1. **S1.4, Exercise 9:** Let $L(x, y)$ be the statement “$x$ loves $y$”, where the domain for both $x$ and $y$ consists of all people in the world. Use quantifiers to express each of these statements:

   a. Everybody loves Jerry:  
      \[
      \forall x L(x, \text{Jerry})
      \]

   b. Everybody loves somebody:  
      \[
      \forall x \exists y L(x, y)
      \]

   c. There is somebody whom everybody loves:  
      \[
      \exists y \forall x L(x, y)
      \]

   d. Nobody loves everybody:  
      \[
      \neg \exists x \forall y L(x, y) \equiv \forall x \exists y \neg L(x, y)
      \]

   e. There is somebody whom Lydia does not love:  
      \[
      \exists y \neg L(\text{Lydia}, y)
      \]

   f. There is somebody whom no one loves:  
      \[
      \exists y \forall x \neg L(x, y)
      \]

   g. There is exactly one person whom everybody loves:  
      \[
      \exists y (\forall x L(x, y) \land \forall z ((\forall w L(w, z)) \to z = y))
      \]

   h. There are exactly two people whom Lynn loves:  
      \[
      \exists x \exists y (L(\text{Lynn}, x) \land L(\text{Lynn}, y) \land x \neq y \land \forall z (L(\text{Lynn}, z) \to (z = x \lor z = y)))
      \]

   i. Everyone loves him or herself:  
      \[
      \forall x L(x, x)
      \]

2. **S1.4, Exercise 33:** Rewrite each of these statements so that negations appear only within predicates (that is, so that no negation is outside a quantifier or an expression involving logical connectives).
a. 
\[ \neg \forall x \forall y P(x, y) \equiv \exists x \exists y \neg P(x, y) \]

b. 
\[ \neg \forall y \forall x (P(x, y) \lor Q(x, y)) \equiv \exists y \exists x (\neg P(x, y) \land \neg Q(x, y)) \]
\[ \equiv \exists y \exists x (\neg P(x, y) \lor \neg Q(x, y)) \]

c. 
\[ \neg (\exists x \exists y \neg P(x, y) \land \forall x \forall y Q(x, y)) \equiv \neg \exists x \exists y \neg P(x, y) \lor \forall x \forall y \neg Q(x, y) \]
\[ \equiv \forall x \forall y \neg P(x, y) \lor \exists x \exists y \neg Q(x, y) \]

d. 
\[ \neg \forall x (\exists y \forall z P(x, y, z) \land \exists z \forall y P(x, y, z)) \equiv \exists x (\exists y \forall z P(x, y, z) \land \exists z \forall y P(x, y, z)) \]
\[ \equiv \exists x (\neg \exists y \forall z P(x, y, z) \lor \neg \exists z \forall y P(x, y, z)) \]
\[ \equiv \exists x (\forall y \exists z \neg P(x, y, z) \lor \forall z \exists y \neg P(x, y, z)) \]