Name : M.Aafreen
Reg.NO : 205001301
Dept : CSE - A - III year
Date : 29/08/2022

Logic Programming

ASSIGNMENT - 1

Propositional Logic

1.

	Valid	Satisfiable	unsatisifiable
A		Yes	
A ∨ ¬B		Yes	
A ∨ ¬A		Yes	
A ∧ ¬A			Yes
A → ¬A		Yes	
A → B		Yes	
A → (B → A)	Yes		
A → (A → B)		Yes	
A ↔ ¬A			Yes

2.

	Y/N
if F is valid then F is satisfiable	Y
if F is satifiable, then ¬F is satisfiable	Y
if F is valid, then ¬F is satisfiable	N
if F is unsatisfiable, then ¬F is valid	Y

3. $(p \rightarrow q) \rightarrow (\neg r \wedge q)$

$(\neg p \vee q) \rightarrow (\neg r \vee q)$

$\neg(\neg p \vee q) \vee (\neg r \wedge q)$

DNF : $(P \wedge \neg q) \vee (\neg r \wedge q)$

CNF : $(P \vee \neg r) \wedge (P \vee q) \wedge (\neg q \vee \neg r)$

$((\neg A \rightarrow B) \vee ((A \wedge \neg C) \leftrightarrow B))$

$((A \vee B) \vee ((A \wedge \neg C) \wedge B) \vee (\neg A \wedge C \wedge \neg B)$

DNF : $(A \wedge \neg C \wedge B) \vee (\neg A \wedge C \wedge \neg B)$

CNF : $(A \vee B \vee C) \wedge (\neg A \vee \neg B \vee \neg C) \wedge (\neg A \vee \neg C \vee B)$
$\wedge (A \vee \neg B \vee C) \wedge (\neg A \vee B \vee C)$

4.

P	q	r	F
1	1	1	1
1	1	0	0
1	0	1	1
1	0	0	0
0	1	1	0
0	1	0	0
0	0	1	1
0	0	0	0

DNF:
$(P \wedge q \wedge r) \vee (P \wedge \neg q \wedge r) \vee$
$(\neg P \wedge \neg q \wedge r)$

CNF:
$(\neg P \vee \neg q \vee r) \wedge (\neg P \vee q \vee r) \wedge$
$(P \vee \neg q \vee \neg r) \wedge (P \vee \neg q \vee r) \wedge$
$(P \vee q \vee r)$

5. i. $(P_5 \rightarrow P_{11}) \wedge (P_2 \wedge P_3 \wedge P_5 \rightarrow P_{13}) \wedge (T \rightarrow P_5) \wedge (P_5 \wedge P_{11} \rightarrow \bot)$

Mark : P_5, through $(T \rightarrow P_5)$

P_{11}, through $(P_5 \rightarrow P_{11})$

Unsatisfiable.

ii. $(T \rightarrow q) \wedge (T \rightarrow s) \wedge (W \rightarrow \bot) (P \wedge q \wedge s \rightarrow \bot) \wedge (V \rightarrow s) \wedge (T \rightarrow r)$
$\wedge (r \rightarrow P)$

Mark : q, s, r throught $(T \rightarrow q), (T \rightarrow s), (T \rightarrow r)$

P through $(r \rightarrow P)$

Unsatisfiable

iii. $(T \rightarrow q) \wedge (T \rightarrow s) \wedge (W \rightarrow T) \wedge (P \wedge q \wedge s \rightarrow V) \wedge (V \rightarrow s) \wedge$
$(T \rightarrow r) \wedge (r \rightarrow P)$

Mark : q, s, W, r, throught $(T \rightarrow q), (T \rightarrow s), (W \rightarrow T)$
$(T \rightarrow r)$

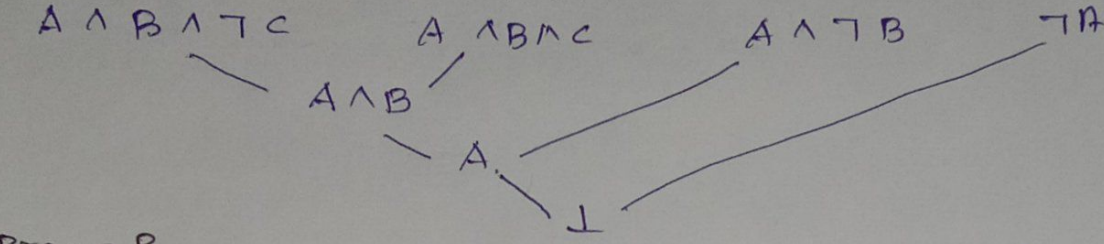
P through $(r \rightarrow P)$ satisfiable

iv. $\neg b \wedge (\neg a \vee b \vee \neg c) \wedge a \wedge (\neg a \vee c)$

$(b \to \bot) \wedge (a \wedge c \to b) \wedge (\top \to a) \wedge (a \to c)$

Mark: a, b, c through $(\top \to a)$, $(a \to b)$ $(a \wedge c \to b)$ then $(b \to \bot)$ unsatisfiable.

6. $F = \{\{A, B, \neg C\}, \{\neg B\}, \{A, B, C\}, \{A, \neg B\}\}$.



7. Prove R

$(P \leftrightarrow Q) \to R \Rightarrow \neg(P \vee Q) \vee R \Rightarrow \neg(\neg P \vee Q) \vee R \Rightarrow (P \vee R) \wedge (\neg Q \vee R)$

$(P \to P) \to R \Rightarrow R$

$(R \to S) \to \neg(S \to Q) \Rightarrow (S \vee R) \wedge (\neg S \vee \neg Q) \wedge (R \vee \neg Q)$

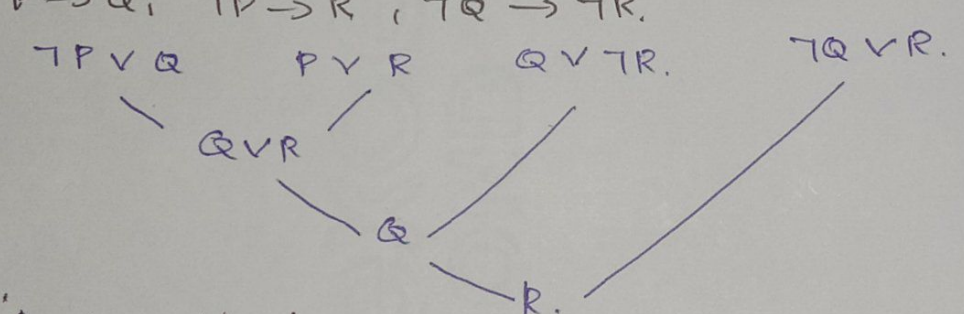
$(P \vee R) \wedge (\neg Q \vee R) R (S \vee R) \wedge (\neg S \vee \neg Q) \wedge (R \vee \neg Q)$ $\neg R$.

$\bot$.

(contradiction)

$\therefore$ R can be proved.

9. $P \to Q,\ \neg P \to R,\ \neg Q \to \neg R$.



8. $\{\neg(P \wedge q), (P \wedge q)\} \models (P \leftrightarrow q)$

P	q	¬P	P∧q	¬(P∧q)	P↔q
0	0	1	0	1	1
0	1	1	0	1	0
1	0	0	0	1	0
0	1	0	1	0	1

False as $\neg(P \wedge q) \models (P \leftrightarrow q)$