1. A correspondence between $\mathbb{N}$ and $\mathbb{Z}$ is defined by ordering the latter thus
   \[0, 1, -1, 2, -2, 3, -3, \ldots\]
   Give a mathematical formula for this correspondence. (i.e. find $f : \mathbb{N} \rightarrow \mathbb{Z}$ which is one-to-one and onto).
   
   Hint: $(-1)^i$ can be used to alternate positive and negative signs. You might also want to use the “floor” and/or “ceiling” integer functions.

2. (from Test 1) Describe a way to list the set of finite subsets of the natural numbers.
   
   Hint: recall the technique I used in lecture 4 to show that the set of languages over the binary alphabet is not countable.

3. Denote by $\neg u$ the negation of the Boolean variable $u$. Here is a proof that
   \[\neg (x \lor y) \iff (\neg x \land \neg y)\]
   
   **proof:** If $x = T$ then
   \[
   \neg (x \lor y) \iff \neg (T \lor y) \\
   \iff \neg T \\
   \iff F
   \]
   and
   \[
   (\neg x \land \neg y) \iff (\neg T \land \neg y) \\
   \iff (F \land \neg y) \\
   \iff F.
   \]
Since the formula is symmetric in \( x, y \), the claim is also true if \( y = T \).
The remaining case is \( X = Y = F \). In this case

\[
\neg(x \lor y) \iff \neg(F \lor F) \\
\iff \neg F \\
\iff T
\]

and

\[
(\neg x \land \neg y) \iff (\neg F \land \neg F) \\
\iff (T \land T) \\
\iff T.
\]

Give an analogous proof that

\[
\neg(x \land y) \iff (\neg x \lor \neg y).
\]

4. Exercise 1.2, page 83 of text.

5. Exercise 1.4, page 84 of text.