1. Use the equivalences $p \rightarrow q \Leftrightarrow \sim p \lor q$ and 
$\sim (p \rightarrow q) \Leftrightarrow p \land \sim q$ (i.e., the negation of $p \rightarrow q$ is equivalent to $p \land \sim q$) to 
\vskip .1cm 
(a) write the statement ``If you work, you have to pay taxes'' as a disjunction 
(as an English sentence), 
\vskip 1.5cm 
(b) write the negation of the statement ``If you earn a lot of money, then you pay 
heavy taxes'' as a conjunction (as an English sentence), 
\vskip 1.5cm 
(c) write the statement ``Alice fails the test or she gets the job'' in the 
if-then form (as an English sentence).

2. Here is an excerpt from an automobile 
insurance policy. ``If the loss is $\$50 \text{ or less}, we will not make any payment.'' 
A policyholder suffers a $\$75 \text{ loss}. According to this excerpt, what are the insurance company's options? Explain!

3. A switching network to control the launching 
of ICBMs is to be designed so that it can be operated by three generals. For 
safety, the Department of Defense requires that in order to fire the missile, at 
least two of the three generals will have to close their switches. Design a 
network that will do this.

4. Complete the truth table for the statements 
$(p \rightarrow q) \rightarrow p$, $(p \rightarrow q) \leftrightarrow (p \rightarrow \sim q)$, and $(p \rightarrow q) \leftrightarrow (p \land q)$.

\begin{matrix} 
\text{p} & \text{q} & \text{p \rightarrow q} & \text{p \rightarrow \sim q} & \text{p \land q} \\
T & T & T & F & F \\
T & F & F & T & F \\
F & T & T & F & T \\
F & F & T & T & T \\
\end{matrix}
\left| \matrix{ (p \to q) \to p \to q } \endmatrix \\
\vspace{-9pt} \hskip-4pt \underline{\text{ }}\\
( p \to q ) \leftrightarrow ( p \to \sim q ) \\
\vspace{-9pt} \hskip-4pt \underline{\text{ }}\\
( p \to q ) \leftrightarrow ( p \vee q ) \\
\right.$