Physics 623 Homework

1. Use NAND gates to form the following:
   (a) \((A \cdot B) + (C \cdot D)\)

   (b) \((A+B) \cdot (\overline{C+D})\)

   (c) \(A + (B \cdot \overline{C})\)
2. Design a ROM* using NAND gates that will take the input of the table and provide the output of the table.  \* "Read-Only Memory"

<table>
<thead>
<tr>
<th>input</th>
<th>output</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000</td>
<td>0001</td>
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<tr>
<td>0001</td>
<td>0010</td>
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<tr>
<td>0010</td>
<td>0011</td>
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<td>0011</td>
<td>0000</td>
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</tbody>
</table>
3. Make a complete truth table to prove the theorems:

\[ A + B = \overline{A \cdot B} \quad \quad A \cdot B = \overline{A + B} \]

(You can do both at once with a ten-column table)

4. Implement the exclusive or function

\[ C = A \oplus B \quad (C = (A+B) \cdot (A \cdot B)) \] using only two-input NOR gates \((C = \overline{A + B})\),

usual symbol =

\[ \begin{array}{c}
A \\
\overline{B}
\end{array} \rightarrow \quad \quad \quad C = \overline{A + B} \]

Use the above theorems to prove that your implementation is correct.