Lab 5: Counters and Clocks

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February 12, 2023

1 Part I

1. Export the subcircuit schematic as an image and include it in your report.
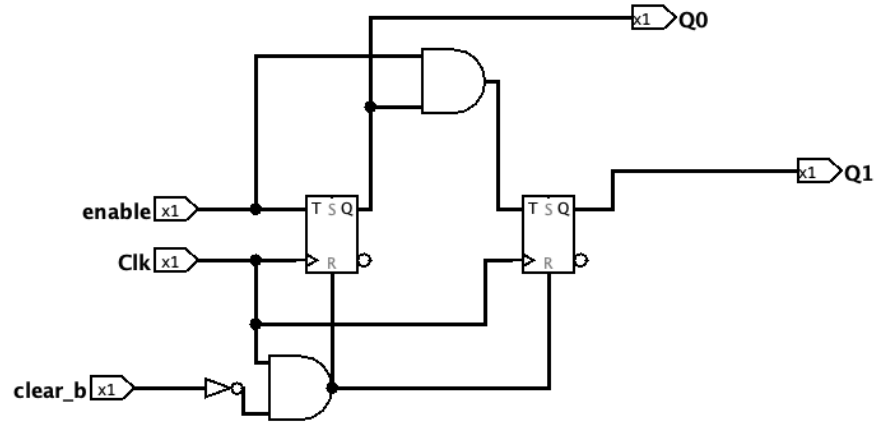

Figure 1: A schematic of counter2.

2. Export the subcircuit schematic as an image and include it in your report.
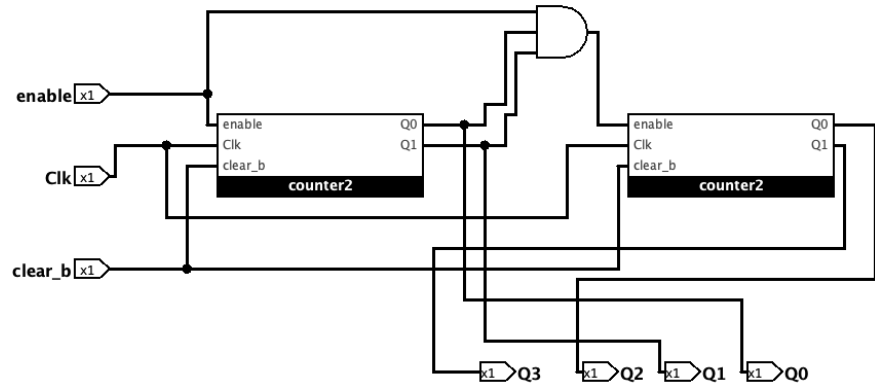

Figure 2: A schematic of counter4.

3. Export the timing diagram as an image and include it in your report.

4. Export the subcircuit schematic as an image and include it in your report.

2 Part II

1. Export the subcircuit schematic as an image and include it in your report.
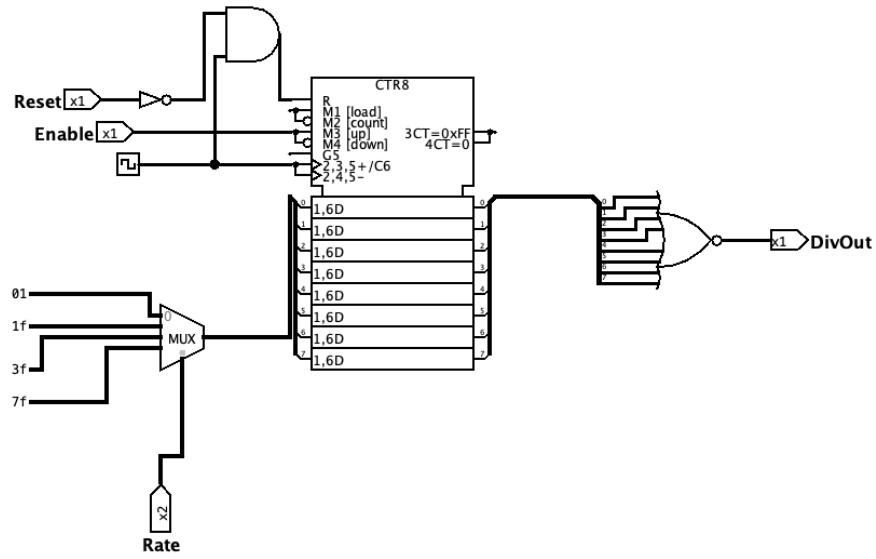
Figure 3: A timing simulation of counter4.

Figure 4: A schematic of counter8.

(a) When the output is 1111 the counter_out would be 1 and the value would go back to a or gate and activate load$M1$, which would load 0 to counter and the maximun value is kept at 1111.

(b) Instead of connecting all of the output to an AND gate, just connect the out_0 and out_2 with an AND gate.

(c) Wrap around
The next value is 0 (if incrementing - the maximum value if decrementing)
Stay at value
The counter's value remains at the maximum
Continue counting
The counter continues incrementing/decrementing, keeping the number of bits as provided by the Data Bits attribute
Load next value
The next value is loaded from the D input. The output is kept at 0.

2. Export the timing diagram as an image and include it in your report.

3   Part III

1. Fill in a table with your binary representation of each letter from S to Z.

2. Export the subcircuit schematic as an image and include it in your report.
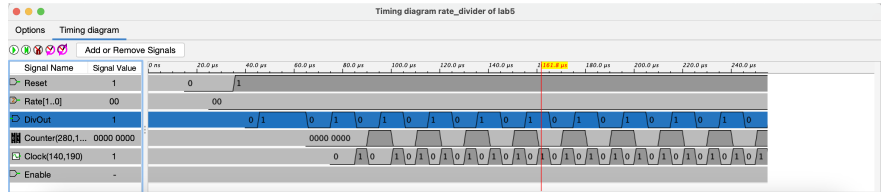
Figure 5: A schematic of rate_divider.

Figure 6: A timing simulation of rate_divider.

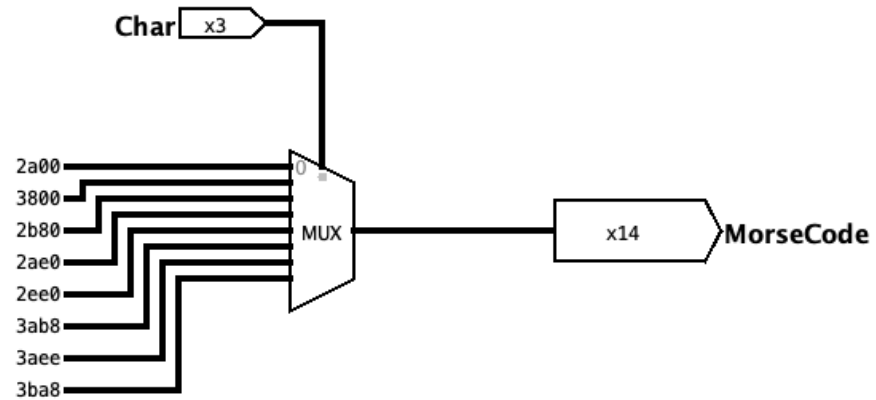| Letter	Morse Code	Pattern Representation (pattern length is <u>14</u> bits)
S	• • •	10101000000000
T	—	11100000000000
U	• • —	10101110000000
V	• • • —	10101011100000
W	• — —	10111011100000
X	— • • —	11101010111000
Y	— • — —	11101011101110
Z	— — • •	11101110101000

Table 1: Morse Pattern Representation with fixed bit-width

Figure 7: A schematic of MORSE_LUT.