

# Computer Science CSCI 355

## Digital Logic and Computer Organization

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# CMOS Logic Design

## ○ Nor Gate

a	b	f
0	0	1
0	1	0
1	0	0
1	1	0

f	0	1
0	1	0
1	0	0

$f$  (p-type) =  $a'b'$  (SOP)

f'	0	1
0	0	1
1	1	1

$f'$  (n-type) =  $a + b$  (POS)

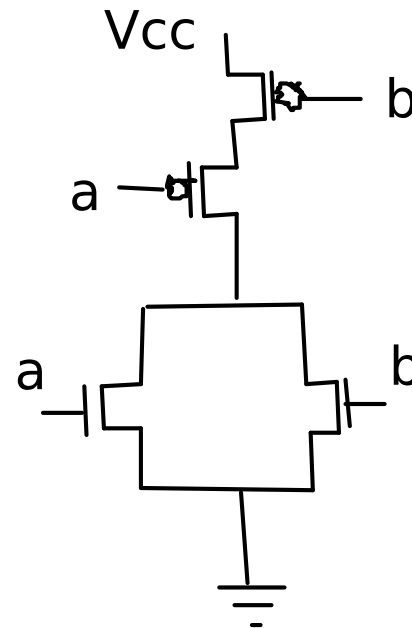
## CMOS Logic Design cont.

### ○ Nor Gate

a	b	f
0	0	1
0	1	0
1	0	0
1	1	0

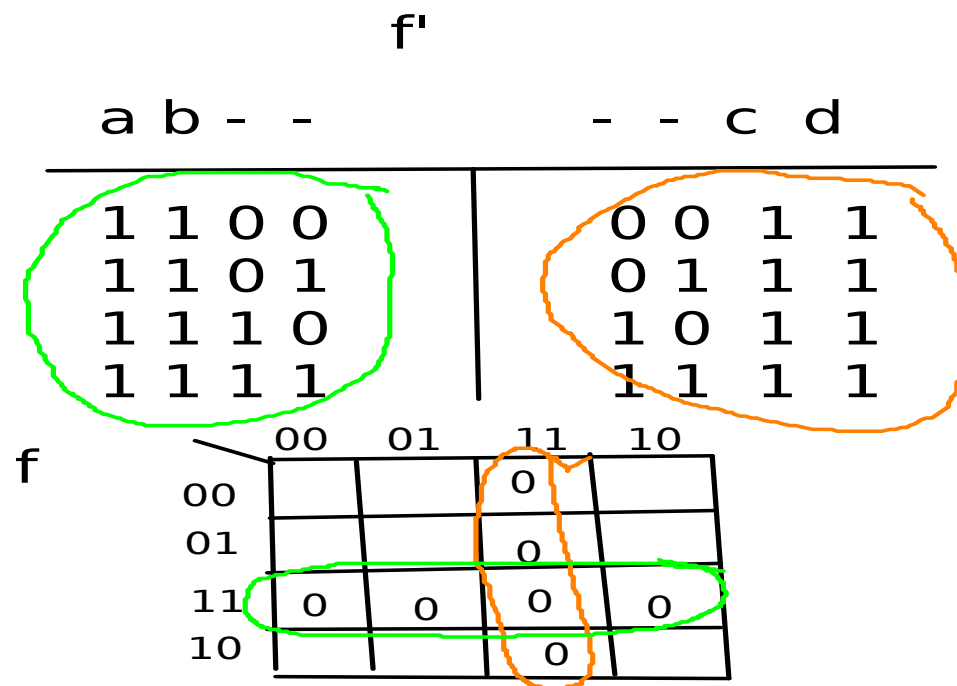
$$f \text{ (p-type)} = a'b' \text{ (SOP)}$$

$$f' \text{ (n-type)} = a + b \text{ (POS)}$$



# Implement $f$ in CMOS

○  $f = \overline{ab + cd}$



## Implement $f$ in CMOS cont.

○  $f = \sum m (0, 1, 2, 4, 5, 6, 8, 9, 10)$

		c d				
		00	01	11	10	
f	a b	00	1	1	0	1
	01	1	1	0	1	
	11	0	0	0	0	
	10	1	1	0	1	

		c d				
		00	01	11	10	
f'	a b	00	0	0	1	0
	01	0	0	1	0	
	11	1	1	1	1	
	10	0	0	1	0	

$f$  (SOP) = ?

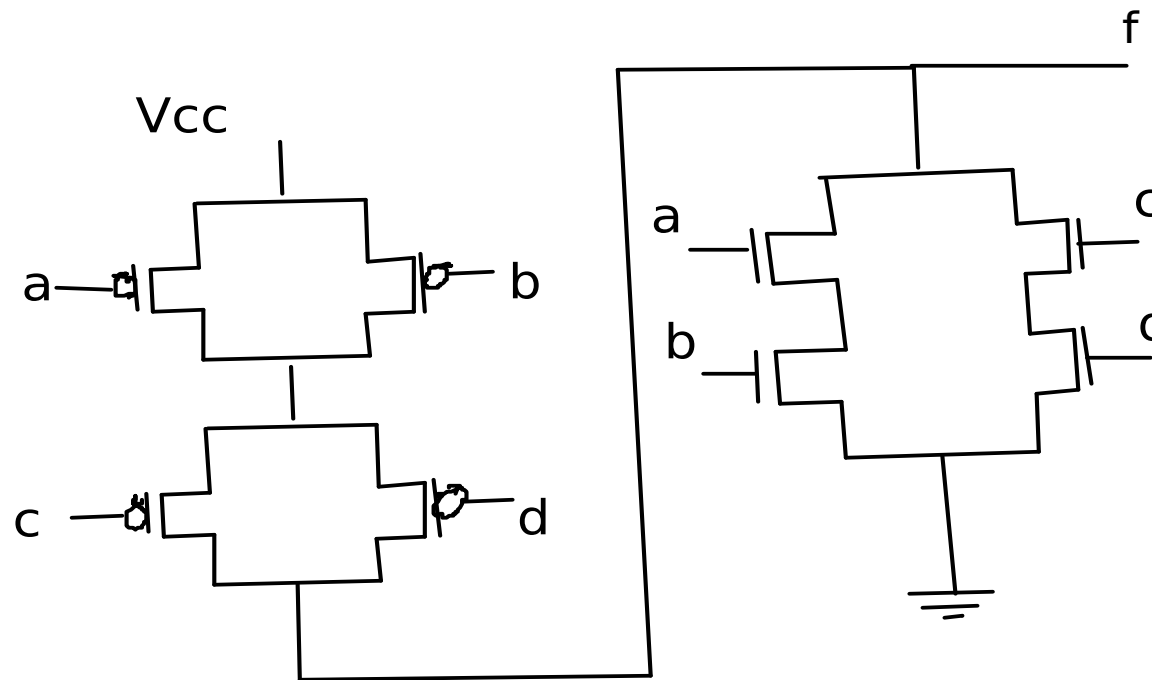
$f'$  (SOP) =  $ab + cd$

$f$  (POS) =  $(a' + b')(c' + d')$

$f'$  (POS) = ?

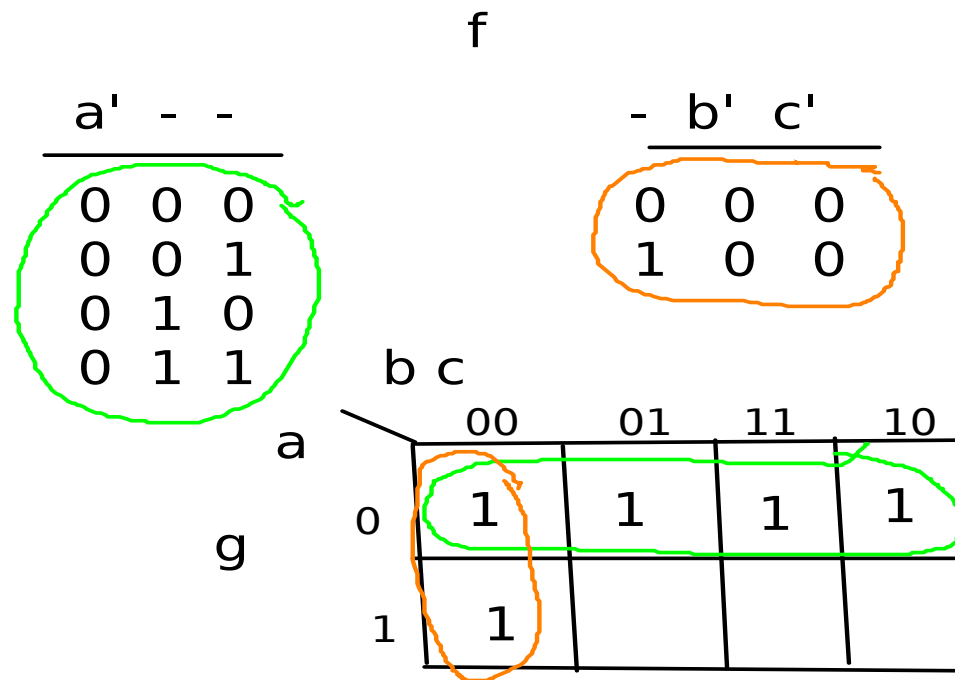
## Implement $f$ in CMOS cont.

○  $f = (\bar{a} + \bar{b})(\bar{c} + \bar{d}) \quad \bar{f} = ab + cd$



# Implement $g$ in CMOS

○  $f = \bar{a} + \bar{b}\bar{c}$



# Implement $g$ in CMOS cont.

○  $f = \sum m (0, 1, 2, 3, 4)$

$g$

		b c			
		00	01	11	10
a	0	1	1	1	1
	1	1			

$g(\text{SOP}) = a' + b'c'$

$g(\text{POS}) = ?$

$g'$

		b c			
		00	01	11	10
a	0	0	0	0	0
	1	0			

$g'(\text{SOP}) = ?$

$g'(\text{POS}) = (a)(b + c)$



## Implement $g$ in CMOS cont.

○  $f = \Sigma m (0, 1, 2, 3, 4)$

