1.1

$\neg(p \vee r) \wedge (\neg p \rightarrow (q \vee r)) \wedge \neg q = 1$ (a)

a

$\neg(p \vee r) = 1$ (b)

$(\neg p \rightarrow (q \vee r)) = 1$ (c)

$\neg q = 1$

b

$\neg p = 1$

$\neg r = 1$

c | c

$\neg p = 0$ | $(q \vee r) = 1$ (d)

Closed

d | d

$q = 1$ | $r = 1$

Closed | closed

Hence, it is not satisfiable.

1.2.

$$\neg((p \to q) \to \neg((p \to t) \wedge (p \wedge t \to q))) = 1 \quad (a)$$

a

$$((p \to q) \to \neg((p \to t) \wedge (p \wedge t \to q))) = 0 \quad (b)$$

b

$$(p \to q) = 1 \quad (c)$$

$$\neg((p \to t) \wedge (p \wedge t \to q)) = 0 \quad (d)$$

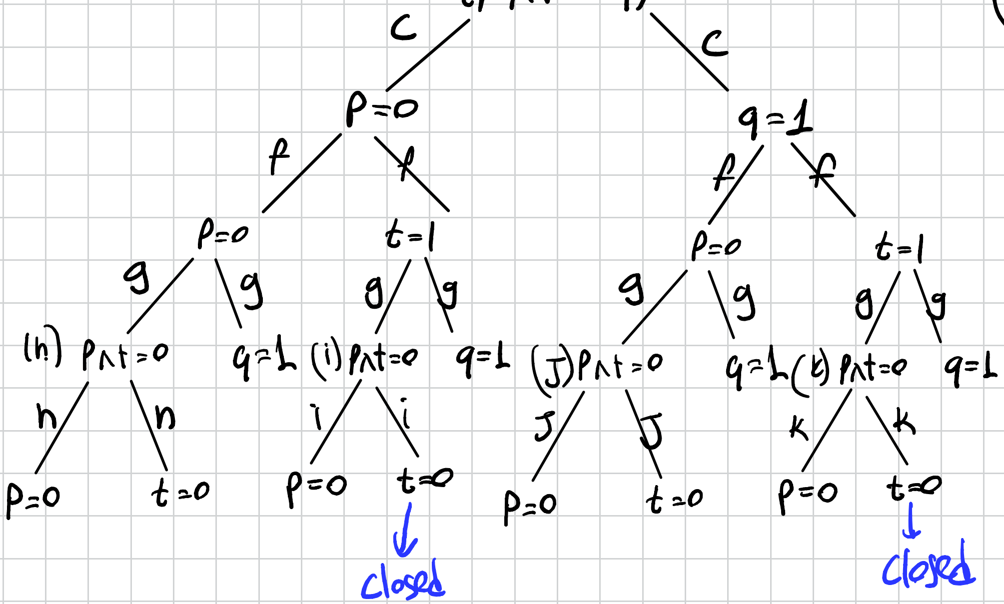
d

$$((p \to t) \wedge (p \wedge t \to q)) = 1$$

e

$$(p \to t) = 1 \quad (f)$$

$$(p \wedge t \to q) = 1 \quad (g)$$

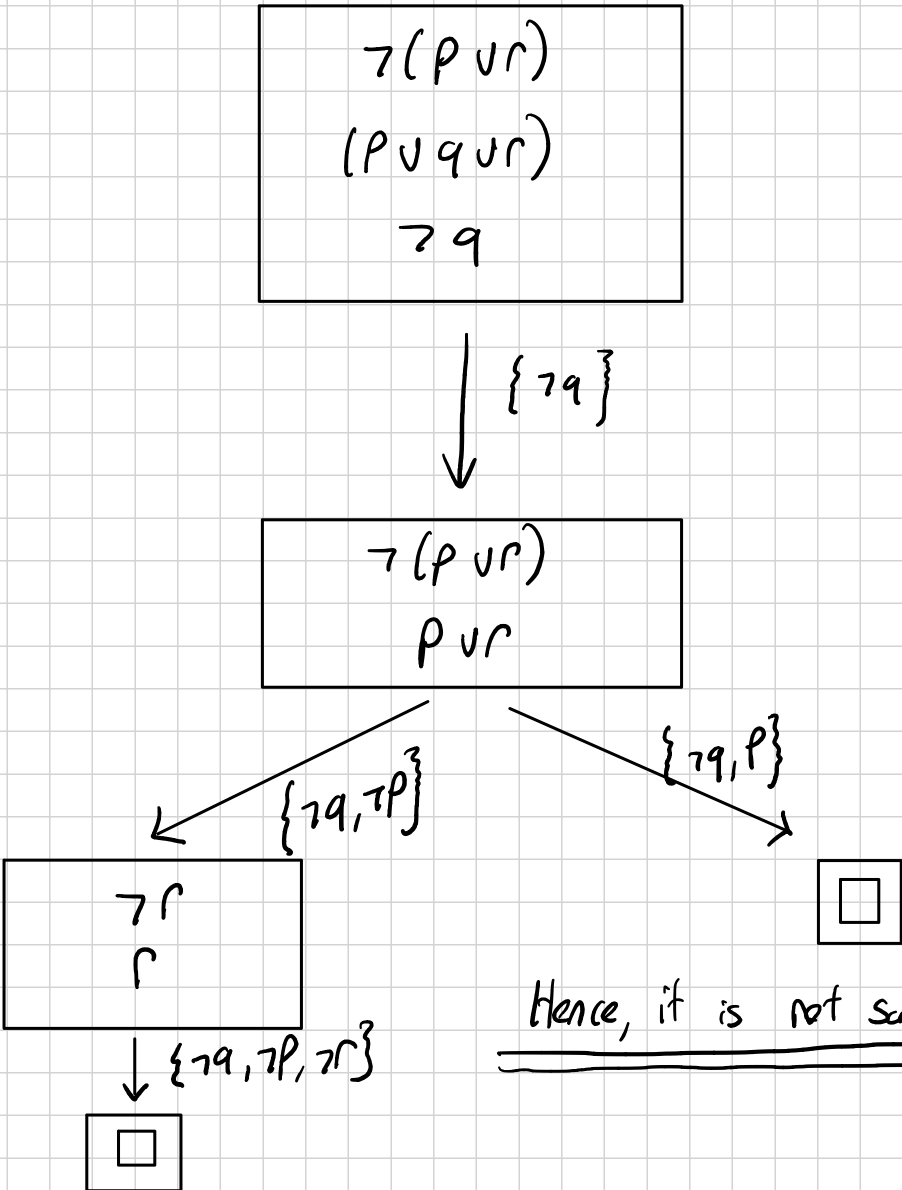


Hence, it is satisfiable.

2.1. $\neg(p \vee r) \wedge (\neg p \to (q \vee r)) \wedge \neg q$

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

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



Hence, it is not satisfiable.

2.2

$$\neg\Big(\underbrace{\big(\underbrace{(p \wedge q \wedge \neg w)}_{P_1} \to r\big)}_{P_2} \to \neg\big(\underbrace{(\underbrace{(p\wedge r)}_{P_3} \to \underbrace{(q\vee w)}_{P_4})}_{P_5} \wedge p \wedge \underbrace{(q \to \neg(r\wedge w))}_{P_6}\big)\Big) \wedge \underbrace{(q\vee\neg r\vee w)}_{P_7}$$

$$\neg(P_2 \to \neg(P_5 \wedge p \wedge P_6)) \wedge P_7$$

$$\neg(\neg P_2 \vee \neg(P_5 \wedge p \wedge P_6)) \wedge P_7$$

$$P_2 \wedge P_5 \wedge p \wedge P_6 \wedge P_7$$

$$P_2 = P_1 \to r$$

$$\neg P_1 \vee r$$

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

$$\neg p \vee \neg q \vee w \vee r$$

$$P_5 = \neg P_3 \vee P_4$$

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

$$\neg p \vee \neg r \vee q \vee w$$

$$P_6 = q \to \neg(r \wedge w)$$

$$\neg q \vee \neg r \vee \neg w$$

General Formula:

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

$$\boxed{\begin{array}{c} \neg p \vee \neg q \vee w \vee r \\ \neg p \vee \neg r \vee q \vee w \\ p \\ \neg q \vee \neg r \vee \neg w \\ q \vee \neg r \vee \neg w \end{array}}$$

$$\Big\downarrow \{p\}$$

$$\boxed{\begin{array}{c} \neg q \vee w \vee r \\ \neg r \vee q \vee w \\ \neg r \vee \neg w \end{array}}$$

$$\Big\downarrow \{p, q\}$$

$$\boxed{\begin{array}{c} w \vee r \\ \neg r \vee \neg w \end{array}}$$

$$\Big\downarrow \{p, q, r\}$$

$$\boxed{\neg w}$$

$$\Big\downarrow \{p, q, r, \neg w\}$$

$$\square$$

Hence, it is satisfiable with the model

$$\{p \leftarrow 1, q \leftarrow 1, r \leftarrow 1, w \leftarrow 0\}$$