$$\neg(\neg p \vee \neg(r \vee s)) \Longleftrightarrow (p \wedge r) \vee (p \wedge s)$$

$$\neg(\neg p \vee \neg(r \vee s))$$

$$\Longleftrightarrow \neg\neg p \wedge \neg\neg(r \vee s) \quad \text{by } dm$$

$$\Longleftrightarrow p \wedge (r \vee s) \quad \text{by } neg *2$$

$$\Longleftrightarrow (p \wedge r) \vee (p \wedge s) \quad \text{by } distr$$

$$p \vee (p \wedge q) \Longleftrightarrow p$$

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

$$\Longleftrightarrow (p \vee p) \wedge (p \vee q) \quad \text{by } distr$$

$$\Longleftrightarrow p \wedge (p \vee q) \quad \text{by } idemp$$

$$\Longleftrightarrow (p \wedge p) \vee (p \wedge q) \quad \text{by } distr$$

$$\Longleftrightarrow p \vee (p \wedge q) \quad \text{by } idemp$$

Restart...

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

$$\Longleftrightarrow (p \wedge true) \vee (p \wedge q) \quad \text{by } simpl$$

$$\Longleftrightarrow p \wedge (true \vee q) \quad \text{by } distr$$

$$\Longleftrightarrow p \wedge true \Longleftrightarrow p \quad \text{by } simpl$$

$\neg((p \land q) \Rightarrow p) \iff$ false

$\neg((p \land q) \Rightarrow p)$

$\iff \neg(\neg(p \land q) \lor p)$ by Impl

$\iff \neg\neg(p \land q) \land \neg p)$ by dm

$\iff (p \land q) \land \neg p$ by neg

$\iff (q \land p) \land \neg p$ by comm   ⎤ don't have to show

$\iff q \land (p \land \neg p)$ by assoc ⎦

$\iff q \land$ false   by contr

$\iff$ false   by simpl   have to show the others tho.

$\neg$true $\iff$ false

$\neg$true

$\iff \neg(p \lor \neg p)$ by lem

$\iff \neg p \land \neg\neg p$ by dm

$\iff \neg p \land p$ by neg

$\iff$ false   by contr.

To prove that P2 is dead code.

$(i \lor \lnot o) \land \lnot\lnot (o \land q) \land o \land \lnot q$

$\Leftrightarrow (i \lor \lnot o) \land (o \land q) \land o \land \lnot q$ by neg

$\Leftrightarrow (i \lor \lnot o) \land o \land false \land o$ by cont'

$\Leftrightarrow false$ by simpl

DNF /CNF examples

① $(p \land q \land r) \lor (\lnot q \land \lnot r)$

DNF

② $\lnot(p \Rightarrow q) \land (r \Leftrightarrow q)$
neither

③ $(p \land q) \lor \lnot q \lor \lnot r$

DNF

④ $(p \lor q) \land \lnot r$

CNF

⑤ p ∨ q
    both

⑥ ¬(p ∧ q) ∨ r
    neither

$$x \wedge (y \Rightarrow x) \Longleftrightarrow x$$

$$x \wedge (y \Rightarrow x)$$

⟨≡⟩ $x \wedge (\neg y \vee x)$ by Impl

⟨≡⟩ $(x \vee \text{false}) \wedge (\neg y \vee x)$ by simpl

⟨≡⟩ $x \vee (\text{false} \wedge \neg y)$ by distr

⟨≡⟩ $x \vee \text{false}$ by simpl

⟨≡⟩ x by simpl