Karnaugh's maps for Task 3

For the Moore's state machine implementation:

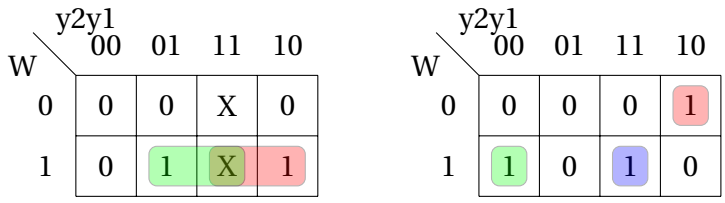

Figure 1: Maps for Y_2 (left) and Y_1 (right) functions.

Where $Y_2 = W \cdot y_1 + W \cdot y_2$, and $Y_1 = W \cdot \overline{y_2} \cdot \overline{y_1}$. From the transitions table, it is simple to see that $Z = y_1$.

And for the Mealy's state machine implementation:

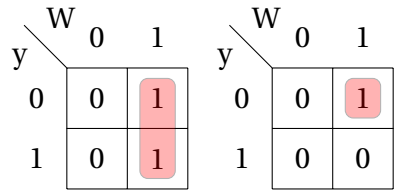

Figure 2: Maps for Y (left) and Z (right)

Where from the left map $Y = W$, and from the right table $Z = \overline{y} \cdot W$.

Level shifter for inputs

From the implemented circuit:

Figure 3: Level shifter for CLK from 5V to 3.3V (VCC)

Usign for $I_{SAT} = 1mA$, considerating $VCE_{SAT} = 0.2V$, the equation from the out mesh:

$$3.3V - VCE_{SAT} - I_{SAT}R_1 = 0$$
$$\frac{3.3V - VCE_{SAT}}{I_{SAT}} = R_1 = 3.1K\Omega$$

Normalizing we have $R_1 = 3.3K\Omega$. Considering $HFE_{MIN} = 100$, from the input mesh:

$$5V - VBE_{ON} - \frac{I_C}{HFE_{MIN}}R_2 = 0$$
$$\frac{5V - VBE_{ON}}{I_C}HFE_{MIN} = R_2 = 430K\Omega$$

Normalizing we have $R_2 = 390K\Omega$.

Driver for output led

Taking the implemented circuit:

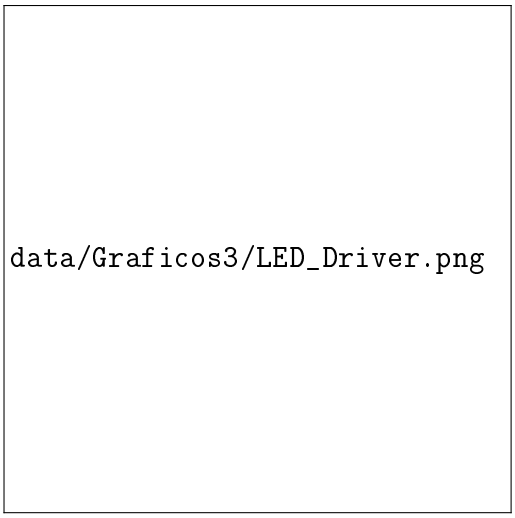

Figure 4: Driver for LED output.

Usign for $I_{LED} = 10mA$, considerating $VCE_{SAT} = 0.2V$ and $VLED = 2V$, the equation from the out mesh:

$$3.3V - V_{LED} - VCE_{SAT} - I_{LED}R_3 = 0$$
$$\frac{3.3V - V_{LED} - VCE_{SAT}}{I_{LED}} = R_3 = 110\Omega$$

Normalizing we have $R_3 = 220\Omega$. Considering $HFE_{MIN} = 100$, from the input mesh:

$$3.3V - VBE_{ON} - \frac{I_C}{HFE_{MIN}}R_4 = 0$$
$$\frac{3.3V - VBE_{ON}}{I_C}HFE_{MIN} = R_4 = 26K\Omega$$

Normalizing we have $R_4 = 22K\Omega$, to guarantee saturation.