

Task 1

In this section, a state machine will be developed for controlling the switching on and off of two pumps, to fill a tank. The are controlled by two sensors from the upper part of the tank (S) and the lower part of the tank (I). The actions to take are as follows:

- Tank full: $S = I = 1$ - Pumps OFF
- Tank empty: $S = I = 0$ - Pumps ON
- Half full tank: $S = 0$ & $I = 1$ - Pumps alternate

With this in mind, a Moore machine is developed as follows.

Using two bits to assign the states, a table of transitions is made, as shown below.

From the table, using Karnaugh's maps the functions for the state variables and the two pumps outputs are made as shown below.

Finally, the state machine is implemented using D Flip Flops:

On the other side, the same system is implemented now using a Mealy state machine, as shown below.

Notice that the direct connection between the input and the pumps outputs reduces the number of states from four to two, in comparison with the Moore machine. Using one bit for the states, a table of transitions is made as follows.

Using again Karnaugh's maps, the functions for the state variable and the two pumps outputs are made as shown below.

Finally, the state machine is implemented using one D Flip Flop.