Homework 4.

1. Show that for any sentences ϕ, ψ, the sentence $-(\phi \rightarrow \psi)$ is logically equivalent to the sentence $\phi \,\&\, -\psi$.

2. Is logical implication symmetric? That is, if ϕ implies ψ then does ψ imply ϕ? Explain your answer.

3. Translate the following into sentence logic form. Choose a (distinct) capital letter for each elementary component sentence, and clearly designate your choices.

   (a) Alice will go to law school only if she is admitted to Yale or Harvard.

   (b) Unless we reduce the incidence of child abuse, future crime rates will increase.

   (c) Plasma televisions are a technological marvel, but they are expensive.

   (d) A necessary condition for a successful business venture is good planning.

   (e) Ozone depletion in the atmosphere is a sufficient condition for increased cancer rates.

4. Show that the sentence connective "It *was* true that . . . " is not truth-functional.

5. Suppose that the sentence connective $\circ$ has the truth table given below.

P	Q	$P \circ Q$
T	T	F
T	F	T
F	T	T
F	F	F

   Do "$\circ$" and "$-$" form a truth-functionally complete set of connectives? Justify your answer.

6. Is the *exclusive* sense of "or" associative? That is, is "$(\phi$ or $\psi)$ or χ" logically equivalent to "ϕ or $(\psi$ or $\chi)$"? Justify your answer using truth-tables.