

Homework # 1
Due at lab time Tuesday

Design a state machine that will create the waveform shown on the back of this page. Before lab you should:

- a) create a neatly drawn, fully labeled, state diagram
- b) design the next state forming logic (i.e write the logic expressions for minimized logic)
- c) design the output forming logic (i.e. write the logic expressions for minimized logic)

Draw a neat logic diagram using only AND, OR, and Inverter gates plus rising-edge triggered D-Flip/Flops to implement your design (no more than 4 inputs on any AND or OR gate).

hint: the design can be done with 4 states.

DO NOT SIMULATE using a simulation program. Rather, once the design is done and a diagram is created, work through the design manually like this (document circuit operation as you work through this):

- 1) Begin by assuming that the flip-flops are in a particular logic state (which signifies a present state in the state diagram) and that the two external inputs X and Y are fixed at certain logic levels (this establishes which waveform will be created)
- 2) Determine what the output of the next-state logic is when the inputs are as specified in (1) above.
- 3) Assume that a rising clock edge arrives at the flipflops and the next state signal is transferred into flip-flop memory. Present state is now what is in memory. Note the new location in the state diagram
- 4) Determine the assertion levels of the Sync and Wave outputs..
- 5) A new present state means that a new input is being asserted on the next state logic (assume that the waveform selection inputs X and Y are constant, not changing), so go back to step (2) and repeat the evaluation.
- 6) Continue steps 2 to 5 until you have “traveled” through a complete state sequence in the state diagram.
- 7) Change the assertions on X or Y or both and start again at step (1) above to create a new waveform output.

You can consider the two inputs X and Y as coming from two human operated switches. Don't worry about transient affects that might happen right when the switches are changed.