CSC258 LAB2 PRELAB

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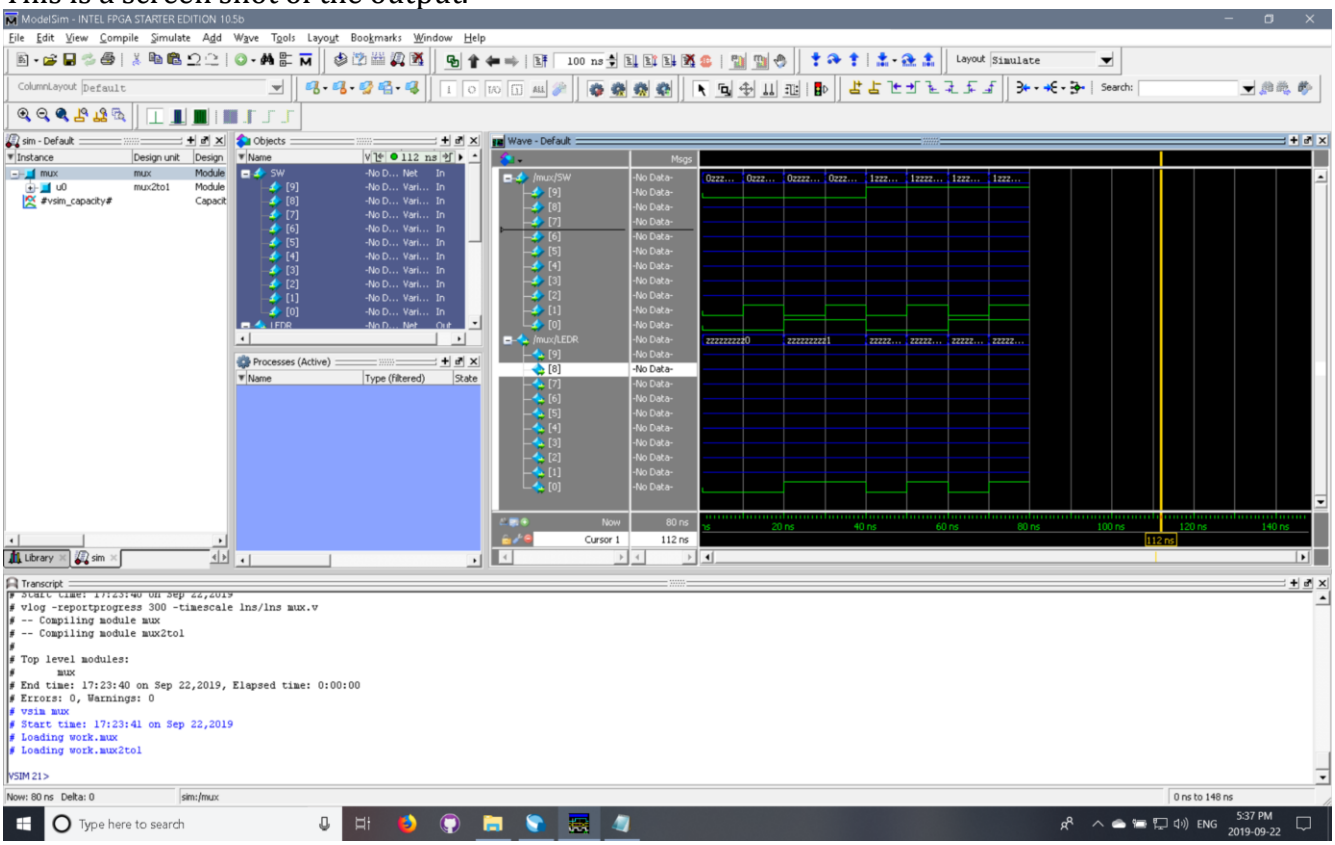
5 PART I

1. This is a screen shot of the output.



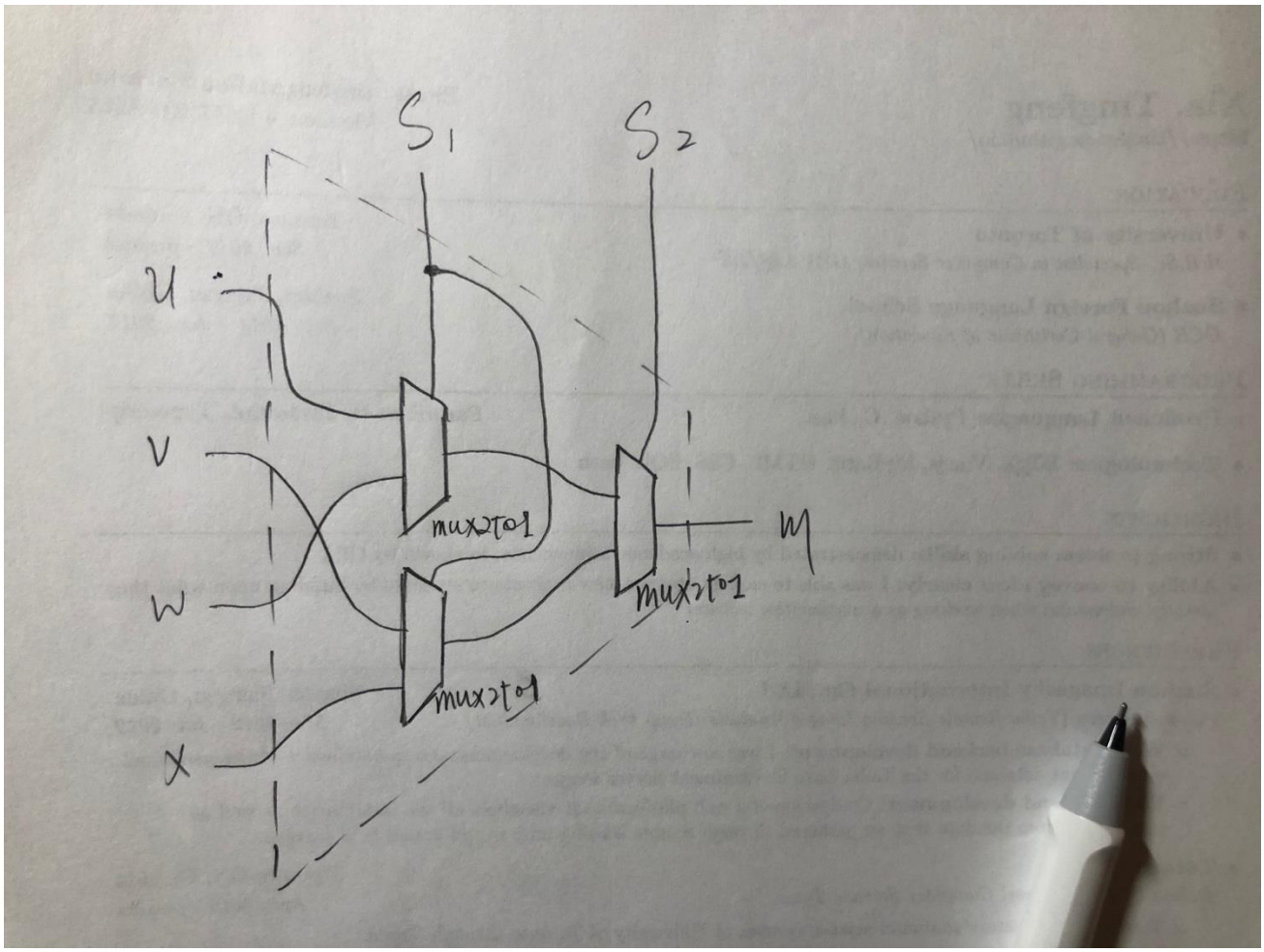
Our inputs are SW[0], SW[1], SW[9] and output is sent to LEDR[0], we ran each combination of input for 10ns. We have the output as follows:

SW[0] (x)	SW[1] (y)	SW[9] (s)	LEDR[0] (m)
0	0	0	0
0	1	0	0
1	0	0	1
1	1	0	1
0	0	1	0
0	1	1	1
1	0	1	0
1	1	1	1

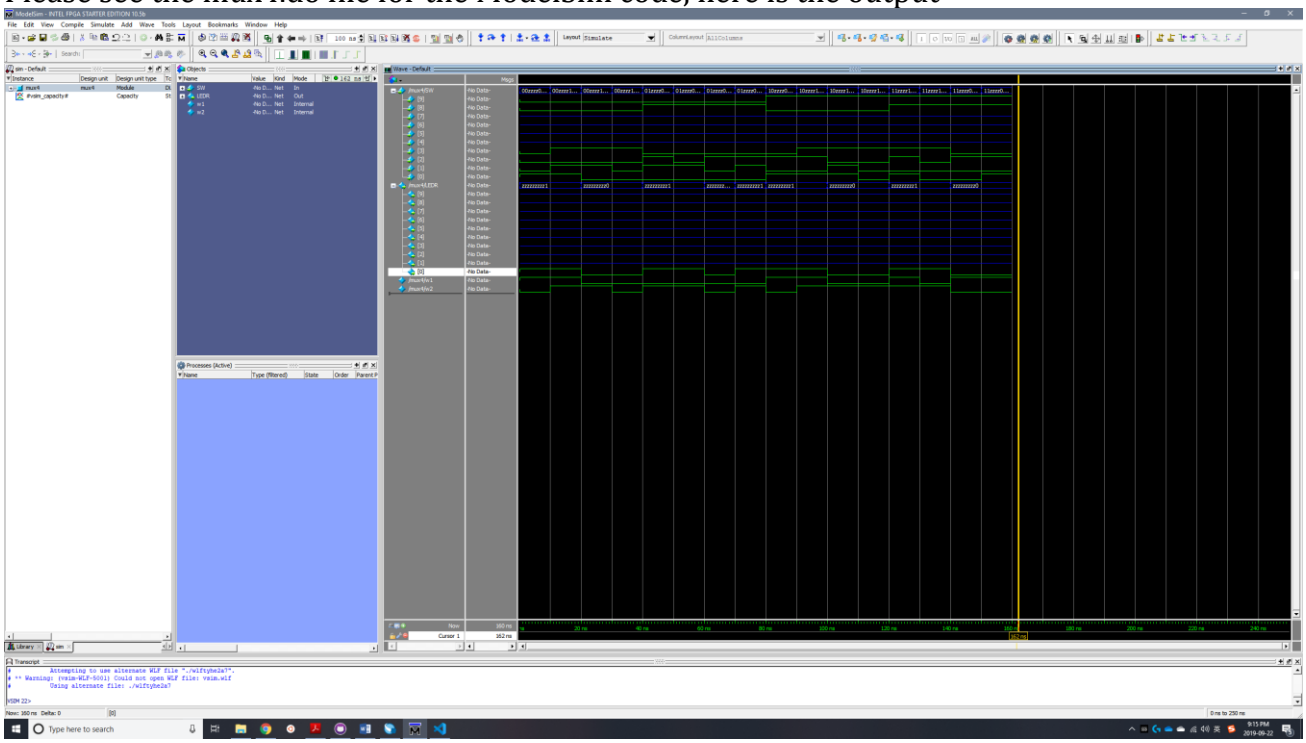
According to the results above, we can confirm that the design is working properly since when SW[9], i.e. input s, is zero, the output m is equal to SW[0] which is our x input and when SW[9] is 1, the output m is equal to the y input(SE[1]). So the multiplexer is correct.

6 PART II

1. Here we have 6 inputs in total to consider, so there would be $2^6 = 64$ rows in a full truth table.
2. Here is my design (Notice that I assumed the mux2to1 multiplexer to have the same input/output layout as specified in the handout.)



3. Please see the mux4.v file.
5. Please see the mux4.do file for the ModelSim code, here is the output



The result is consistent with my design. Notice that by the way I designed my do file, the first 40ns output wave should look like the first input(u, SW[0]), the second 40ns output should look like the second input(V, SW[1]), the third 40ns input should look like the third input(w,

SW[2]) and the last 40ns input should look like the fourth input(x, SW[3]). The output that I got from LEDR[0] is exactly what I expected so I am confident that my circuit is working correctly.

7 PART III

1. First, let's write down the full truth table (Notice that here 0 marks emitting light)

hex.	C_3	C_2	C_1	C_0	HEX[0]	HEX[1]	HEX[2]	HEX[3]	HEX[4]	HEX[5]	HEX[6]
0	0	0	0	0	0	0	0	0	0	0	1
1	0	0	0	1	1	0	0	1	1	1	1
2	0	0	1	0	0	0	1	0	0	1	0
3	0	0	1	1	0	0	0	0	1	1	0
4	0	1	0	0	1	0	0	1	1	0	0
5	0	1	0	1	0	1	0	0	1	0	0
6	0	1	1	0	0	1	0	0	0	0	0
7	0	1	1	1	0	0	0	1	1	1	1
8	1	0	0	0	0	0	0	0	0	0	0
9	1	0	0	1	0	0	0	0	1	0	0
A	1	0	1	0	0	0	0	1	0	0	0
B	1	0	1	1	1	1	0	0	0	0	0
C	1	1	0	0	0	1	1	0	0	0	1
D	1	1	0	1	1	0	0	0	0	1	0
E	1	1	1	0	0	1	1	0	0	0	0
F	1	1	1	1	0	1	1	1	0	0	0

#NOTATION: For the following 7 tables and expressions, by $\overline{AB}$ I mean $\bar{A}\bar{B}$, this was to simplify the typesetting.

a. For HEX[0], we have the Karnaugh map

	$\overline{c_1c_0}$	$\bar{c}_1c_0$	c_1c_0	$c_1\bar{c}_o$
$\overline{c_3c_2}$	0	1	0	0
$\bar{c}_3c_2$	1	0	0	0
c_3c_2	0	1	0	0
$c_3\bar{c}_2$	0	0	1	0

Thus, $HEX[0] = \overline{c_3c_2c_1}c_0 + \bar{c}_3c_2\bar{c}_1\bar{c}_0 + c_3c_2\bar{c}_1c_0 + c_3\bar{c}_2c_1c_0$

b. For HEX[1], we have the Karnaugh map

	$\overline{c_1c_0}$	$\bar{c}_1c_0$	c_1c_0	$c_1\bar{c}_o$
$\overline{c_3c_2}$	0	0	0	0
$\bar{c}_3c_2$	0	1	0	1
c_3c_2	1	0	1	1
$c_3\bar{c}_2$	0	0	1	0

Thus, $HEX[1] = \bar{c}_3c_2\bar{c}_1c_0 + c_3c_1c_0 + c_2c_1\bar{c}_0 + c_3c_2\bar{c}_0$

c. For HEX[2], we have the Karnaugh map

	$\overline{c_1c_0}$	$\bar{c}_1c_0$	c_1c_0	$c_1\bar{c}_o$
$\overline{c_3c_2}$	0	0	0	1
$\bar{c}_3c_2$	0	0	0	0

c_3c_2	1	0	1	1
$c_3\overline{c_2}$	0	0	0	0

Thus, $HEX[2] = c_3c_2\overline{c_0} + c_3c_2c_1 + \overline{c_3c_2}c_1\overline{c_o}$

d. For HEX[3], we have the Karnaugh map

	$\overline{c_1c_0}$	$\overline{c_1}c_0$	c_1c_0	$c_1\overline{c_o}$
$\overline{c_3c_2}$	0	1	0	0
$\overline{c_3}c_2$	1	0	1	0
c_3c_2	0	0	1	0
$c_3\overline{c_2}$	0	0	0	1

Thus, $HEX[3] = \overline{c_3}c_2\overline{c_1c_0} + \overline{c_3c_2}\overline{c_1}c_0 + c_2c_1c_0 + c_3\overline{c_2}c_1\overline{c_0}$

e. For HEX[4], we have the Karnaugh map

	$\overline{c_1c_0}$	$\overline{c_1}c_0$	c_1c_0	$c_1\overline{c_o}$
$\overline{c_3c_2}$	0	1	1	0
$\overline{c_3}c_2$	1	1	1	0
c_3c_2	0	0	0	0
$c_3\overline{c_2}$	0	1	0	0

Thus, $HEX[4] = \overline{c_3}c_0 + \overline{c_2}\overline{c_1}c_0 + \overline{c_3}c_2\overline{c_1}$

f. For HEX[5], we have the Karnaugh map

	$\overline{c_1c_0}$	$\overline{c_1}c_0$	c_1c_0	$c_1\overline{c_o}$
$\overline{c_3c_2}$	0	1	1	1
$\overline{c_3}c_2$	0	0	1	0
c_3c_2	0	1	0	0
$c_3\overline{c_2}$	0	0	0	0

Thus, $HEX[5] = \overline{c_3}\overline{c_2}c_0 + \overline{c_3}\overline{c_2}c_1 + \overline{c_3}c_1c_0 + c_3c_2\overline{c_1}c_0$

g. For HEX[6], we have the Karnaugh map

	$\overline{c_1c_0}$	$\overline{c_1}c_0$	c_1c_0	$c_1\overline{c_o}$
$\overline{c_3c_2}$	1	1	0	0
$\overline{c_3}c_2$	0	0	1	0
c_3c_2	1	0	0	0
$c_3\overline{c_2}$	0	0	0	0

Thus, $HEX[6] = \overline{c_3}\overline{c_2}\overline{c_1} + \overline{c_3}c_2c_1c_0 + c_3c_2\overline{c_1}\overline{c_0}$

2. Please see the hexdecoder.v file
3. Here is a screenshot of the output, please see the hexdecoder.do file for the test code, notice that here we are using BA3165 which is the lab name for the test.