

**Task 1:**

[Negate.cct]	
Schematic	
Test Cases [Pass 3 (0011)] with complement switch off	<p>Passing 3, Without Negating It</p> <p>The circuit diagram shows a 4-bit incrementer block labeled INC_4. It has four data inputs: A3, A2, A1, and A0. Each input is connected to a switch. Switches for A3, A2, and A1 are set to 0. Switch for A0 is set to 1. There is an additional input labeled INC, which is connected to a switch labeled PASS'Y2'sCOMP, also set to 0. The block has four sum outputs: S0, S1, S2, and S3, and a carry-out output COUT. The output values are displayed as green circles: S0=1, S1=1, S2=0, S3=0, and COUT=0.</p>
Test Cases [Pass - 7 (1111)] with complement switch set on	<p>Passing -7, Negating It</p> <p>The circuit diagram is identical to the one above, but the switches for A3, A2, A1, and A0 are all set to 1. The PASS'Y2'sCOMP switch is also set to 1. The output values are displayed as green circles: S0=1, S1=0, S2=0, S3=0, and COUT=0.</p>

Truth Table for Suggested Case: “. Show an input of 3, and set the circuit not to negate it. Then, show an input of 7, with the circuit set to negate it”		<div>S      A3      A2      A1      A0</div>					<div>S0      S1      S2      S3      COUT</div>				
	A/B' = 1	<div>1      1      1      1      1</div>					<div>1      0      0      0      0</div>				
	A/B' = 0	<div>0      0      0      1      1</div>					<div>1      1      0      0      0</div>				

Task 2:

[MUX_1.cct]																																					
Schematic	<p>MUX_1</p> <p><math>S = A/B'</math></p>																																				
SOP Equation	$Y = \bar{S}A + SB$																																				
Truth Table	<table><thead><tr><th>S</th><th>A</th><th>B</th><th>Y</th></tr></thead><tbody><tr><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>0</td><td>1</td><td>0</td></tr><tr><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td></tr><tr><td>1</td><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>1</td><td>1</td></tr></tbody></table>	S	A	B	Y	0	0	0	0	0	0	1	0	0	1	0	1	0	1	1	1	1	0	0	0	1	0	1	1	1	1	0	0	1	1	1	1
S	A	B	Y																																		
0	0	0	0																																		
0	0	1	0																																		
0	1	0	1																																		
0	1	1	1																																		
1	0	0	0																																		
1	0	1	1																																		
1	1	0	0																																		
1	1	1	1																																		

K-Map (Y)

		A, B			
		00	01	11	10
S	0	0	0	1	1
	1	0	1	1	0

$\bar{S}A + SB$

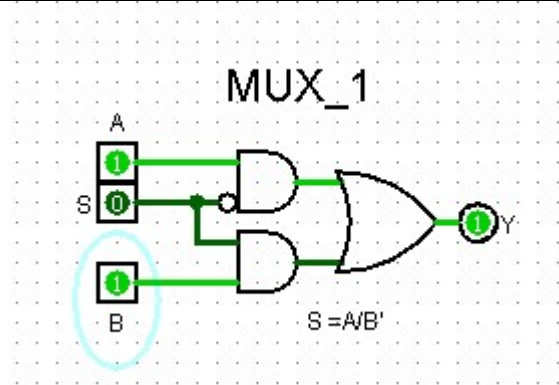
### Test Cases

S = 0

A = 1

B = 1

Y = 1

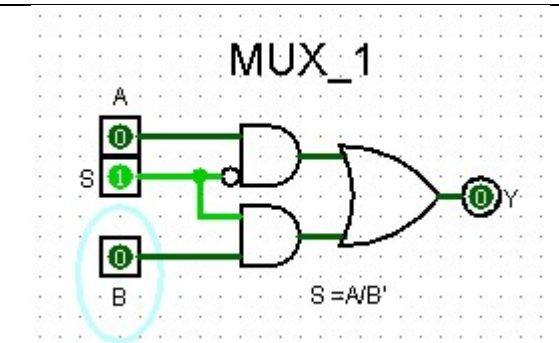


S = 1

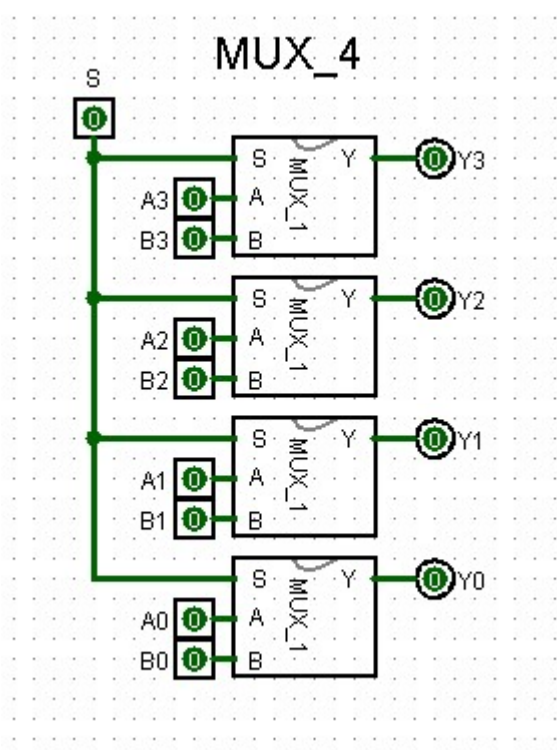
A = 0

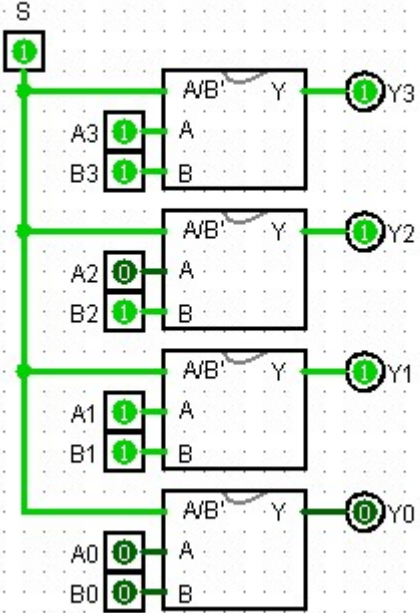
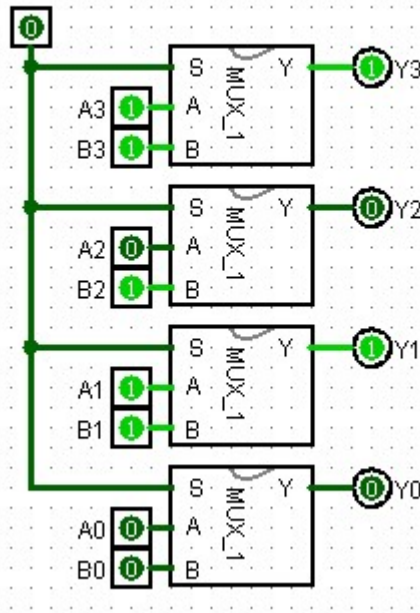
B = 0

Y = 0



[MUX\_4.cct]

Overall Schematic														
SOP Equation	$Y_n = \bar{S}A_n + SB_n \text{ for } n = 0,1,2,3$													
Truth Table for Suggested Case: 'A = 12, B = 7, A/B' = 1 and then with A/B' = 0'		S	A3	A2	A1	A0	B3	B2	B1	B0	Y3	Y2	Y1	Y0
A/B' = 1		1	1	0	1	0	0	1	1	1	0	1	<u>1</u>	1
A/B' = 0		0	1	0	0	1	1	0	0	1	1	0	0	1

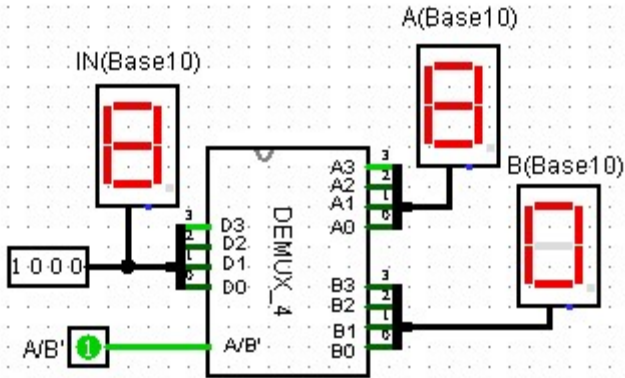
Suggested Case Results	$A/B' = 1$	<p>MUX_4 <math>A/B = 1, A = 12, B = 7</math></p> 
	$A/B' = 0$	<p>MUX_4 <math>A/B' = 0, A = 12, B = 7</math></p> 

Task 3:

[DEMUX_1.cct]																						
Schematic	<div>1-Bit Demultiplexer SOP Form</div>																					
SOP Equation	$A = SI$	$B = \bar{S}I$																				
Truth Table	<table><tr><th>S</th><th>I</th><th>A</th><th>B</th></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>1</td><td>0</td></tr></table>		S	I	A	B	0	0	0	0	0	1	0	1	1	0	0	0	1	1	1	0
S	I	A	B																			
0	0	0	0																			
0	1	0	1																			
1	0	0	0																			
1	1	1	0																			
K-Map (A)	<table><tr><th colspan="2"></th><th colspan="2">I</th></tr><tr><th colspan="2"></th><th>0</th><th>1</th></tr><tr><th rowspan="2">S</th><th>0</th><td>0</td><td>0</td></tr><tr><th>1</th><td>0</td><td>1</td></tr></table> <p>SI</p>				I				0	1	S	0	0	0	1	0	1					
		I																				
		0	1																			
S	0	0	0																			
	1	0	1																			
K-Map (B)	<table><tr><th colspan="2"></th><th colspan="2">I</th></tr><tr><th colspan="2"></th><th>0</th><th>1</th></tr><tr><th rowspan="2">S</th><th>0</th><td>0</td><td>1</td></tr><tr><th>1</th><td>0</td><td>0</td></tr></table> <p><math>\bar{S}I</math></p>				I				0	1	S	0	0	1	1	0	0					
		I																				
		0	1																			
S	0	0	1																			
	1	0	0																			

Test Cases for Rows 2-3	<p>1-Bit Demultiplexer SOP Form</p> <p><math>I = IN</math> <math>S = \text{Switch } (A/B)</math></p>
	<p>1-Bit Demultiplexer SOP Form</p> <p><math>I = IN</math> <math>S = \text{Switch } (A/B)</math></p>

[DEMUX_4.cct]		
Overall Schematic	<p>2 Output 4-bit Demultiplexer</p> <p><math>S = A/B'</math></p>	
SOP Equation	$A_n = D_n S \text{ for } n = 0,1,2,3$	$B_n = D_n \bar{S} \text{ for } n = 0,1,2,3$

		<table><tr><th>S</th><th>D3</th><th>D2</th><th>D1</th><th>D0</th><th>A3</th><th>A2</th><th>A1</th><th>A0</th><th>B3</th><th>B2</th><th>B1</th><th>B0</th></tr><tr><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td></tr></table>	S	D3	D2	D1	D0	A3	A2	A1	A0	B3	B2	B1	B0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0
S	D3	D2	D1	D0	A3	A2	A1	A0	B3	B2	B1	B0																													
1	1	0	0	0	1	0	0	0	0	0	0	0																													
0	1	0	0	0	0	0	0	0	1	0	0	0																													
Truth Table for Suggested Case: 'IN = 8, A/B' = 1 and then with A/B' = 0	A/B' = 1																																								
	A/B' = 0																																								
Suggested Case Results	A/B' = 1	<div>DEMUX_4 A/B' = 1, IN = 8</div> 																																							
	A/B' = 0	<div>DEMUX_4 A/B' = 0, IN = 8</div> 