. With p=F and q=T, antecedent becomes True and conclusion becomes False. So, the Compound Proposition becomes False. Not Tautology.

C. With p=T and r=F, Antecedent becomes True and Conclusion becomes False. So, the Compound Proposition becomes False. Not Tautology.

D. Either p or q will be True. In any case, r will happen (becomes True). It is Tautology.

Answer: A, D

answered Mar 29, 2024 • selected Mar 31, 2024 by **Deepak Poonia**

Https_guru

Question 2

Let p, q be two atomic propositional assertions. Then which of the following is/are false?

A. $(p \rightarrow q) \vee (p \rightarrow \neg q)$ is a tautology.
B. $(p \rightarrow q) \vee (q \rightarrow p)$ is a tautology.
C. $(p \rightarrow q) \vee (q \rightarrow \neg p)$ is a tautology.
D. $(p \rightarrow q) \vee (\neg q \rightarrow \neg p)$ is a tautology.

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Answer 2

Solving them By Case Method, Case 1 : p = true, Case 2 : p = false

(A) : Case 1 : $(T \rightarrow q) \vee (T \rightarrow q') = q \vee q' = T$ **Hence a tautology.**

Case 2 : $(F \rightarrow q) \vee (F \rightarrow q') = T \vee T = T$ **Hence a tautology.**

(B) : Case 1 : $(T \rightarrow q) \vee (q \rightarrow T) = q \vee T = T$. **Hence a tautology.**

Case 2 : $(F \rightarrow q) \vee (q \rightarrow F) = T \vee q' = T$. **Hence a tautology.**

(C) : Case 1 : $(T \rightarrow q) \vee (q \rightarrow F) = q \vee q' = T$. **Hence a tautology.**

Case 2 : $(F \rightarrow q) \vee (q \rightarrow T) = T \vee T = T$. **Hence a tautology.**

(D) : Case 1 : $(T \rightarrow q) \vee (p \rightarrow q) = (T \rightarrow q) \vee (T \rightarrow q) = q \vee q = q$. **We can stop here as q can either be True or False hence a contingency and not a tautology.**

Hence, Answer to this question would be option d.

answered Apr 6, 2023 • selected Apr 6, 2023 by **Deepak Poonia**

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Chokostar

Question 3

Let's consider the interpretation v where $v(p) = F, v(q) = T, v(r) = T$. Which of the following propositional formulas are satisfied by v?

A. $(p \to \neg q) \vee \neg(r \wedge q)$
B. $(\neg p \vee \neg q) \to (p \vee \neg r)$
C. $\neg(\neg p \to \neg q) \wedge r$
D. $\neg(\neg p \to q \wedge \neg r)$

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Answer 3

A row in a truth table is known as Intrepretation. (An Intrpretation is a combination of truth values assigned to the propositional variables)

One of the given intrepretation v is $p = F, q = T, r = T$

Option A: $(p \to\sim q) \vee \sim (r \wedge q) = T$

Option B: $(\sim p \vee \sim q) \to (p \vee \sim r) = F$

Option C: $\sim (\sim p \to\sim q) \wedge r = T$

Option D: $\sim (\sim p \to (q \wedge \sim r)) = T$

Option A, C, D ***True*** and hence are said to satisfy the given intrepretation v

answered Apr 6, 2023 • selected Apr 6, 2023 by **Deepak Poonia**

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Vineeth Rambhiya

Question 4

Consider the following atomic propositions:

- R: It is Raining
- S: Sonu is Sick

Which of the following is/are correct English Translation of the following logical expression:

$$(\mathrm{R} \vee \neg \mathrm{S}) \wedge (\neg \mathrm{R} \vee \mathrm{S})?$$

A. It is raining if and only if sonu is not sick
B. If sonu is sick then it is raining, and vice versa
C. It is raining is equivalent to sonu is sick
D. It is raining or sonu is sick but not both

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Answer 4

My approach :

Using $A \to B = \neg A \vee B$

$\boxed{(R \vee \neg S) \wedge (\neg R \vee S) = (S \to R) \wedge (R \to S) = R \leftrightarrow S}$

option A: $R \leftrightarrow \neg S = (R \wedge \neg S) \vee (\neg R \wedge S) = R \oplus S$

option B is directly an english interpretation of this hence correct.

option C: $R \equiv S = R \leftrightarrow S$, hence option C is also correct.

option D: $R \oplus S$, we know that bi-implication is same as not(xor) but option D means xor so incorrect.

answered Apr 6, 2023 • edited Dec 8, 2024 by **Anujs**

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Chokostar

Question 5

Consider the following arguments.

- Argument 1: Kerry errs or Myrna fails to show. If Kerry errs, then he does not break the record. Myrna fails to show. Therefore, Kerry does break the record.
- Argument 2: If Tasha leaves, then Carol moves in. If Carol moves in, then Sam is not happy. If Sam is not happy, then Josh laughs. Sam is happy. Hence, Tasha does not leave.

Which of the following is true?

A. Only Argument 1 is valid.
B. Only Argument 2 is valid.
C. Both Arguments are valid.
D. No Argument is valid.

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Answer 5

Argument 1:

Let, K: Kerry errs; M: Myrna fails to show; B: Kerry does break record.

Forming Argument:

$K \vee M$

$K \rightarrow \neg B$

M

$\therefore K$

Assuming conclusion is False and trying to make all premises True. If we become succeed then argument is not valid otherwise argument is valid.

K=False (Assuming conclusion is False)
M=True (made third premise True)

$K \rightarrow \neg B \equiv False \rightarrow \neg B \equiv True$ (2nd Premise is True)

$K \vee M \equiv False \vee True \equiv True$ (1st Premise is True)

Hence, Argument 1 is not valid.

Argument 2:

Let, L: Tasha leaves; C: Carol moves in; S: Sam is happy; J: Josh laughs

Forming Argument:

$L \rightarrow C$

$C \rightarrow \neg S$

$\neg S \rightarrow J$

S

$\therefore \neg L$

Assuming conclusion is False and trying to make all premises True. If we become succeed then argument is not valid otherwise argument is valid.

With L=True, Conclusion becomes false.

S=True (made 4th premise True)

$\neg S \rightarrow J \equiv \neg True \rightarrow J \equiv False \rightarrow J \equiv True$ (3rd premise is True)

$C \rightarrow \neg S \equiv C \rightarrow \neg True \equiv C \rightarrow False$

To make 2nd premise True, take C=False. $False \rightarrow False \equiv True$ (2nd premise True)

$L \rightarrow C \equiv True \rightarrow False \equiv False$ (unable to make 1st premise True)
Hence, Argument 2 is Valid.

Answer: Option B: Only Argument 2 is valid.

answered Mar 29, 2024

Https_guru

Question 6

Let F and G be two propositional formula.

Which of the following is/are True?

A. $F \vee G$ is a tautology iff at least one of them is a tautology
B. If $F \rightarrow G$ is a tautology and F is a tautology, then G is a tautology.
C. $(F \rightarrow G) \vee (F \rightarrow \neg G)$ is a tautology.
D. $(F \rightarrow G) \wedge (F \rightarrow \neg G)$ is a tautology iff F is a contradiction.

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Answer 6

here answer should be ABCD but given is BCD

A because FVQ so if atleast one of them is true then output is true ..

answered Apr 6, 2023

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JayRathi

Question 7

The “implies” connective “$\rightarrow$” is one of the stranger connectives in propositional logic. Below are a series of statements regarding implications.

Which of the following statements is/are TRUE?

A. For any propositions P and Q, the following is always true: $(P \rightarrow Q) \vee (Q \rightarrow P)$.

B. For any propositions P, Q and R, the following statement is always true: $(P \rightarrow Q) \vee (Q \rightarrow R)$.

C. For any propositions P, Q and R, the following statement is always true: $(P \rightarrow Q) \vee (\neg P \rightarrow R)$.

D. For any propositions P, Q and R, the following statement is always true: $(P \rightarrow Q) \vee (R \rightarrow Q)$.

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Answer 7

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A. For any propositions P and Q, the following is always true: $(\mathrm{P} \to \mathrm{Q}) \vee (\mathrm{Q} \to \mathrm{P})$.

$\mathbf{Proof:}$

Here's one way to see this. If Q is true, then $\mathrm{P} \to \mathrm{Q}$ is true because anything implies a true statement. If Q is false, then $\mathrm{Q} \to \mathrm{P}$ is true because false implies anything. (If this is confusing, you should review the truth table for $\to$)

B. For any propositions P, Q, and R, the following statement is always true: $(\mathrm{P} \to \mathrm{Q}) \vee (\mathrm{Q} \to \mathrm{R})$.

$\mathbf{Proof:}$

This is basically the same argument as before. If Q is true, then $\mathrm{P} \to \mathrm{Q}$ is true because anything implies a true statement. If Q is false, then $\mathrm{Q} \to \mathrm{R}$ is true because false implies anything.

Of all the connectives we've seen, the $\to$ connective is probably the trickiest. We asked this question to force you to disentangle notions of correlation or causality from the behavior of the $\to$ connective.

Question 8

Which of the following logical arguments is/are valid?

A.
$$P \to (Q \to R)$$
$$\neg R$$
$$\therefore \neg P$$

B.
$$(P \wedge Q) \to \neg R$$
$$R \to P$$
$$\therefore \neg(Q \wedge R)$$

C.
$$(Q \to P) \vee R$$
$$\neg(R \wedge Q)$$
$$\therefore \neg\neg Q \to P$$

D.
$$P \to (Q \vee R)$$
$$\neg R$$
$$Q \to \neg(P \wedge R)$$
$$\therefore Q$$

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Answer 8

It's easier to disprove. $A \rightarrow B$ doesn't hold when $A = True$ and $B = False$

A. $\{\underbrace{(P \rightarrow (Q \rightarrow R)) \land \neg R}_{T}\} \rightarrow \underbrace{\neg P}_{F}$

For $P = true, R = false, Q = false$ the antecedent becomes True, and the consequent becomes False.

Hence Not valid.

B. $\{\underbrace{((P \land Q) \rightarrow \neg R) \land (R \rightarrow P)}_{T}\} \rightarrow \{\underbrace{\neg(Q \land R)}_{F}\}$

we can't find any set of values for which antecedent is true and consequent is false.

Hence this is valid.

C. $\{\underbrace{((Q \rightarrow P) \lor R) \land \neg(R \land Q)}_{T}\} \rightarrow \{\underbrace{\neg\neg Q \rightarrow P}_{F}\}$

here also we are unable to find a set of values.

Hence this is valid

D. $\{\underbrace{(P \rightarrow (Q \lor R)) \land \neg R \land (Q \rightarrow \neg(P \land R))}_{T}\} \rightarrow \underbrace{Q}_{F}$

For $P = false, R = false, Q = false$ antecedent becomes True, and the consequent becomes False.

Hence not valid

Answer is B and C.

answered Apr 7, 2023

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Rhl

Question 9

The Logic Problem, taken from "WFF'N PROOF, The Game of Logic" has these two assumptions:

1. "Logic is difficult or not many students like logic."
2. "If mathematics is easy, then logic is not difficult."

By translating these assumptions into statements involving propositional variables and logical connectives, Find out which of the following are valid conclusions of these assumptions:

A. "Mathematics is not easy, if many students like logic."
B. "Not many students like logic, if mathematics is not easy."
C. "Mathematics is not easy or logic is difficult."
D. "Logic is not difficult or mathematics is not easy."

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Answer 9

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Now, we can symbolically express the two assumptions:

i. $(D(l) \vee \neg S(l))$
ii. $(E(m) \rightarrow \neg D(l))$

Observe that (by the definition of implication and by contraposition, respectively) these two are equivalent to the following:

i. $(S(l) \rightarrow D(l))$
ii. $(D(l) \rightarrow \neg E(m))$

We are now ready to check the following claims:

A. "Mathematics is not easy if many students like logic." This claim can be written as $(S(l) \rightarrow \neg E(m))$. Since we know from above that $(S(l) \rightarrow D(l))$, and that $(D(l) \rightarrow \neg E(m))$, we conclude that this claim is true.

B. "Not many students like logic if mathematics is not easy." This claim can be written as $(\neg E(m) \rightarrow \neg S(l))$. By contraposition, we obtain $(S(l) \rightarrow E(m))$. Again, we know from our hypotheses that $(S(l) \rightarrow D(l))$, and that $(D(l) \rightarrow \neg E(m))$, so we conclude that this claim is false.

C. "Mathematics is not easy or logic is difficult." We can write this claim as $(\neg E(m) \vee D(l))$, which is equivalent (by the definition of implication) to $(E(m) \rightarrow D(l))$. However, this claim contradicts $(E(m) \rightarrow \neg D(l))$, which is one of our hypotheses. Therefore the claim is false.

D. "Logic is not difficult or mathematics is not easy." Symbolically, we express this claim as $(\neg D(l) \vee \neg E(m))$. If we convert this to an implication, we get $(D(l) \rightarrow \neg E(m))$, which is one of our hypotheses. The claim is therefore true.

References:

- http://www.cs.cornell.edu/courses/cs280/2002sp/homework/hw02sol.pdf
- https://gateoverflow.in/306902/kenneth-rosen-edition-7-exercise-1-6-question-34-page-no-80

answered Apr 5, 2023 • edited Mar 28, 2024 by **Deepak Poonia**

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Question 10

Which of the following statements is/are true?

A. The argument form with premises $p_1, p_2, \ldots, p_n$ and conclusion $q \rightarrow r$ is valid iff the argument form with premises $p_1, p_2, \ldots, p_n, r$, and conclusion q is valid.

B. The argument form with premises $p_1, p_2, \ldots, p_n$ and conclusion $q \rightarrow r$ is valid iff the argument form with premises $p_1, p_2, \ldots, p_n, q$, and conclusion r is valid.

C. The argument form with premises $p_1, p_2, \ldots, p_n$ and conclusion $q \rightarrow r$ is valid iff the argument form with premises $p_1, p_2, \ldots, p_n, q$, and conclusion $\sim r$ is valid.

D. The argument form with premises $p_1, p_2, \ldots, p_n$ and conclusion $q \rightarrow r$ is valid iff the argument form with premises $p_1, p_2, \ldots, p_n, \sim r$, and conclusion $\sim q$ is valid.

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Answer 10

Here is the answer – Using simplification method

$$\begin{array}{l} p1 \\ p2 \\ \vdots \\ pn \\ \hline \therefore q \rightarrow r \end{array} \quad \longleftrightarrow \quad \begin{array}{l} p1 \\ p2 \\ \vdots \\ pn \\ r \\ \hline \therefore q \end{array}$$

Given question is: $\left(\left(p1 \wedge p2 \wedge \cdots \wedge pn\right) \rightarrow (q \rightarrow r)\right) \leftrightarrow$
$\left(\left(\left(p_1 \wedge p2 \wedge \cdots \wedge pn\right) \wedge r \rightarrow q\right)\right.$

More generally, assume $p = p1 \wedge p2 \wedge \cdots \wedge pn$.

So prove that $\left(p \rightarrow (q \rightarrow r)\right) \leftrightarrow \left((p \wedge r) \rightarrow q\right)$ is a tautology or $p \rightarrow (q \rightarrow r) \equiv (p \wedge r) \rightarrow q$ (By def^{n} of $\equiv$)

A: $p \rightarrow (q \rightarrow r) \equiv (p \wedge r) \rightarrow q$
B: $p \rightarrow (q \rightarrow r) \equiv (p \wedge q) \rightarrow r$
C: $p \rightarrow (q \rightarrow r) \equiv (p \wedge q) \rightarrow \bar{r}$
D: $p \rightarrow (q \rightarrow r) \equiv (p \wedge \bar{r}) \rightarrow \bar{q}$

Which of the option is correct?

$p \rightarrow (q \rightarrow r) = \bar{p} + (q \rightarrow r) = \bar{p} + \bar{q} + r$

A. $p \wedge r \rightarrow q = \overline{pr} + q = \bar{p} + \bar{r} + q$ ✗
B. $p \wedge q \rightarrow r = \overline{pq} + r = \bar{p} + \bar{q} + r$ ✓
C. $p \wedge q \rightarrow \bar{r} = \overline{pq} + \bar{r} = \bar{p} + \bar{q} + \bar{r}$ ✗
D. $p \wedge \bar{r} \rightarrow \bar{q} = \overline{p\bar{r}} + \bar{q} = \bar{p} + \bar{q} + r$ ✓

So option B & D are only logically equivalent.