Stock Data on 7 Segment Display

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Functional Description of Circuit

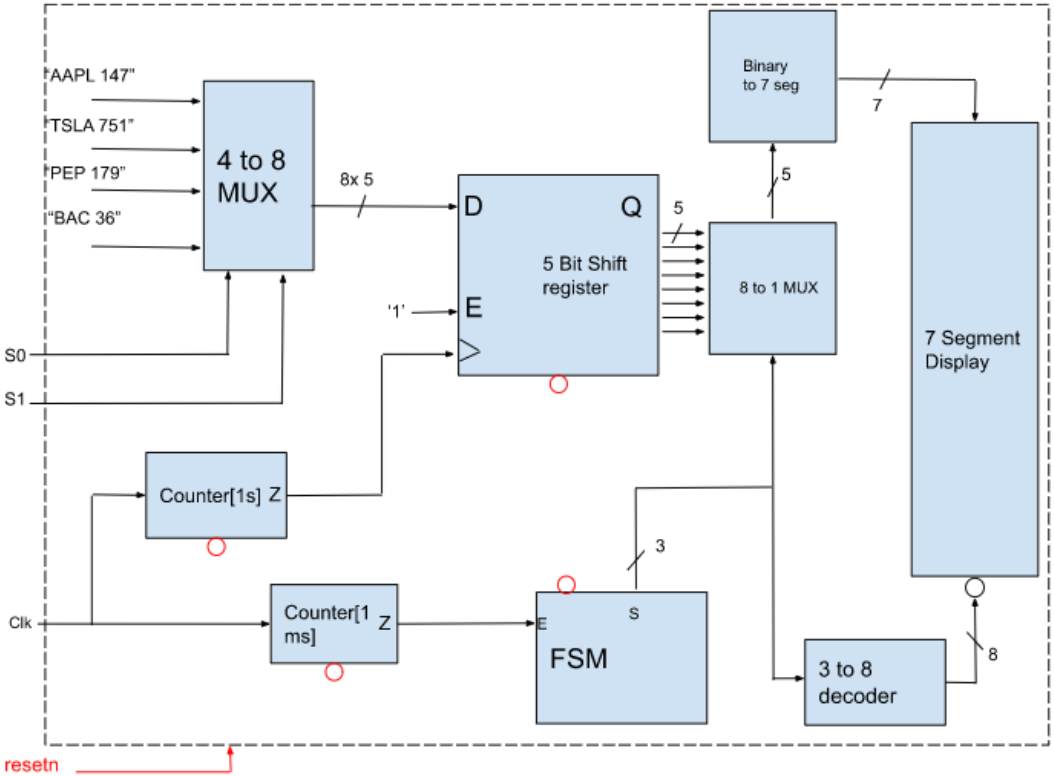
- Our circuit displays the stock price of 4 stocks (i.e Apple, Pepsi, Bank of America, and Tesla) across all 8 seven segment displays on an Nexys A7-50T FPGA board.

- The user has the option of selecting between 2 switches to decide what stock will be displayed across the FPGA.

- Each letter and or number will be “shifted in” from the left and continue to move in that direction in a continuous loop until a new stock is selected and the reset button is pushed.

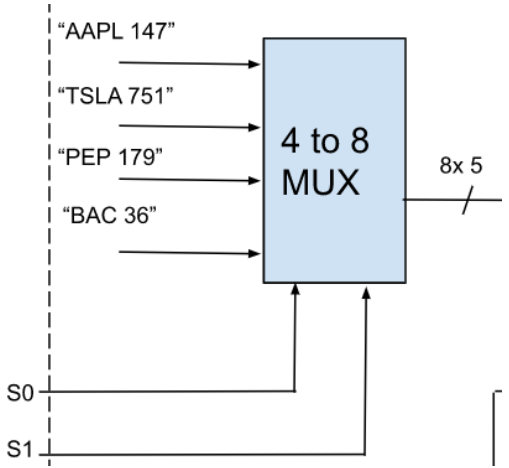
Block Diagram

- This circuit utilizes the serializer digital logic system explained in class with the addition of a 5-bit shift register, a 1ms counter, and an 8-1 multiplexer.



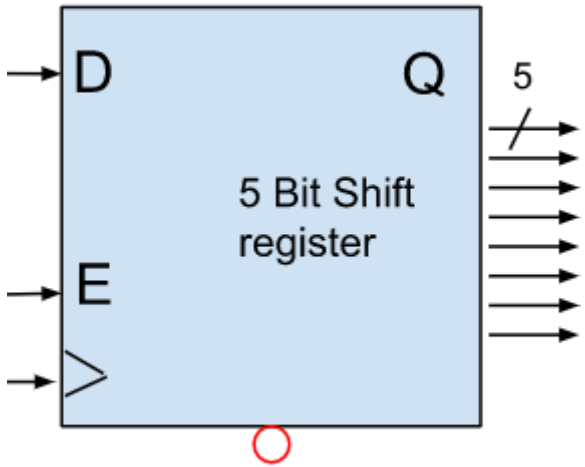
“The Beginning” 4-8 Multiplexer

- The beginning of this circuit consists of a 4-8 multiplexer which is operated by two switches.
- The cases for the multiplexer output are when select line = “00” APPLE, “01” Tesla, “10” PEP, “11” BAC
- Once the ticker symbol is selected, the multiplexer will output an array of length 8 where each value of the array holds 5 bits representing a number or letter.
- This array will be then be inputted into the 5 bit - shift register



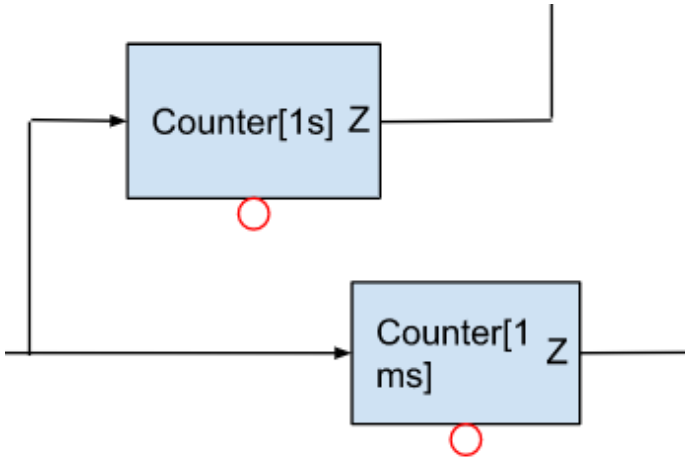
5 Bit Shift Register

- The input to to the register is the output array of the 4 - 8 multiplexor.
- This means that each letter or number will have an initial position and will shift to the right on every rising edge of the 1s counter.
- Each position change is outputted as a 5 bit number still representing a letter to the 8 -1 multiplexer.



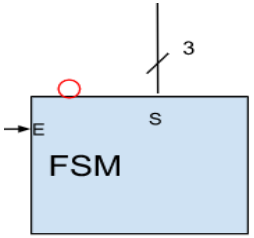
Counters

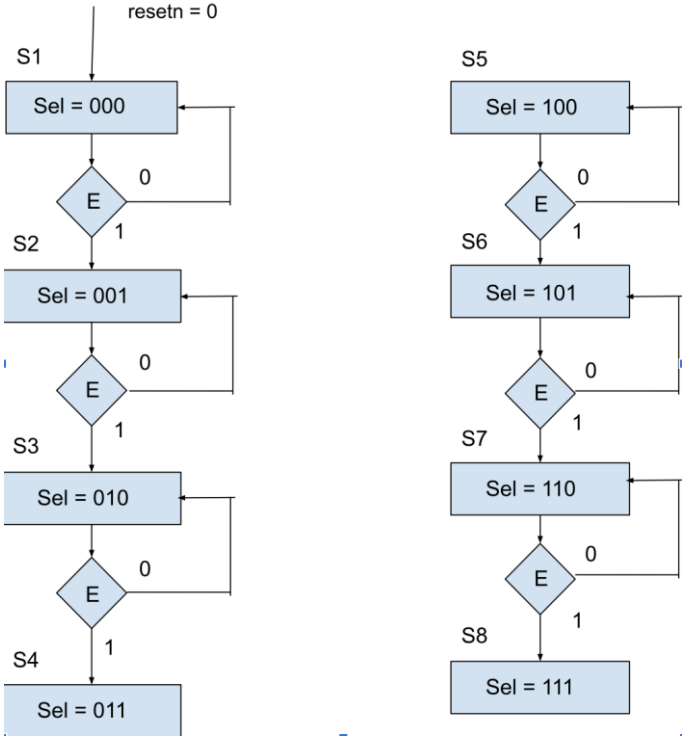
- Inputs: Standard 100MHZ with a 50% duty cycle clock
- Outputs: Counter signal ‘Z’
- There are two counters that are 1s and 1ms.
- The 1s counter for the shift register shifts each letter/number down every second as it is hooked up to the clock port of the register.
- The 1ms counter is for the FSM which is hooked up to the enable. This allows for a state change every 1ms.



FSM

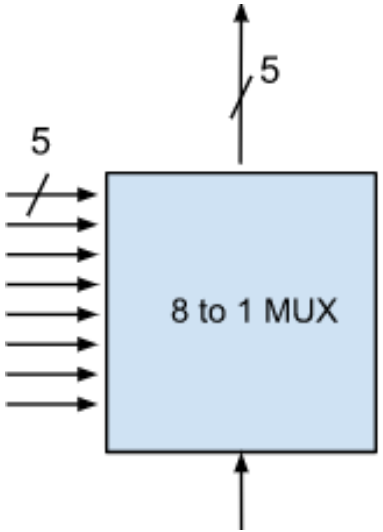
- The purpose of the FSM is to output the 3 bit select line number to the 8-1 multiplexor as well as the 3 - 8 decoder.
- The FSM has 8 states (1 for each seven segment display).
- The state changes when the output from the 1ms counter is 1 and output's the 3 - bit select line number corresponding to the state (S1 = "000", S2 = "001" etc.)
- The FSM runs through all the states much faster than the time it takes for the shift register to shift so all of the letters, numbers, and spaces are effectively displayed as separate characters.





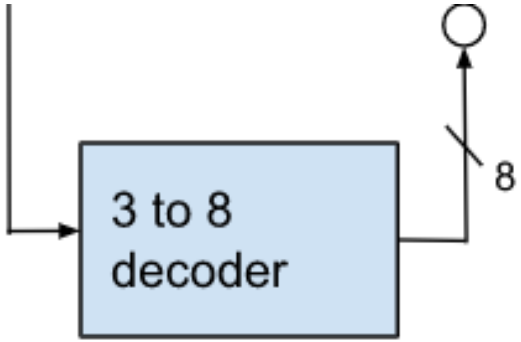
8-1 Multiplexor

- The inputs of the multiplexer are all of the 8 characters of a given message outputted from the 5 bit register.
- The FSM output will select what character is selected from the sequence based off what the state it is in.
- The selected character will output a vector of 5 bits to be sent to the 7-segment decoder.



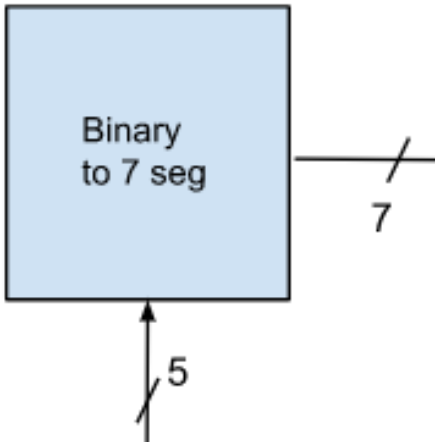
3-to-8 Decoder

- The 3-to-8 decoder acts synchronously with the 8 to 1 multiplexor
- It selects what 7-segment display out of the 8 displays is being sent data and only enables that display
- The enable of this decoder shares the FSM output with the 8 to 1 mux as an input to enable the displays to show differing characters on each display.



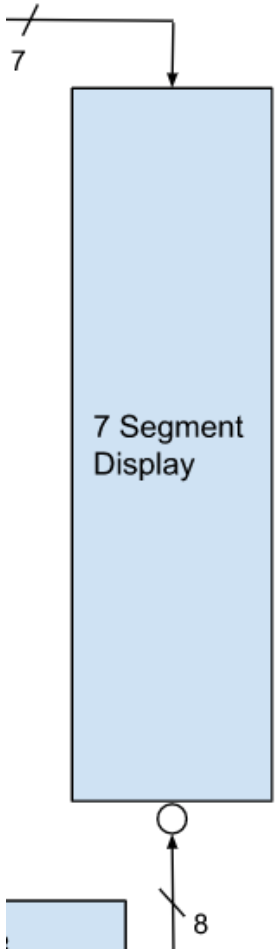
Binary to Seven Segment

- This converts the 5 bit signal from the 8-1 multiplexer into a 7 bit signal that determines which segments of the 7-segment leds to enable.
- This was accomplished by implementing a directory of all the numbers, letters, and spaces used for each stock ticker and price
- For example, when a value in the 8 bit array is equal to "00000”, the binary to seven segment converter will output "1111110” which will show “0” on one of the seven segment displays.



7 Segment Displays

- The seven segment displays are the final output of the circuit.
- The inputs are the 7 bit data signal with the character values from the Binary to Seven Segment Decoder and the 8 bit signal from the 3-to-8 decoder that turns on any one of the 7 segment displays
- The output is the stock ticker symbol as well as the price of the stock shifting to the left across all of the displays



Demo Video

https://youtube.com/shorts/HihTrQEnMqc?feature=share