1. Consider the theorem "$A, \neg B \vdash_L \neg(A \rightarrow B)$".

   (a) Write down the truth table for "$(A \wedge \neg B) \rightarrow \neg(A \rightarrow B)$" to show it is a tautology.

   (b) Suppose that in the middle of my "proof" of this proposition, I have a line which says "$\neg B \rightarrow (A \rightarrow B)$". How do I know there is a mistake in my proof?

2. My brother claims to have shown "$A \vdash_L A \rightarrow B$" in proof system L. Could he possibly have found a proof? Explain why or why not.

3. Consider Theorem L14 (on page 20) which says "$\vdash_L A \rightarrow ((A \rightarrow B) \rightarrow B)$"

   (a) Show this proposition is a tautology by writing down its truth table (an abbreviated truth table is ok).

   (b) Prove this proposition in L using the deduction theorem and modus ponens (no lemmas allowed).

   (c) Prove this proposition in L without the deduction theorem (you may use any lower numbered theorems). *Annoying hint:* Using previous lemmas, there is a 2 line proof.
   OR *Bullet proof/brute force method:* Use our translation procedures to turn (b)'s answer into (c)'s answer.

4. Prove at least 3 of the 7 theorems L19 through L25 (pages 21 and 22) – skip any one I do in class. You may use the deduction theorem and theorems with lower numbers (including ones you've skipped) in your proofs.