Quiz #1

1. **S1.3, Exercise 31:** Suppose that the domain of $Q(x, y, z)$ consists of triples x, y, z, where $x = 0, 1,$ or 2, $y = 0$ or 1, and $z = 0$ or 1. Write out these propositions using disjunctions and conjunctions.

   a. $\forall y Q(0, y, 0) \equiv Q(0, 0, 0) \wedge Q(0, 1, 0)$

   b. $\exists x Q(x, 1, 1) \equiv Q(0, 1, 1) \vee Q(1, 1, 1) \vee Q(2, 1, 1)$

   c. $\exists z \neg Q(0, 0, z) \equiv \neg Q(0, 0, 0) \vee \neg Q(0, 0, 1) \equiv \neg(Q(0, 0, 0) \wedge Q(0, 0, 1))$

   d. $\exists x \neg Q(x, 0, 1) \equiv \neg Q(0, 0, 1) \vee \neg Q(1, 0, 1) \vee \neg Q(2, 0, 1) \equiv \neg(Q(0, 0, 1) \wedge Q(1, 0, 1) \wedge Q(2, 0, 1))$

2. **S1.3, Exercise 61:** We have the following statements:

$$
\begin{array}{ll}
P(x): & x \text{ is a baby} \\
Q(x): & x \text{ is logical} \\
R(x): & x \text{ is able to manage a crocodile} \\
S(x): & x \text{ is despised}
\end{array}
$$

   Suppose that the domain consists of all people. Express each of these statements using quantifiers, logical connectives, and the predicates given above.

   (a) Babies are illogical.
   $$\forall x (P(x) \rightarrow \neg Q(x))$$

   (b) Nobody is despised who can manage a crocodile.
   $$\neg \exists x (S(x) \wedge R(x))$$

   (c) Illogical people are despised.
   $$\forall x (\neg Q(x) \rightarrow S(x))$$

   (d) Babies cannot manage crocodiles.
   $$\forall x (P(x) \rightarrow \neg R(x))$$