

# ECE 1315 DIGITAL LOGIC DESIGN

ECE Dept, UMD  
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## EXPERIMENT # 6: Implementation of Boolean Functions Using Multiplexers and Decoders

This lab involves design of standard Boolean functions using multiplexers and decoders. Implement the given functions on your breadboard and test your circuit using LogiScan to verify the implementation. Before implementation, carefully study the data sheets of 74LS151 and 74LS138.

**Part A:** Implement the following Boolean function using a 74LS151 8-to-1 multiplexer and one inverter (if necessary).

$$f(w,x,y,z) = w'y' + w'x'z + wx'y + wy'z'$$

**Part B:** Implement the following two functions using a single decoder 74LS138 and some supporting gates.

$$g(x,y,z) = x'z + xz' + xy$$

$$h(x,y,z) = x'z + xyz' + x'y'z'$$

## EXPERIMENT #6 RESULTS

Your Name: \_\_\_\_\_

Witnessed by Instructor or TA: \_\_\_\_\_

Date \_\_\_\_\_

### Part A: Boolean function implementation using Mux

Express  $f(w,x,y,z)$  using minterms.

$$f(w,x,y,z) = \Sigma($$

Fill in the minterm table and derive the circuit for each mux input.

	I <sub>0</sub>	I <sub>1</sub>	I <sub>2</sub>	I <sub>3</sub>	I <sub>4</sub>	I <sub>5</sub>	I <sub>6</sub>	I <sub>7</sub>
w'	0	1	2	3	4	5	6	7
w	8	9	10	11	12	13	14	15

Show the circuit.

Build the circuit on your breadboard and verify your circuit using LogiScan. Fill in the truth table observed from LogiScan.

w	x	y	z	f
0	0	0	0	
0	0	0	1	
0	0	1	0	
0	0	1	1	
0	1	0	0	
0	1	0	1	
0	1	1	0	
0	1	1	1	
1				
1				
1				
1				
1				
1				
1				
1				

**Part B: Boolean function implementation using decoders**

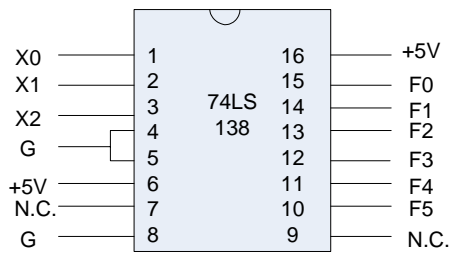
Find the minterms for the given functions g and h.

$$g(x,y,z) = \Sigma(\dots)$$

$$h(x,y,z) = \Sigma(\dots)$$

Design the circuit.

Before you build the actual circuit, test the functionality of the 74LS138 using the LogiScan. Build the following simple circuit and test its outputs by manually changing X2, X1, and X0. All labels outside the 138 denote the connections to the LogiScan.



After learning about the 74LS138 chip, build the circuit for the given functions  $g(x,y,z)$  and  $h(x,y,z)$  on your breadboard and verify your circuit using LogiScan. Fill in the truth table observed from the LogiScan.

<b>x</b>	<b>y</b>	<b>z</b>	<b>g</b>	<b>h</b>
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

Have your TA verify your work.