Problem 1
From the State Transition Table, the expressions for the next-state bits can be written as,

\[ a^+ = c \]
\[ b^+ = \bar{b} + \bar{a} \bar{c} \]
\[ c^+ = \bar{a} \cdot b \]

The counter is implemented using D-type flip-flops as shown in the figure below. The \( Q' \) output of the flip-flop is used to directly provide \( a', b' \) and \( c' \). Inverters can also be used to provide these signals from the \( Q \) outputs.

![Diagram of flip-flop circuit]

Problem 2
The expressions for the inputs of the flip-flops are:

\[ Y_2 = \overline{w} \cdot y_2 + \overline{y_1} \cdot \overline{y_2} \]
\[ Y_1 = w \oplus y_1 \oplus y_2 \]

The output equation is

\[ z = y_1 \cdot y_2 \]

The output \( z \), of this circuit depends on the state of the circuit only. This is a Moore machine. The circuit schematic is shown on the next page.
Problem 3

The new next-state and output equations are found to be:

\[ Y_2 = \overline{y_1} \cdot \overline{y_2} + w \cdot y_2 \]
\[ Y_1 = \overline{y_1} \cdot y_2 + w \cdot \overline{y_2} \]
\[ z = y_1 \cdot \overline{y_2} \]

This code assignment seems to be a better choice, as compared to the previous one.

<table>
<thead>
<tr>
<th>Present State</th>
<th>Next State $Y_2Y_1$</th>
<th>Output $z$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y_2y_1$</td>
<td>$w = 0$</td>
<td>$w = 1$</td>
</tr>
<tr>
<td>1 1</td>
<td>0 0</td>
<td>0</td>
</tr>
<tr>
<td>1 0</td>
<td>1 0</td>
<td>1</td>
</tr>
<tr>
<td>0 0</td>
<td>0 1</td>
<td>1</td>
</tr>
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<td>1</td>
</tr>
</tbody>
</table>
Figure 1: Circuit Diagram