

# 10/1/2009 Outline

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- Enable Bit with decoder

- MUX:

2:1 Gates + multip bits

4:1  $\bar{w}$  2:1

8:1  $\bar{w}$  2:1

- Demux:

1:2

1:4

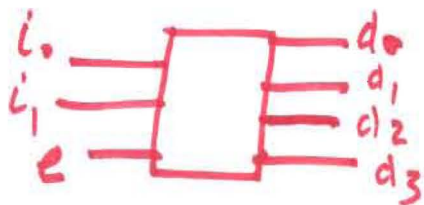
1:8

- Wave forms + timing diagrams

MUX

# Decoder

3 2 1 0



2:4 Decoder  
inputs outputs

enable (e)

positive logic:

\*  $e=1$  enabled  
 $e=0$  disabled

negative logic:

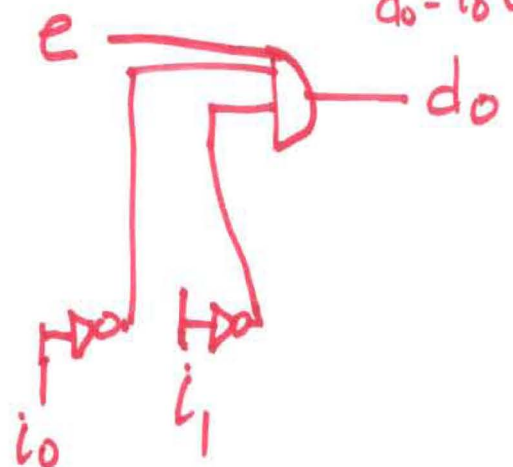
$e=1$  disable  
\*  $e=0$  enabled

Given  $i_0$  and  $i_1$

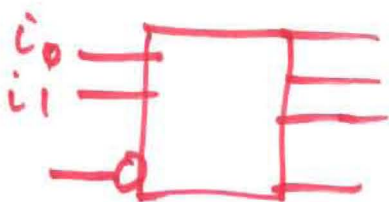
$d_0 - d_3$  will output  
a '1'

e	$i_1$	$i_0$	$d_0$	$d_1$	$d_2$	$d_3$
1	0	0	1	0	0	0
1	0	1	0	1	0	0
1	1	0	0	0	1	0
1	1	1	0	0	0	1
0	x	0	0	0	0	0

$$d_0 = \bar{i}_0 \bar{i}_1 e$$



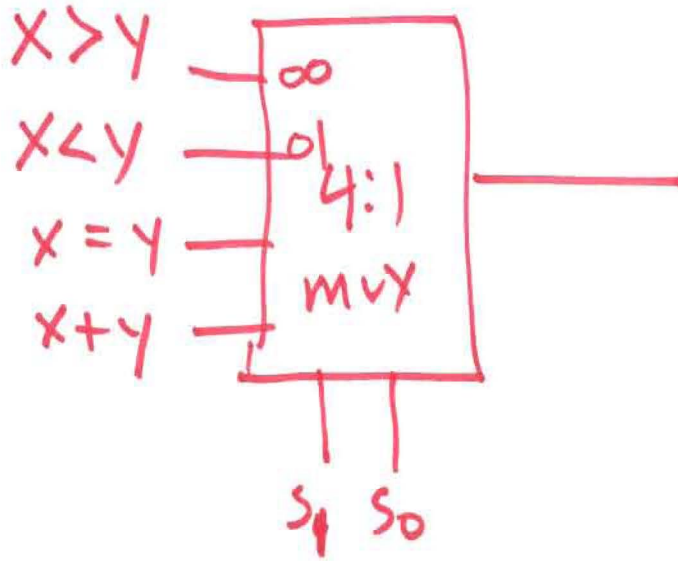
$$d_1 = \bar{i}_1 i_0 e$$



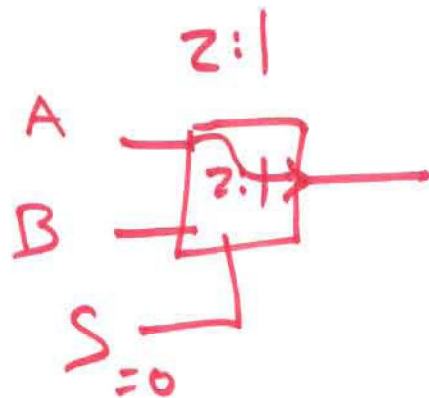
enable enable - n

input

Output



$S_1 = 0$   
 $S_0 = 0$   
 output  $X > Y$ ?  
 01  
 $X < Y$



inputs

S	A	B	f
0	0	0	A (0)
0	0	1	A (0)
0	1	0	A (1)
0	1	1	A (1)
1	0	0	B (0)
1	0	1	B (0)
1	1	0	B (1)
1	1	1	B (1)

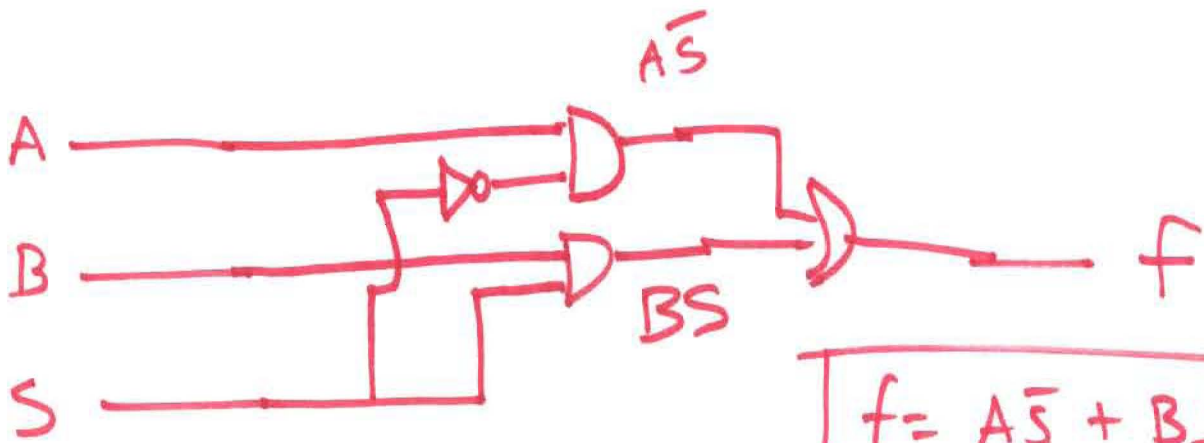
S = Select

A, B input

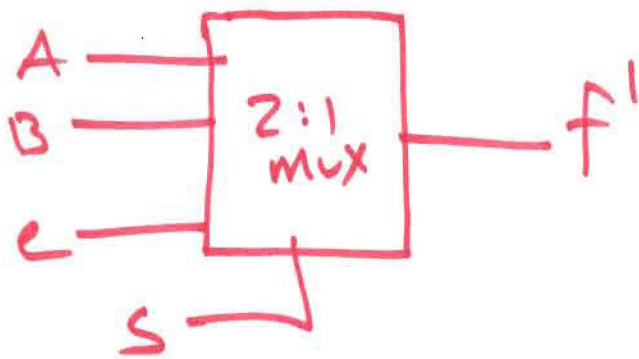
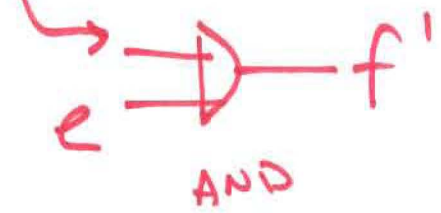
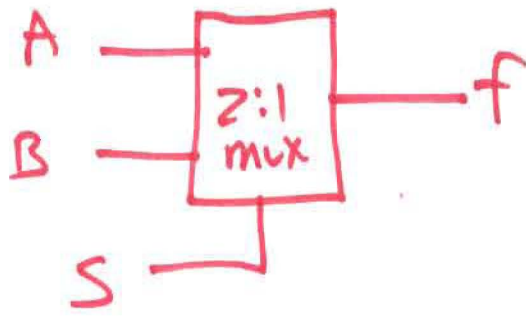
$f = A \quad S = 0$

$f = B \quad S = 1$

# 2:1 MUX

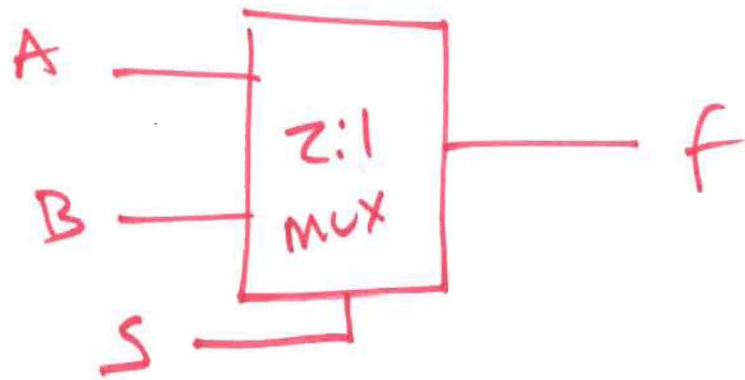


$$f = A\bar{S} + BS$$

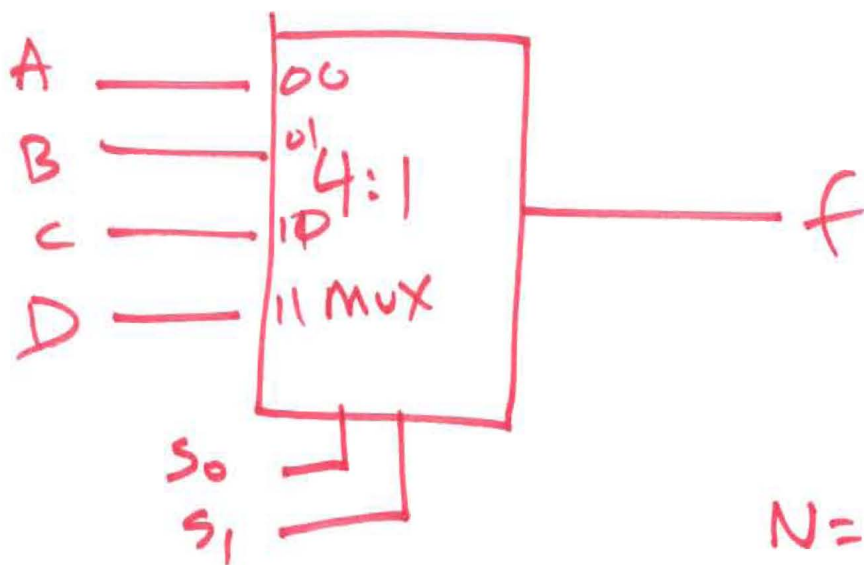


e	S	A	B	f
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	1
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	1
1	0	1	1	1
1	1	0	0	0
1	1	0	1	0
1	1	1	0	1
1	1	1	1	1

The table includes handwritten annotations: a vertical dashed line separates the first two columns (e, S) from the last three (A, B, f). A horizontal dashed line separates the first four rows from the last eight rows. Two vertical dashed lines are drawn between columns A and B, with circles around the '0' and '1' entries in these columns. Arrows labeled 'A' and 'B' point to these circles.

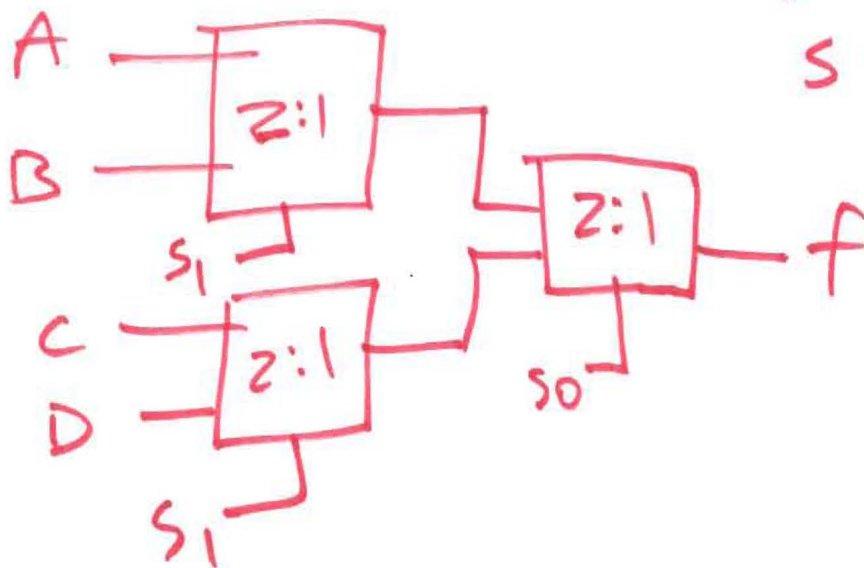


$N = 2$   
 $S = \log_2(N)$



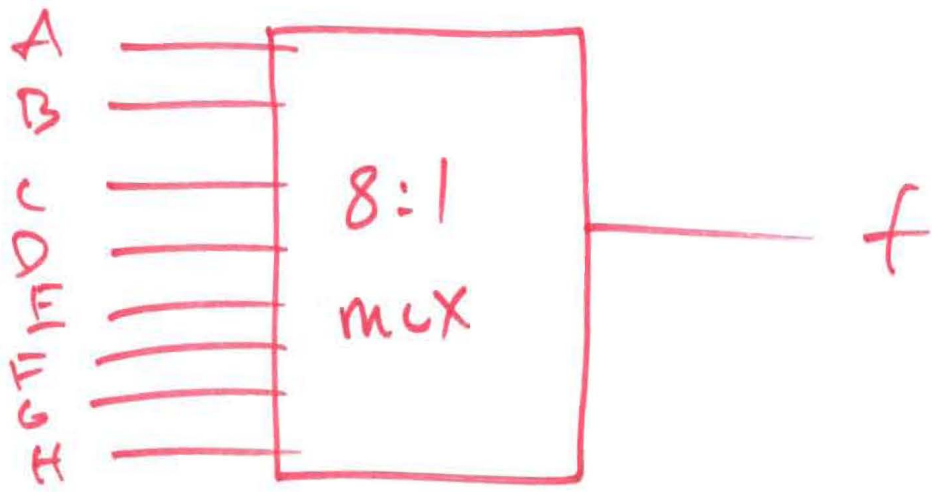
~~2~~  
 $2^S = N$

$N = 4$   
 $2^S = 4$   
 $S = 2$

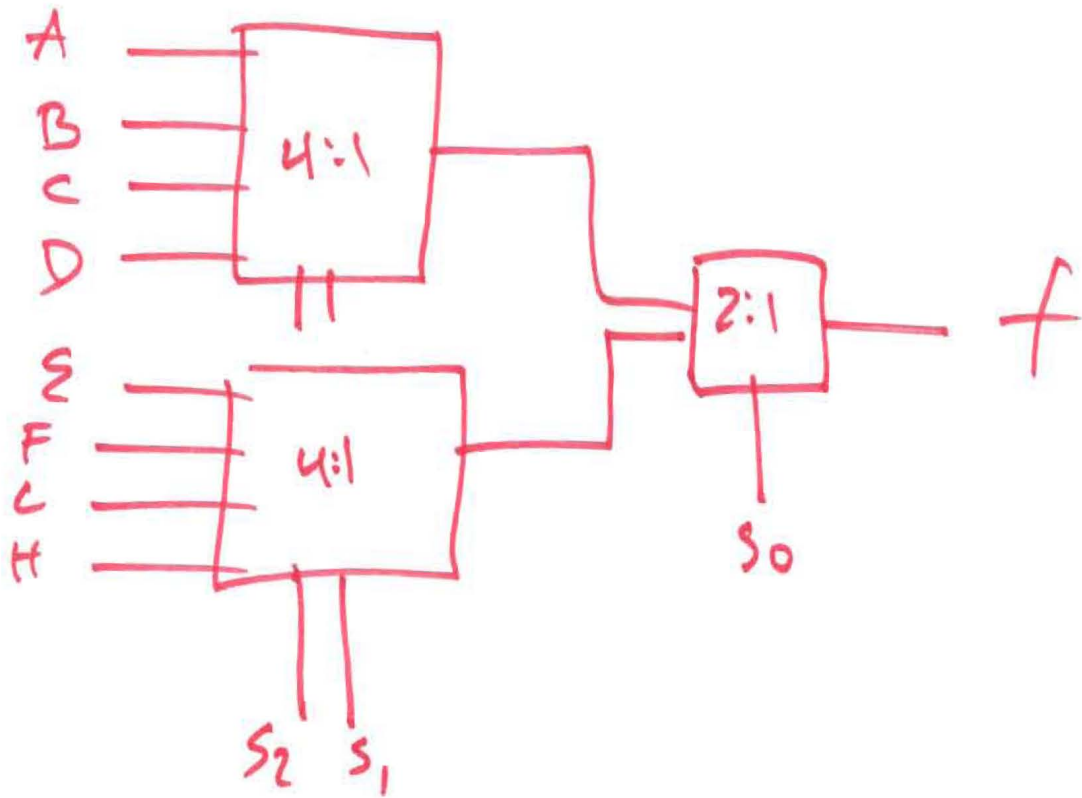


$S_1 = 0$   
 $S_0 = 1$

$S_0 = 0$	
$S_1 = 0$	
$f = A$	
<hr/>	
$S_0 = 0$	
$S_1 = 1$	
$f = B$	
$S_0 = 1$	$f = C$
$S_1 = 0$	



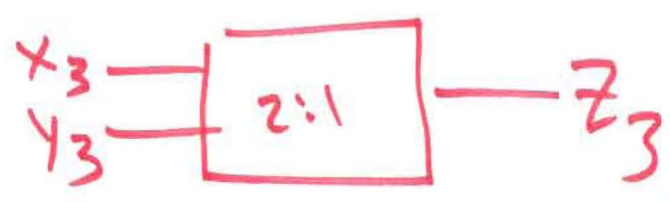
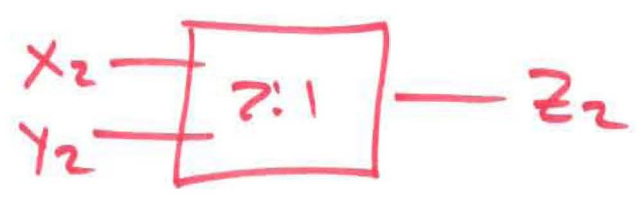
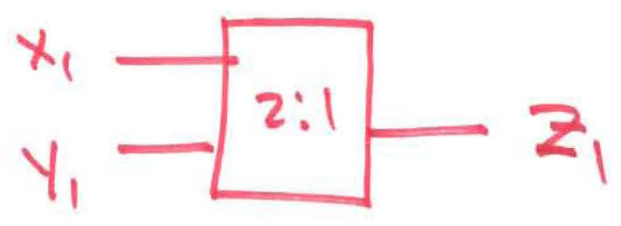
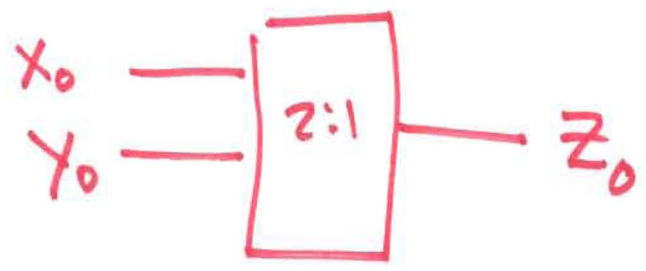
$$S = 3$$



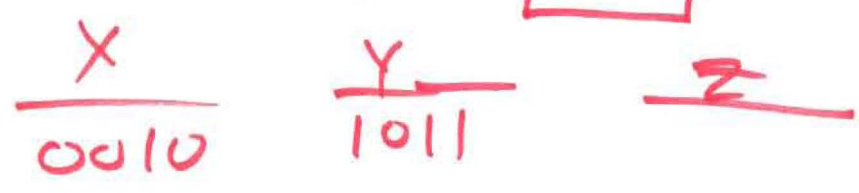
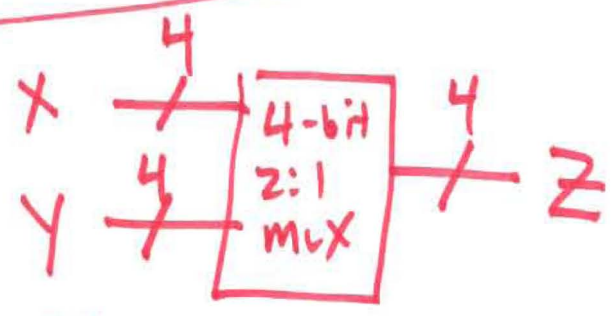
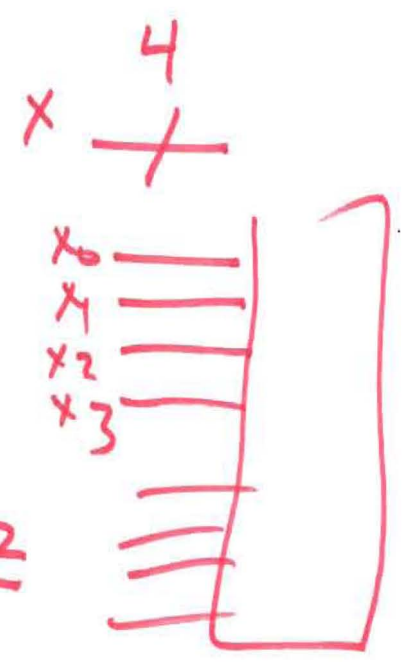
2:1

2-bit

X } 2 bit values  
Y }  
Z



2:1 MUX  
4-bit



# Demux

