1. State the order of precedence for the logical operators $\land$, $\lor$, $\neg$, and $\to$.

   $\neg > \land > \lor > \to$

2. Write down a truth table for the formula $\theta = \neg P \land (\neg P \to Q)$

<table>
<thead>
<tr>
<th>$P$</th>
<th>$Q$</th>
<th>$\neg P$</th>
<th>$\neg P \to Q$</th>
<th>$\theta$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
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<tr>
<td>0</td>
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</tr>
</tbody>
</table>

   Is $\neg P \land (\neg P \to Q)$ logically equivalent to $\neg P \to Q$? No.

   Re-write $\neg P \land (\neg P \to Q)$ using the least number of logical operators. $\neg P \land Q$

3. State DeMorgan’s Law. $\neg (P \land Q) = \neg P \lor \neg Q$

4. Translate the following sentences into a formula of sentential logic: “A country must shut down the government if it has a political deadlock and its head of state does not negotiate. An exception is made for European and Communist countries.”

   Use HasPoliticalDeadlock, HeadOfStateNegotiates, European, Communist, ShutDownGovt in your answer.

   $\text{HasPoliticalDeadlock} \land \neg \text{HeadOfStateNegotiates} \land \neg \text{European} \land \neg \text{Communist} \to \text{ShutDownGovt}$
1. Cut and shuffle \( \pi_0 \) in your proposed number of moves to see if you can indeed reach \( \pi \).

2. Treat \( \text{if } s \text{ then } p \text{ else } q \) like code. It is the same as \( \text{if } s \text{ ? } p : q \) or
   
   ```
   if (s) {
       output = p;
   } else {
       output = q;
   }
   ```

3. A mux (multiplexor) is a common device in circuit design that selects one signal to output from multiple inputs.

4. You need not define variables for the various conditions. Use words or phrases like in #4 of the mock quiz for the various conditions to formulate the answer.

5. You may define variables, for example \( c_A \), to mean that A is guilty (copied). A student cannot be both guilty and innocent, though there may not be enough information to show either way. A student can only be completely truthful or completely lying.

6. Recall that \( \{ \land, \lor, \neg \} \) is logically complete.

7. A party function returns 1 when the input contains an odd number of ones. Note: an earlier version of this assignment contained a non-essential typo for the parity function formula.