Topic:- Mathematical Logic.

* Tutorial *

SYB22

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Q.1. Write the following formulas in prefix & suffix form. The following precedance is assumed:
$\rightleftarrows, \rightarrow, \vee, \wedge, \neg$ ($\neg$ Having the highest precedance)

1.a) $P \rightarrow Q \vee R \vee S$

$\rightarrow$ $(P \rightarrow ((Q \vee R) \vee S))$

Prefix :- $\rightarrow P \vee \vee Q R S$

suffix :- $P Q R \vee S \vee \rightarrow$

1.c) $P \wedge \neg (R \rightleftarrows P \vee Q)$

$\rightarrow$ $(P \wedge_{2} (\neg_{3} (R \rightleftarrows_{4} (P \vee_{5} Q))))$

Prefix: $\wedge P \neg \rightleftarrows R \vee P Q$

suffix: $P Q \vee R \rightleftarrows \neg P \wedge$

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Q.1. Show the validity of the following arguments, for which the premises are given on the left and the conclusion on the right.

1.c) $\neg J \rightarrow (M \vee N)$, $(H \vee G) \rightarrow \neg J$, $H \vee G$ $\quad\quad$ $M \vee N$

→

1)	$H \vee G$	P
2)	$(H \vee G) \rightarrow \neg J$	P
3)	$\neg J$	T from 1) & 2)
4)	$\neg J \rightarrow (M \vee N)$	P
5)	$M \vee N$	T from 3) & 4)

1.f) $P \rightarrow Q$, $Q \rightarrow \neg R$, R, $P \vee (J \wedge S)$ $\quad\quad$ $J \wedge S$

→

1)	R	P
2)	$Q \wedge \rightarrow \neg R$	P
3)	$\neg Q$	T from 1) & 2)
4)	$P \rightarrow Q$	P
5)	$\neg P$	T from 3) & 4)
6)	$P \vee (J \wedge S)$	P
7)	$J \wedge S$	T from 5) & 6)

1.b) $(A \rightarrow B) \wedge (A \rightarrow C)$, $\neg (B \wedge C)$, $D \vee A$ $\quad\quad$ D

Q.2. Derive the following, using rule CP if necessary.

2.d) $(P \vee Q) \rightarrow R \Rightarrow (P \wedge Q) \rightarrow R$

→ $(P \vee Q) \rightarrow R, P, Q \Rightarrow R$.

1) P	CP
2) Q	CP
3) $P \vee Q \rightarrow R$	P
4) R	T from 1), 2) & 3).

Q.4. Show that the following sets of premises are inconsistent.

4.a) $P \rightarrow Q, P \rightarrow R, Q \rightarrow \neg R, P$

→

1) P	P
2) $P \rightarrow Q$	P
3) Q	T from 1) & 2).
4) $P \rightarrow R$	P
5) R	T from 1) & 4).
6) $Q \rightarrow \neg R$	P
7) $\neg R$	T from 3) & 6)
8) $R \wedge \neg R$	T from 5) & 7)

∴ The given set of premises is inconsistent.

Q.5. Show the following (use indirect method if needed)

5.b) $S \rightarrow \neg Q, S \vee R, \neg R, \neg R \rightleftarrows Q \Rightarrow \neg P$

→ let $\neg\neg P$ be true. ie. P be true.

∴ $S \rightarrow \neg Q, S \vee R, \neg R, \neg R \rightleftarrows Q, P \Rightarrow \neg P$

1) $\neg R$	P
2) $S \vee R$	P
3) S	T from 1) & 2)
4) $S \rightarrow \neg Q$	P
5) $\neg Q$	T from 3) & 4)

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6) $\neg R \rightleftarrows Q$ P

7) Q T from 1) & 6)

8) $Q \wedge \neg Q$ T from 5) & 7)