Homework 3

Due Friday 5 October

(1) Make a truth table for each of the following:

(a) $((\neg P \to Q) \to (P \vee Q))$

(b) $(\neg\neg P \wedge P)$

(c) $(P \leftrightarrow \neg\neg P)$

(d) $((P \wedge Q) \vee (P \wedge R))$

(e) $((P \to Q) \to (P \to R))$

(2) (a) Find an SC negation with this truth table.

A	B	
1	1	0
1	0	0
0	1	1
0	0	0

(b) Find an SC conjunction with this truth table.

A	B	
1	1	1
1	0	1
0	1	1
0	0	0

(c) Find an SC conditional with this truth table.

A	B	C	
1	1	1	1
1	1	0	1
1	0	1	0
1	0	0	1
0	1	1	1
0	1	0	0
0	0	1	1
0	0	0	0

(d) Find an SC disjunction with this truth table.

A	B	C	
1	1	1	1
1	1	0	1
1	0	1	0
1	0	0	1
0	1	1	1
0	1	0	0
0	0	1	1
0	0	0	0

(3) Classify each of the following as inconsistent, contingent, a tautology, or not an SC sentence.

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

(4) For each SC sentence listed in question (3), write down a logically equivalent sentence in disjunctive normal form.

(5) Give an example of each of the following, if there is an example.
If there is no example, explain why there is no example.

(a) A conditional which is a tautology with an antecedent which is a tautology.

(b) An inconsistent conditional with an inconsistent antecedent.

(c) An inconsistent disjunction with neither disjunct inconsistent.

(d) An inconsistent biconditional with components each inconsistent.

(e) A conjunction which is a tautology, although neither of its conjuncts is a tautology.

(f) A tautology containing no negation symbols.