CISC204 Assignment 1 Question 3

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1. Conjunctive and Disjunctive normal form

   in this question we will explore converting sequents into Conjunctive normal form (CNF) and disjunctive normal form (DNF).

   we are given 2 sequents:

$$s1 = (\neg(R \wedge Q) \rightarrow ((R \wedge P) \rightarrow Q)) \tag{1}$$
$$s2 = ((((P \vee Q) \rightarrow Q) \wedge Q) \rightarrow \neg(Q \vee P)) \tag{2}$$

   for each sequent we must:

   (a) find the Conjunctive Normal Form
   (b) find the Disjunctive Normal Form

   while these are similar and share commonalities in their algorithms it is important to distinguish them as they are each vital for simplifying and understanding propositional logic.

2. Answer

(a) i. (1)

$(\neg(R \wedge Q) \rightarrow ((R \wedge P) \rightarrow Q))$	*starting formula*
$(\neg\neg(R \wedge Q) \vee (\neg(R \wedge P) \vee Q))$	*implication free*
$(\neg\neg(R \wedge Q) \vee ((\neg R \vee \neg P) \vee Q))$	*deMorgans law*
$((R \wedge Q) \vee ((\neg R \vee \neg P) \vee Q))$	*double negation*
$((R \vee ((\neg R \vee \neg P) \vee Q)) \wedge (Q \vee ((\neg R \vee \neg P) \vee Q)))$	*distribution*

ii. (2)

$((((P \vee Q) \rightarrow Q) \wedge Q) \rightarrow \neg(Q \vee P))$	*starting formula*
$(\neg((\neg(P \vee Q) \vee Q) \wedge Q) \vee \neg(Q \vee P))$	*implication free*
$((\neg((\neg P \wedge \neg Q) \vee Q) \vee \neg Q) \vee (\neg Q \wedge \neg P))$	*deMorgans law*
$((((\neg\neg P \vee \neg\neg Q) \wedge \neg Q) \vee \neg Q) \vee (\neg Q \wedge \neg P))$	*deMorgans law*
$((((P \vee Q) \wedge \neg Q) \vee \neg Q) \vee (\neg Q\neg \wedge P))$	*double negation*
$(((((P \vee Q) \wedge \neg Q) \vee \neg Q) \vee \neg Q) \wedge ((((P \vee Q) \wedge \neg Q) \vee \neg Q) \vee \neg P))$	*distribution*

(b) ...