1. Exclusive Or
For each of the following, decide whether inclusive-or or exclusive-or is intended:

(a) Experience with C or Java is required.

Solution:
Inclusive Or.

(b) Lunch includes soup or salad.

Solution:
Exclusive Or.

(c) Publish or perish

Solution:
Exclusive Or.

(d) To enter the country you need a passport or voter registration card.

Solution:
Inclusive Or.

2. Translations
For each of the following, define propositional variables and translate the sentences into logical notation.

(a) I will remember to send you the address only if you send me an e-mail message.

Solution:
\[ p : \text{I will remember to send you the address} \]
\[ q : \text{You send me an e-mail message} \]

\[ p \rightarrow q \]

(b) If berries are ripe along the trail, hiking is safe if and only if grizzly bears have not been seen in the area.

Solution:
\[ p : \text{Berries are ripe along the trail} \]
\[ q : \text{Hiking is safe} \]
\[ r : \text{Grizzly bears have not been seen in the area} \]

\[ p \rightarrow (q \leftrightarrow r) \]

(c) Unless I am trying to type something, my cat is either eating or sleeping.
Solution:

\[ p : \text{My cat is eating} \]
\[ q : \text{My cat is sleeping} \]
\[ r : \text{I’m trying to type} \]

\[ \neg r \rightarrow (p \oplus q) \]

3. Teatime
Consider the following sentence:

If I am drinking tea then I am eating a cookie, or, if I am eating a cookie then I am drinking tea.

(a) Define propositional variables and translate the sentence into an expression in logical notation.

Solution:

\[ p : \text{I am drinking tea} \]
\[ q : \text{I am eating a cookie} \]

\[ (p \rightarrow q) \lor (q \rightarrow p) \]

(b) Fill out a truth table for your expression.

Solution:

<table>
<thead>
<tr>
<th>( p )</th>
<th>( q )</th>
<th>( p \rightarrow q )</th>
<th>( q \rightarrow p )</th>
<th>( (p \rightarrow q) \lor (q \rightarrow p) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>T</td>
<td>T</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>T</td>
<td>F</td>
<td>F</td>
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<td>F</td>
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<td>T</td>
<td>T</td>
</tr>
</tbody>
</table>

(c) Based on your truth table, classify the original sentence as a contingency, tautology, or contradiction.

Solution:
Tautology
4. Truth Tables
Write a truth table for each of the following:

(a) \((p \oplus q) \lor (p \oplus \neg q)\)

Solution:

<table>
<thead>
<tr>
<th>(p)</th>
<th>(q)</th>
<th>(p \oplus q)</th>
<th>(p \oplus \neg q)</th>
<th>((p \oplus q) \lor (p \oplus \neg q))</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>T</td>
<td>F</td>
<td>T</td>
<td></td>
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<td>T</td>
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<td>F</td>
<td>F</td>
<td>T</td>
<td></td>
</tr>
</tbody>
</table>

(b) \((p \lor q) \rightarrow (p \oplus q)\)

Solution:

<table>
<thead>
<tr>
<th>(p)</th>
<th>(q)</th>
<th>(p \lor q)</th>
<th>(p \oplus q)</th>
<th>((p \lor q) \rightarrow (p \oplus q))</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>T</td>
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<td>F</td>
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<td>F</td>
<td>T</td>
</tr>
</tbody>
</table>

(c) \(p \leftrightarrow \neg p\)

Solution:

<table>
<thead>
<tr>
<th>(p)</th>
<th>(\neg p)</th>
<th>(p \leftrightarrow \neg p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>F</td>
<td>T</td>
<td>F</td>
</tr>
</tbody>
</table>

5. Circuitous
Translate the following circuit into a logical expression.

Solution:

\(\neg (\neg p \lor (p \land \neg q))\)