1. (a) (10 points) Let $\phi$, $\psi$, and $\chi$ be propositional formulas on $\Omega$. Show that \( (\phi \lor (\psi \land \chi)) \mid \rho = (\phi \lor \psi) \land (\phi \lor \chi) \mid \rho \) for any assignment $\rho$ to the variables $\Omega$.

(b) (10 points) Let $\psi_{1,1}, \ldots, \psi_{1,n}$, $\psi_{2,1}, \ldots, \psi_{2,m}$ be propositional formulas on $\Omega$. Let $\phi_1 = \bigwedge_{i=1}^{n} \psi_{1,i}$ and $\phi_2 = \bigwedge_{j=1}^{m} \psi_{2,j}$.
Show that \( (\phi_1 \lor \phi_2) \mid \rho = (\bigwedge_{i=1}^{n} \bigvee_{j=1}^{m} (\psi_{1,i} \lor \psi_{2,j})) \mid \rho \) for any assignment $\rho$ to the variables $\Omega$.

(c) (10 points) Let $\Omega$ be a set of variables. We say that a propositional formula is a literal if the formula is equal to $x$ or $\neg x$ for $x \in \Omega$.
We say that a propositional formula on $\Omega$ is in conjunctive normal form if it is equal to $\bigwedge_{i=1}^{n} \bigvee_{j=1}^{m} \psi_{i,j}$, where $\psi_{i,j}$ is a literal.
Let $\phi$ be a propositional formula on $\Omega$. Show using structural induction that there is a propositional formula $\psi$ on $\Omega$ in conjunctive normal form such that $\psi \mid \rho = \phi \mid \rho$ for any assignment $\rho$ to $\Omega$. 