CS & IT

ENGINEERING

Discrete maths

Mathematical logic



Lecture No. 03



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01 Inference Rule

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02 Type 3 Questions in logic

...

03 Type 3 with Type 1

...

04 GATE QUESTIONS on 3 &1

....

05 Practice



premises conclusion.

True check.

True false

premises > propositional state

Inference Rule.:

Considering premises as the check the conclusion.

if it's true it comes under I.R.



premises -> conclusion or premises.

P3 ... Q.



P1: mobile left or Right pocket.
P2: mobile is not inleft pocket.

Q: Rightpocket

valid: ((LVR) 17L) -> R.

PI: LVR >T.

P2: 7L



Pi: if Graph is planar then es3n-6.(T)

Pz: Graph is planar

e < 3n-6

 $\left(\left(P \rightarrow Q \right) \wedge P \right) \rightarrow Q$

P Q (e (3n-6)





P1: if perfect matching exist then no of vertices will be even. I.
P2: no of vertices even.

Perfect matching.

P: Perfect matching. Q: no of vertices.



$$\frac{1 \cdot P \to Q}{P \to Q} [(P \to Q) \land P] \to Q$$
(modus pomens)



P -> pvq. or P (addition)

PUR PUR



Question:

(a \((a \to b) \) \((\tab \v c) \) \(\to \)

(a) \(\text{Q} \) \(\text{Nodus ponens} \)

(b) \(\text{Nodus ponens} \)

C

Gim 7bVC.



P and Q are two propositions. Which of the following logical expressions are equivalent?

II.
$$\sim (\sim P \wedge Q)$$

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

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

(GATE-08)

- (a) Only I and II
- (b) Only I, II and III
- (c) Only I, II and IV
- (d) All of I, II, III and IV



P and Q are two propositions. Which of the following logical expressions are equivalent?

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I. PV~Q
II. ~(~PΛQ)
III. (PΛQ)V(PΛ~Q)V(~PΛ~Q)
IV. (PΛQ)V(PΛ~Q)V(~PΛQ)
(GATE-08)
```

- (a) Only I and II
- (b) Only I, II and III
- (c) Only I, II and IV
- (d) All of I, II, III and IV



Establish the validity of the following arguments.

a)
$$[p \land (p \rightarrow q) \land (\neg q \lor r)] \rightarrow r$$

b)
$$p \rightarrow q$$

$$\neg q$$

$$\neg r$$

$$\therefore \neg (p \lor r)$$

c)
$$p \rightarrow q$$

$$r \rightarrow \neg q$$

$$r$$

Let p, q, r and s be four primitive statements. Consider the following arguments:



P:
$$[(\sim p \lor q) \land (r \rightarrow s) \land (p \lor r)] \rightarrow (\sim s \rightarrow q)$$

Q:
$$[(\sim p \land q) \land [q \rightarrow (p \rightarrow r)]] \rightarrow \sim r$$

$$R: [[(q \land r) \rightarrow p] \land (\sim q \lor p)] \rightarrow r$$

S:
$$[p \land (p \rightarrow r) \land (q \lor \sim r)] \rightarrow q$$

Which of the above arguments are valid?(GATE - 04)

- (a) P and Q only
- (b) P and R only
- (c) P and S only
- (d) P, Q, R and S



d)
$$p \wedge q$$

 $p \rightarrow (r \wedge q)$
 $r \rightarrow (s \vee t)$
 $\neg s$
 $\therefore t$

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

 $p \lor s$
 $t \rightarrow q$
 $\neg s$

 $\therefore \neg r \rightarrow \neg t$



Which one of the following is NOT equivalent to p \leftrightarrow q?

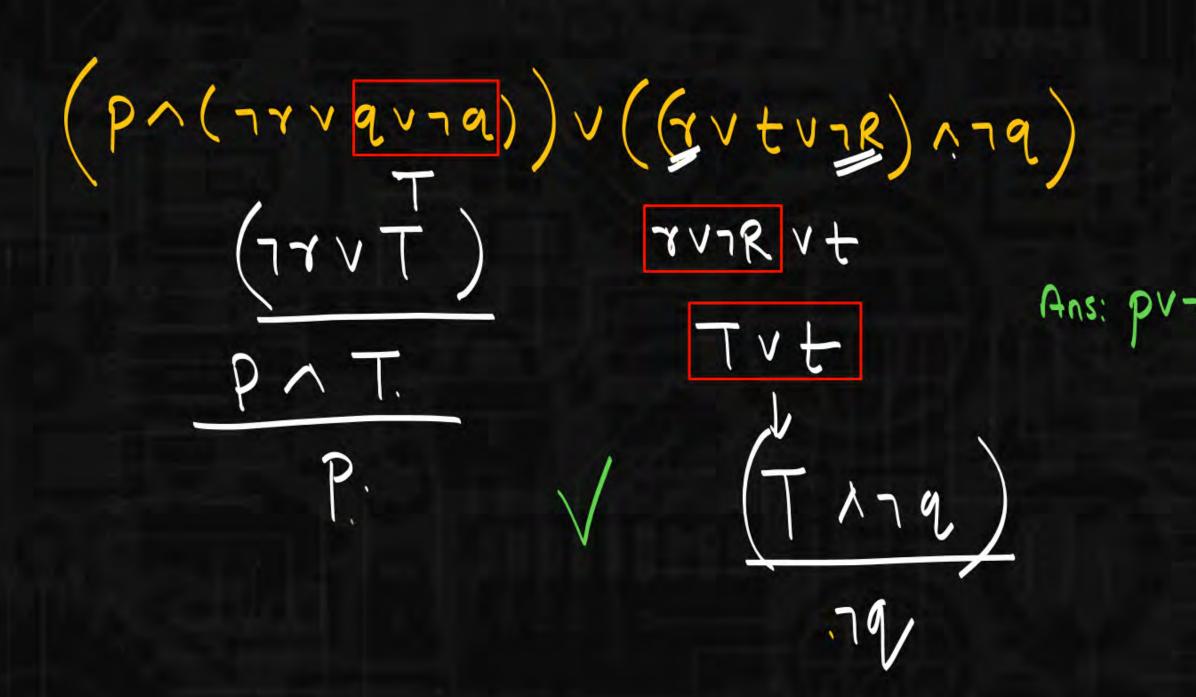
(GATE-15-Set1)

- (a) $(\sim pVq)\Lambda(pV\sim q)$
- (b) $(\sim pVq)\Lambda(q\rightarrow p)$
- (c) $(\sim p \land q) \lor (p \land \sim q)$
- (d) $(\sim p \land \sim q) \lor (p \land q)$



The Simplest form of $(p\Lambda(\sim r \lor q \lor \sim q))\lor((r \lor t \lor \sim r)\land \sim q)$ is

- (a) p∧~q
- (b) p∨~q√
- (c) t
- (d) $(p \rightarrow \sim q)$





Let p, q, r and s be four primitive statements. Consider the following arguments:

 $P:[(\sim pVq)\Lambda(r\rightarrow s)\Lambda(pVr)]\rightarrow(\sim s\rightarrow q)$

 $Q:[(\sim p \land q) \land [q \rightarrow (p \rightarrow r)]] \rightarrow \sim r$

 $R:[(q \land r) \rightarrow p] \land (\sim q \lor p)] \rightarrow r$

 $S:[p\Lambda(p\rightarrow r)\Lambda(qV\sim r)]\rightarrow q$

Which of the above arguments are valid?

(GATE - 04)

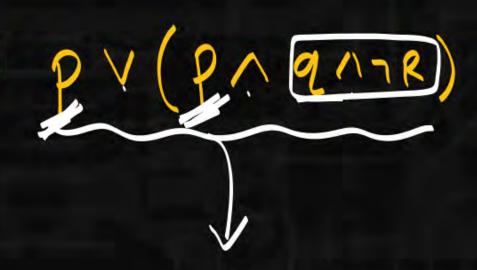
- (a) P and Q only
- (b) P and R only
- (c) P and S only
- (d) P,Q,R and S



The Simplest form of

- (pV(pAq)V(pAqA~r))A((pArAt)Vt)is Awangement
- (a) p \wedge t
- (b) $q \wedge t$
- $(c) p \wedge r$
- $(d) p \wedge q$

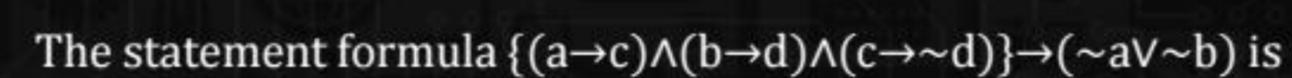




$$S_1$$
: {(~ p \rightarrow (q \rightarrow ~ W)) \land (~ S \rightarrow q) \land ~ t \land (~ p \lor t)} \rightarrow (w \rightarrow s)



$$S_2$$
: { $(q \rightarrow t) \land (s \rightarrow r) \land (\sim q \rightarrow s)$ } $\rightarrow (\sim t \rightarrow r)$





- (a) satisfiable but not-valid
- (b) valid
- (c) not satisfiable
- (d) none of these



The statement formula

$$\{((\sim p \lor q) \rightarrow r) \land (r \rightarrow (s \lor t)) \land (\sim s \land \sim u) \land (\sim u \rightarrow \sim t)\} \rightarrow p \text{ is}$$

- (a) valid
- (b) not satisfiable
- (c) satisfiable but not valid
- (d) none of these



