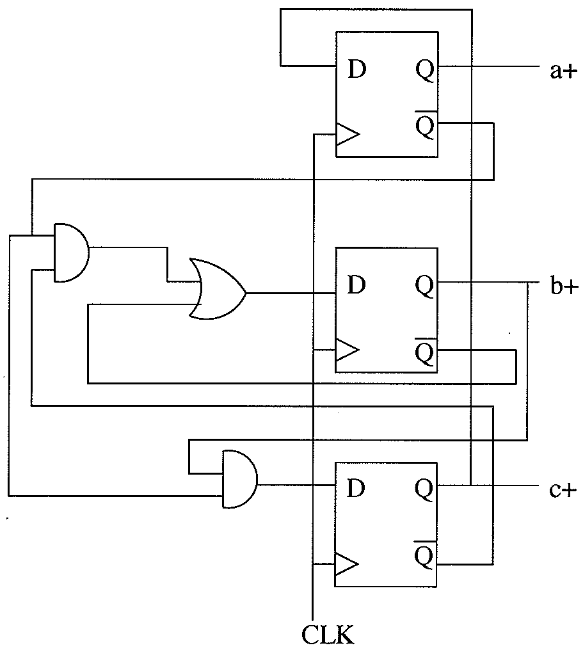
Problem 1

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

$$
\begin{aligned}
a^+ &= c \\
b^+ &= \bar{b} + \bar{a}.\bar{c} \\
c^+ &= \bar{a}.b
\end{aligned}
$$

The counter is impemented 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.



Problem 2

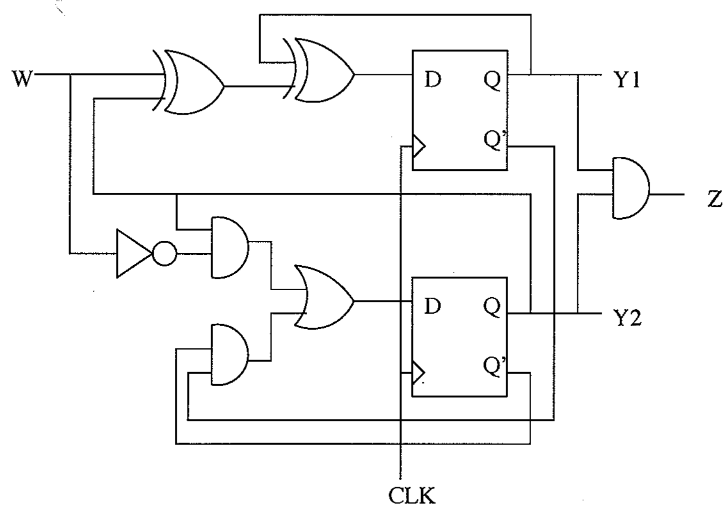
The expressions for the inputs of the flip-flops are:

$$
\begin{aligned}
Y_2 &= \overline{w}.y_2 + \overline{y_1}.\overline{y_2} \\
Y_1 &= w \oplus y_1 \oplus y_2
\end{aligned}
$$

The output equation is

$$z = y_1.y_2$$

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:

$$Y_2 = \overline{y_1}.\overline{y_2} + w.y_2$$
$$Y_1 = \overline{y_1}.y_2 + w.\overline{y_2}$$
$$z = y_1.\overline{y_2}$$

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

Table 1: State Transition Table

Present State		Next State				Output
		$w=0$		$w=1$		
y_2y_1		Y_2Y_1		Y_2Y_1		z
1	1	0	0	0	1	0
1	0	1	0	1	1	0
0	0	0	1	1	1	0
0	1	0	0	1	0	1

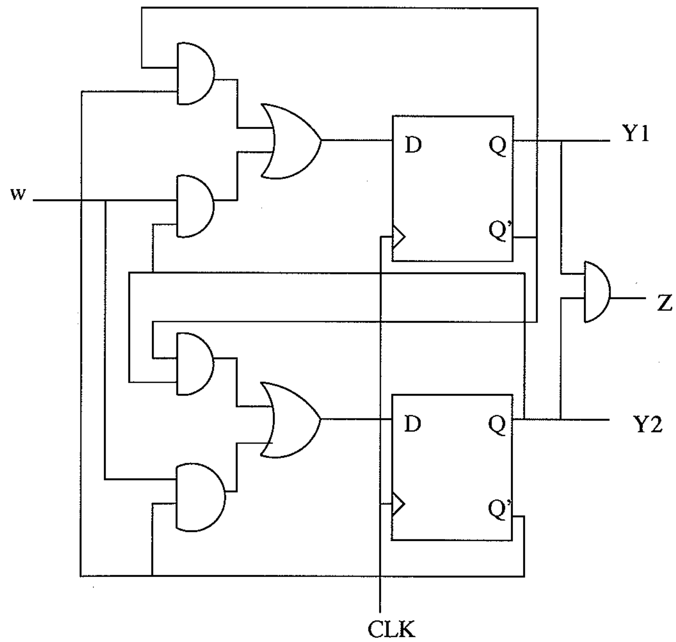


Figure 1: Circuit Diagram