Tableau Root $D \wedge (R \to S) \wedge (R \to \sim D) \wedge R$ — ①

D — ②

By Applying Rule 1 to 1

R — ③

By Applying Rule 1 to 1

$(R \to S)$ — ④

By Applying Rule 1 to 1

$\sim R$ S — ⑤

By Applying Rule 6 to 4

{closed $R, \sim R$}

$(R \to \sim D)$ — ⑥

By Applying Rule 1 to 1

$\sim R$ $\sim D$ ← [closed $D, \sim D$]

By Applying Rule 6 to 6

{closed $R, \sim R$}

Therefore from these tableau we conclude that D is not tableau provable.

$\therefore$ $\sim D$ will be tableau provable

$\therefore$ It is proved that Property dealers are not happy and it is tableau provable.

Resolution in propositional logic

Resolution refutation is a method to proof a formula by contradiction where negetation of goal which is added to given set of clause and it is shown that there exists refutation in new set of sentences by using resolution principle.

Conjunctive and Disjunctive Normal form.

Def^n:- A formula is in its normal form if it constructed using only natural connectives $\{\sim, \wedge, \vee\}$.

Def^n:- A literal is an atom or its negetation.

Def^n:- A formula $L_1 \vee L_2 \vee \dots \vee L_n$ is called disjunction of literals.

and A formula $L_1 \wedge L_2 \wedge \dots \wedge L_n$ is called conjunction of literals.

Def^n:- In disjunctive normal form (DNF) — a formula is represented in the form $(L_{11} \wedge \dots \wedge L_{1n}) \vee \dots \vee (L_{m1} \wedge \dots \wedge L_{mn})$, where all L_{ij}'s are literals.

Therefore its is disjunction of conjunctions.

Def^n:- Conjunctive normal form (CNF) is conjunction of disjunction's. Therefore it is represented as $(L_{11} \vee \dots \vee L_{1m}) \wedge \dots \wedge (L_{p1} \vee \dots \vee L_{pm})$. Where all L_{ij}'s are literals.

Conversion of a formula to its CNF

Each formula in propositional logic can be easily transformed into its equivalent CNF or DNF representation. It should follow the following laws:

1. eliminate '$\rightarrow$' & '$\leftrightarrow$' by using following equivalence laws.

$P \rightarrow Q \cong \sim P \vee Q$

$P \leftrightarrow Q \cong (P \rightarrow Q) \wedge (Q \rightarrow P)$

$\cong (\sim P \vee Q) \wedge (\sim Q \vee P)$

2. Use demorgan's law to push '$\sim$' immediately before atomic formula.

$\sim (P \wedge Q) \cong \sim P \vee \sim Q$

$\sim (P \vee Q) \cong \sim P \wedge \sim Q$

3. eliminate double negetation by $\sim\sim P \cong P$

4. use distributive law to get CNF. $P \vee (Q \wedge R) \cong (P \vee Q) \wedge (P \vee R)$.

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Eg: Convert $P \wedge ((\sim Q \rightarrow R) \leftrightarrow W)$ into its corresponding CNF representation.

Ans. $P \wedge ((\sim Q \rightarrow R) \leftrightarrow W)$

elimination of $\rightarrow$ $\cong P \wedge ((\sim\sim Q \vee R) \leftrightarrow W)$

elimination of $\sim\sim$ $\cong P \wedge ((Q \vee R) \leftrightarrow W)$.

elimination of $\leftrightarrow$ $\cong P \wedge (\sim(Q \vee R) \vee W) \wedge (\sim W \vee (Q \vee R))$

use de morgan's law $\cong P \wedge ((\sim Q \wedge \sim R) \vee W) \wedge (\sim W \vee Q \vee R))$

use distributive law $\cong P \wedge ((\sim Q \vee W) \wedge (\sim R \vee W)) \wedge (\sim W \vee Q \vee R))$

$\cong P \wedge (\sim Q \vee W) \wedge (\sim R \vee W) \wedge (\sim W \wedge Q \vee R)$

Definition A clause is a special formula expressed as disjunction of literals. If a clause contains only one literal then it is called unit clause.

If CNF representation of a formula is $C_1 \wedge C_2 \wedge \cdots C_n$, where each C_K is called a clause.

Resolvent of Clauses

Def^n:- If two clauses C_1 & C_2 contain complementary pair of literals $\{L, \sim L\}$, then these clauses can be resolved together by deleting L from C_1 & $\sim L$ from