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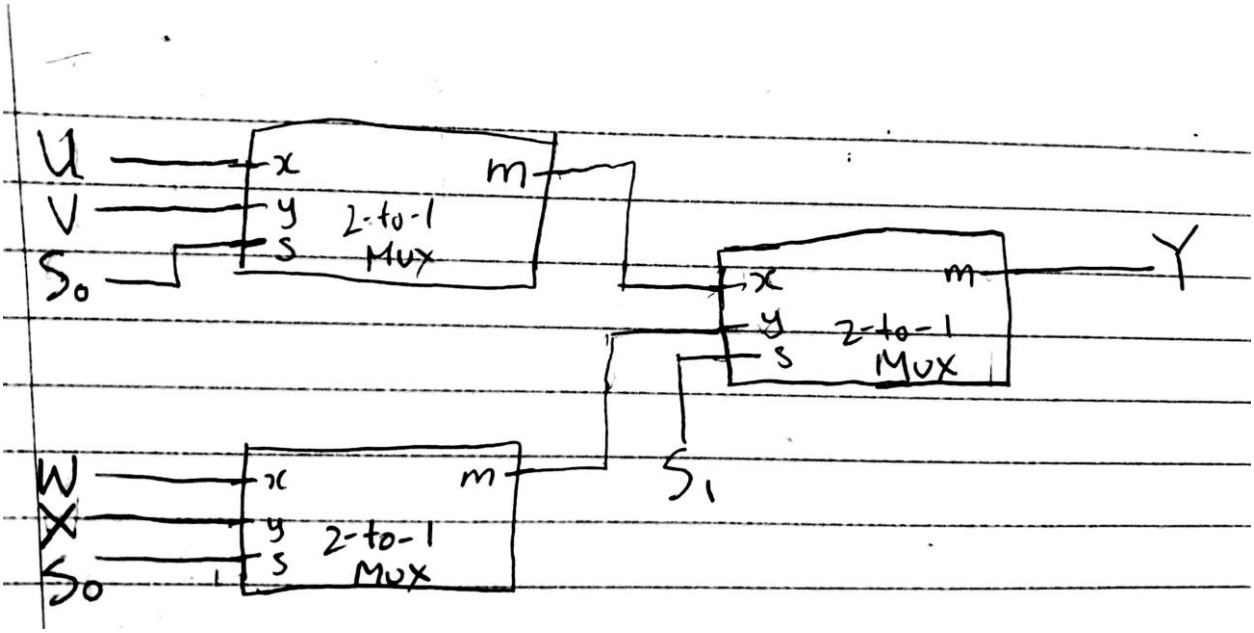
Sep. 29, 2020

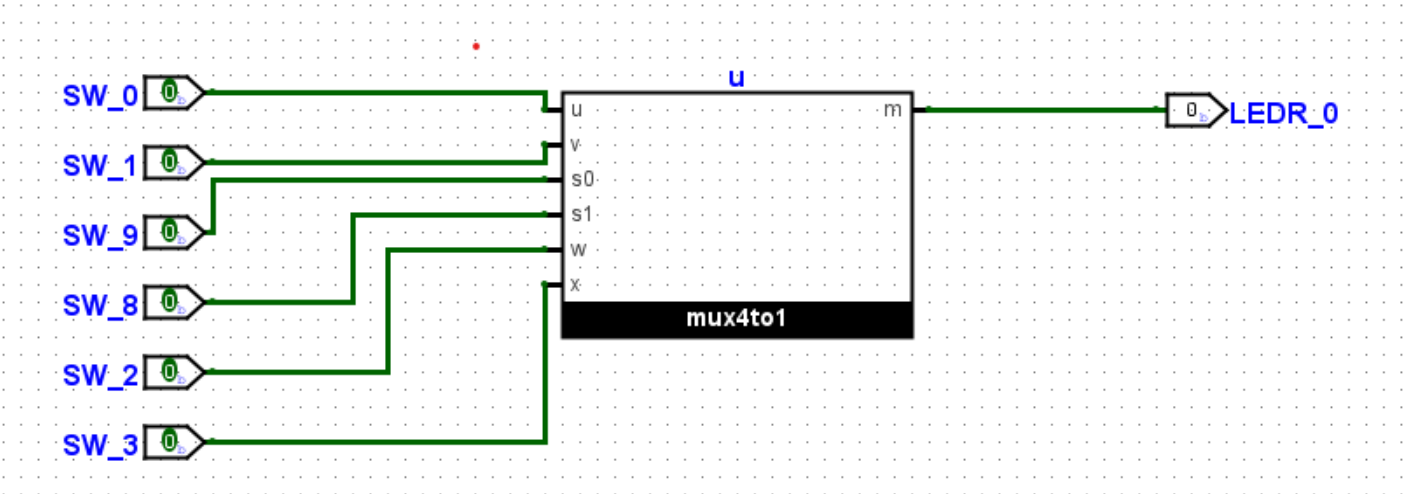
CSC258 Prelab (Lab 2)

Part 2: 4-to-1 Multiplexer

1. The full truth table for the 4-to-1 multiplexer would have 2^6 or 64 rows because there are 6 inputs.
2. Schematic of connecting mux2to1 components to build a 4-to-1 multiplexer:



5. Below is a screenshot of a map of my Logisim design of the 4-to-1 Mux onto a DE1-SoC board

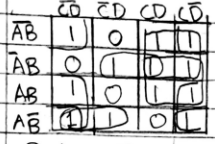


Part 3: 7 Segment Decoder

1. Below is the truth table for each of the 7 segments in the decoder with the Karnaugh maps that correspond to each segment which optimize the Boolean expression for each segment.

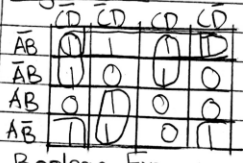
A	B	C	D	Segment0	Segment1	Segment2	Segment3	Segment4	Segment5	Segment6
0	0	0	0	1	1	1	1	1	1	0
0	0	0	1	0	1	1	0	0	0	0
0	0	1	0	1	1	0	1	1	0	1
0	0	1	1	1	1	1	1	0	0	1
0	1	0	0	0	1	1	0	0	1	1
0	1	0	1	1	0	1	1	0	1	1
0	1	1	0	1	0	1	1	1	1	1
0	1	1	1	1	1	1	0	0	0	0
1	0	0	0	1	1	1	1	1	1	1
1	0	0	1	1	1	1	0	0	1	1
1	0	1	0	1	1	1	0	1	1	1
1	0	1	1	0	0	1	1	1	1	1
1	1	0	0	1	0	0	1	1	1	0
1	1	0	1	0	1	1	1	1	0	1
1	1	1	0	1	0	0	1	1	1	1
1	1	1	1	1	0	0	0	1	1	1

Segment 0



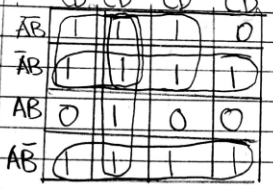
Boolean Expression: $\bar{B}\bar{D}+\bar{A}\bar{C}+BC+A\bar{D}+\bar{A}B\bar{D}+A\bar{B}\bar{C}=Y$

Segment 1



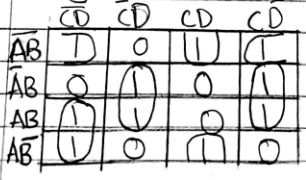
Boolean Expression: $\bar{A}\bar{B}+\bar{B}\bar{D}+\bar{A}\bar{C}\bar{D}+\bar{A}CD+A\bar{C}D=Y$

Segment 2



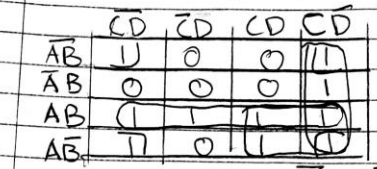
Boolean Expression: $\bar{A}\bar{C}+\bar{A}D+\bar{C}D+\bar{A}B+A\bar{B}=Y$

Segment 3



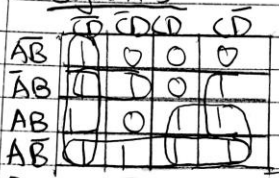
Boolean Expression: $\bar{A}\bar{B}\bar{D}+\bar{B}CD+B\bar{C}D+BC\bar{D}+A\bar{C}\bar{D}=Y$

Segment 4



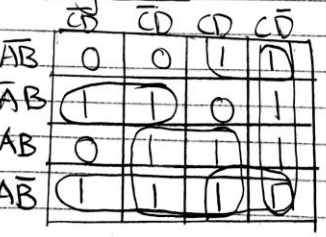
Boolean Expression: $\bar{B}\bar{D}+C\bar{D}+AC+AB=Y$

Segment 5



Boolean Expression: $C\bar{D}+A\bar{B}+B\bar{D}+AC+\bar{A}B\bar{C}=Y$

Segment 6



Boolean Expression: $\bar{B}C+C\bar{D}+A\bar{B}+AD+\bar{A}B\bar{C}=Y$

3. Below are the screenshots of the test vectors for each segment of the decoder.

Segment 0:

Passed: 16 Failed: 0

status	A	B	C	D	Y
pass	0	0	0	0	1
pass	0	0	0	1	0
pass	0	0	1	0	1
pass	0	0	1	1	1
pass	0	1	0	0	0
pass	0	1	0	1	1
pass	0	1	1	0	1
pass	0	1	1	1	1
pass	1	0	0	0	1
pass	1	0	0	1	1
pass	1	0	1	0	1
pass	1	0	1	1	0
pass	1	1	0	0	1
pass	1	1	0	1	0
pass	1	1	1	0	1
pass	1	1	1	1	1

Segment 1:

Passed: 16 Failed: 0

status	A	B	C	D	Y
pass	0	0	0	0	1
pass	0	0	0	1	1
pass	0	0	1	0	1
pass	0	0	1	1	1
pass	0	1	0	0	1
pass	0	1	0	1	0
pass	0	1	1	0	0
pass	0	1	1	1	1
pass	1	0	0	0	1
pass	1	0	0	1	1
pass	1	0	1	0	1
pass	1	0	1	1	0
pass	1	1	0	0	0
pass	1	1	0	1	1
pass	1	1	1	0	0
pass	1	1	1	1	0

Segment 2:

Passed: 16 Failed: 0

status	A	B	C	D	Y
pass	0	0	0	0	1
pass	0	0	0	1	1
pass	0	0	1	0	0
pass	0	0	1	1	1
pass	0	1	0	0	1
pass	0	1	0	1	1
pass	0	1	1	0	1
pass	0	1	1	1	1
pass	1	0	0	0	1
pass	1	0	0	1	1
pass	1	0	1	0	1
pass	1	0	1	1	1
pass	1	1	0	0	0
pass	1	1	0	1	1
pass	1	1	1	0	0
pass	1	1	1	1	0

Segment 3:

Passed: 16 Failed: 0

status	A	B	C	D	Y
pass	0	0	0	0	1
pass	0	0	0	1	0
pass	0	0	1	0	1
pass	0	0	1	1	1
pass	0	1	0	0	0
pass	0	1	0	1	1
pass	0	1	1	0	1
pass	0	1	1	1	0
pass	1	0	0	0	1
pass	1	0	0	1	0
pass	1	0	1	0	0
pass	1	0	1	1	1
pass	1	1	0	0	1
pass	1	1	0	1	1
pass	1	1	1	0	1
pass	1	1	1	1	0

Segment 4:

Passed: 16 Failed: 0

status	A	B	C	D	Y
pass	0	0	0	0	1
pass	0	0	0	1	0
pass	0	0	1	0	1
pass	0	0	1	1	0
pass	0	1	0	0	0
pass	0	1	0	1	0
pass	0	1	1	0	1
pass	0	1	1	1	0
pass	1	0	0	0	1
pass	1	0	0	1	0
pass	1	0	1	0	1
pass	1	0	1	1	1
pass	1	1	0	0	1
pass	1	1	0	1	1
pass	1	1	1	0	1
pass	1	1	1	1	1

Segment 5:

Passed: 16 Failed: 0

status	A	B	C	D	Y
pass	0	0	0	0	1
pass	0	0	0	1	0
pass	0	0	1	0	0
pass	0	0	1	1	0
pass	0	1	0	0	1
pass	0	1	0	1	1
pass	0	1	1	0	1
pass	0	1	1	1	0
pass	1	0	0	0	1
pass	1	0	0	1	1
pass	1	0	1	0	1
pass	1	0	1	1	1
pass	1	1	0	0	1
pass	1	1	0	1	0
pass	1	1	1	0	1
pass	1	1	1	1	1

Segment 6:

Passed: 16 Failed: 0

status	A	B	C	D	Y
pass	0	0	0	0	0
pass	0	0	0	1	0
pass	0	0	1	0	1
pass	0	0	1	1	1
pass	0	1	0	0	1
pass	0	1	0	1	1
pass	0	1	1	0	1
pass	0	1	1	1	0
pass	1	0	0	0	1
pass	1	0	0	1	1
pass	1	0	1	0	1
pass	1	0	1	1	1
pass	1	1	0	0	0
pass	1	1	0	1	1
pass	1	1	1	0	1
pass	1	1	1	1	1