

1.

$$a) [(x+y'+z)(x'+z')(x+y)]'$$

$$= (x+y'+z)' + (x+z')' + (x+y)'$$

$$= (x'yz') + (x'z) + (x'y')$$

$$b) [(AB'+C)D'+E]'$$

$$= (AB'+C)D'E'$$

$$= ((AB'+C)' + D)E'$$

$$= (((AB')'C') + D)E'$$

$$= (((A'+B)C') + D)E'$$

$$= (A'C' + B'C' + D)E'$$

$$= A'C'E' + B'C'DE'$$

2.

$$F = xy + x'y' + y'z$$

a) AND, OR, and Inverter:

$$F = xy + x'y' + y'z$$

b) OR and Inverter:

$$F = (x' + y')' + (x + y)' + (y + z)'$$

c) AND and Inverter:

$$F = [(xy)'(x'y')'(y'z)']'$$

3.

$$a) F(A,B,C,D) = B'D + A'D + BD$$

A	B	C	D	B'D	A'D	BD	F
0	0	0	0	0	0	0	0
0	0	0	1	1	1	0	1
0	0	1	0	0	0	0	0
0	0	1	1	1	1	0	1
0	1	0	0	0	0	0	0
0	1	0	1	0	1	1	1
0	1	1	0	0	0	0	0
0	1	1	1	0	1	1	1
1	0	0	0	0	0	0	0
1	0	0	1	1	0	0	1
1	0	1	0	0	0	0	0
1	0	1	1	1	0	0	1
1	1	0	0	0	0	0	0
1	1	0	1	0	0	1	1
1	1	1	0	0	0	0	0
1	1	1	1	0	0	1	1

Sum of Minterms:

$$=(A'B'C'D)+(A'B'CD)+(A'BC'D)+(A'BCD)+(AB'C'D)+(AB'CD)+(ABC'D)+(ABCD)$$

Product of Maxterms:

$$=(A+B+C+D)(A+B+C'+D)(A+B'+C+D)(A+B'+C'+D)(A'+B+C+D)(A'+B+C'+D)(A'+B'+C+D)(A'+B'+C'+D)$$

b) $F = (AB+C)(B+C'D)$

A	B	C	D	AB	AB+C	C'D	B+C'D	F
0	0	0	0	0	0	0	0	0
0	0	0	1	0	0	1	1	0
0	0	1	0	0	1	0	0	0
0	0	1	1	0	1	0	0	0
0	1	0	0	0	0	0	1	0
0	1	0	1	0	0	1	1	0
0	1	1	0	0	1	0	1	1
0	1	1	1	0	1	0	1	1
1	0	0	0	0	0	0	0	0
1	0	0	1	0	0	1	1	0
1	0	1	0	0	1	0	0	0
1	0	1	1	0	1	0	0	0
1	1	0	0	1	1	0	1	1
1	1	0	1	1	1	1	1	1
1	1	1	0	1	1	0	1	1
1	1	1	1	1	1	0	1	1

Sum of Minterms:

$$=(A'BCD')+(A'BCD)+(ABC'D')+(ABC'D)+(ABCD')+(ABCD)$$

Product of Maxterms:

$$=(A+B+C+D)(A+B+C+D')(A+B+C'+D)(A+B+C'+D')(A+B'+C+D)(A+B'+C+D')(A'+B+C+D)(A'+B+C+D')(A'+B+C'+D)(A'+B+C'+D')$$

4.

a) $F(A,B,C,D) = \sum(0,2,6,11,13,14)$

A	B	C	D	F
0	0	0	0	1
0	0	0	1	0
0	0	1	0	1
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	1
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0

Sum of Minterms of Compliment:

$$= (A'B'C'D) + (A'B'CD) + (A'BC'D') + (A'BC'D) + (A'BCD) + (AB'C'D') + (AB'C'D) + (AB'CD') + (ABC'D') + (ABCD)$$

b) $F(x,y,z) = \Pi(0,3,6,7)$

x	y	z	F
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	0

Sum of Minterms of Compliment:

$$= (x'y'z') + (x'yz) + (xyz') + (xyz)$$

5.

a) $F(x,y,z) = \sum(0,2,6,7)$

x/yz	00	01	11	10
0	1			1
1			1	1

$$F(x,y,z) = xy + x'z'$$

b) $F(A,B,C) = \sum(0,2,3,4,6)$

A/BC	00	01	11	10
0			1	1
1	1			1

$$F(A,B,C) = AC' + A'B$$

c) $F(a,b,c) = \sum(0,1,2,3,7)$

a/bc	00	01	11	10
0	1	1	1	1
1				1

$$F(a,b,c) = a' + bc'$$

d) $F(x,y,z) = \sum(3,5,6,7)$

x/yz	00	01	11	10
0			1	
1		1	1	1

$$F(x,y,z) = xy + xz + yz$$

6.

a) $F(w,x,y,z) = \sum(2,3,10,11,12,13,14,15)$

wx/yz	00	01	11	10
00			1	1
01				
11	1	1	1	1
10			1	1

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

b) $F = x'z + w'xy' + w(x'y + xy')$

	w	x	y	z	x'z	w'xy'	x'y	xy'	x'y+xy'	w(x'y+xy')	F
m0	0	0	0	0							
m1	0	0	0	1	1						1
m2	0	0	1	0			1		1		
m3	0	0	1	1	1		1		1		1
m4	0	1	0	0		1		1	1		1
m5	0	1	0	1		1		1	1		1
m6	0	1	1	0							
m7	0	1	1	1							
m8	1	0	0	0							
m9	1	0	0	1	1						1
m10	1	0	1	0			1		1	1	1
m11	1	0	1	1	1		1		1	1	1
m12	1	1	0	0				1	1	1	1
m13	1	1	0	1				1	1	1	1
m14	1	1	1	0							
m15	1	1	1	1							

$\sum(1,3,4,5,9,10,11,12,13)$

wx/yz	00	01	11	10
00		1	1	
01	1	1		
11	1	1		
10		1	1	1

$$F = y'z + xy' + wx'y + w'x'z$$

d) $F = A'B'C'D' + AC'D' + B'CD' + A'BCD + BC'D$

	A	B	C	D	$A'B'C'D'$	$AC'D'$	$B'CD'$	$A'BCD$	$BC'D$	F
m0	0	0	0	0	1					1
m1	0	0	0	1						
m2	0	0	1	0			1			1
m3	0	0	1	1						
m4	0	1	0	0						
m5	0	1	0	1					1	1
m6	0	1	1	0						
m7	0	1	1	1				1		1
m8	1	0	0	0		1				1
m9	1	0	0	1						
m10	1	0	1	0			1			1
m11	1	0	1	1						
m12	1	1	0	0		1				1
m13	1	1	0	1					1	1
m14	1	1	1	0						
m15	1	1	1	1						

$\Sigma(0,2,5,7,8,10,12,13)$

AB/CD	00	01	11	10
00	1			1
01		1	1	
11	1	1		
10	1			1

$$F = A'B'D' + A'BD + ABC' + AB'D'$$

7.

a) $F = AC' + B'D + A'CD + ABCD$

	A	B	C	D	AC'	B'D	A'CD	ABCD	F
m0	0	0	0	0					
m1	0	0	0	1		1			1
m2	0	0	1	0					
m3	0	0	1	1		1	1		1
m4	0	1	0	0					
m5	0	1	0	1					
m6	0	1	1	0					
m7	0	1	1	1			1		1
m8	1	0	0	0	1				1
m9	1	0	0	1	1	1			1
m10	1	0	1	0					
m11	1	0	1	1		1			1
m12	1	1	0	0	1				1
m13	1	1	0	1	1				1
m14	1	1	1	0					
m15	1	1	1	1				1	1

AB/CD	00	01	11	10
00	0	1	1	0
01	0	0	1	0
11	1	1	1	0
10	1	1	1	0

Sum of Products Simplified:

$$F = AC' + CD + A'B'D$$

Product of Sums Simplified:

$$F = (C'+D)(A+B'+C)(A+C+D)$$

b) $F = (A' + B' + D')(A + B' + C')(A' + B + D')(B + C' + D')$

	A	B	C	D	$A' + B' + D'$	$A + B' + C'$	$A' + B + D'$	$B + C' + D'$	F
m0	0	0	0	0	1	1	1	1	1
m1	0	0	0	1	1	1	1	1	1
m2	0	0	1	0	1	1	1	1	1
m3	0	0	1	1	1	1	1		
m4	0	1	0	0	1	1	1	1	1
m5	0	1	0	1	1	1	1	1	1
m6	0	1	1	0	1		1	1	
m7	0	1	1	1	1		1	1	
m8	1	0	0	0	1	1	1	1	1
m9	1	0	0	1	1	1		1	
m10	1	0	1	0	1	1	1	1	1
m11	1	0	1	1	1	1			
m12	1	1	0	0	1	1	1	1	1
m13	1	1	0	1		1	1	1	
m14	1	1	1	0	1	1	1	1	1
m15	1	1	1	1		1	1	1	

AB/CD	00	01	11	10
00	1	1		1
01	1	1		
11	1			1
10	1			1

Sum of Products Simplified:

$$F = A'C' + AD' + B'CD'$$

Product of Sums Simplified:

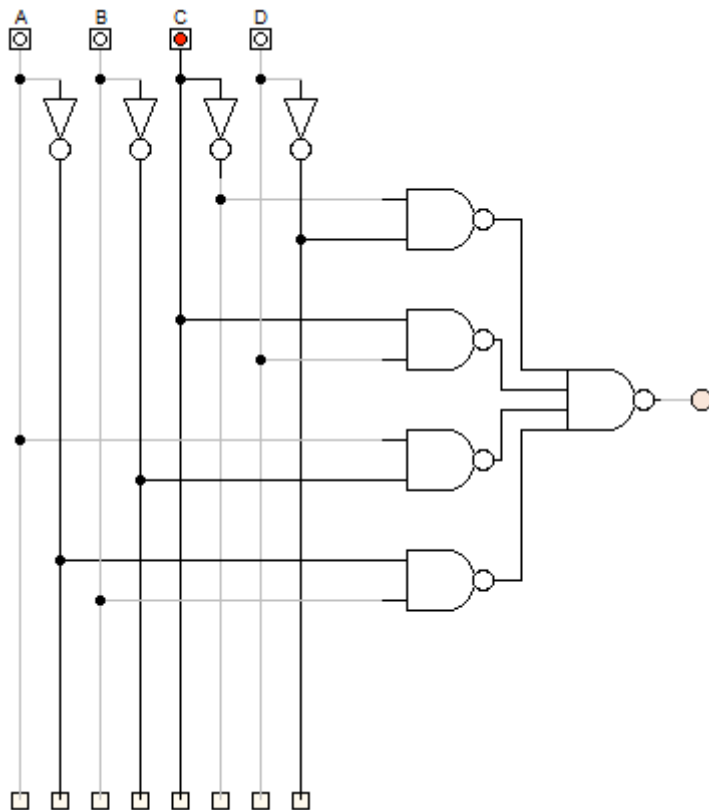
$$F = (A' + D')(C' + D')(A + B' + C')$$

8.

$$F = (AB + A'B')(CD' + C'D)$$

	A	B	C	D	AB	A'B'	CD'	C'D	AB+A'B'	CD'+C'D	F
m0	0	0	0	0		1			1		
m1	0	0	0	1		1		1	1	1	1
m2	0	0	1	0		1	1		1	1	1
m3	0	0	1	1		1			1		
m4	0	1	0	0							
m5	0	1	0	1				1		1	
m6	0	1	1	0			1			1	
m7	0	1	1	1							
m8	1	0	0	0							
m9	1	0	0	1				1		1	
m10	1	0	1	0			1			1	
m11	1	0	1	1							
m12	1	1	0	0	1				1		
m13	1	1	0	1	1			1	1	1	1
m14	1	1	1	0	1		1		1	1	1
m15	1	1	1	1	1				1		

$$F = C'D' + CD + AB' + A'B$$

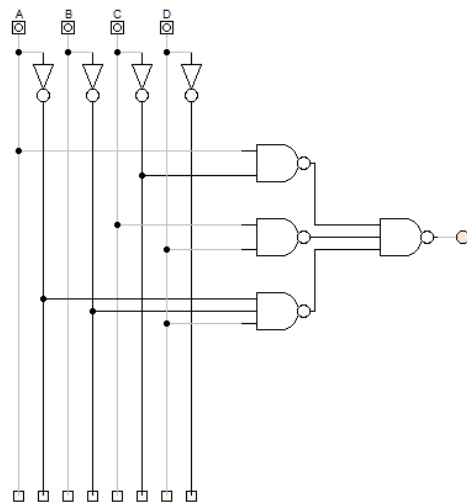
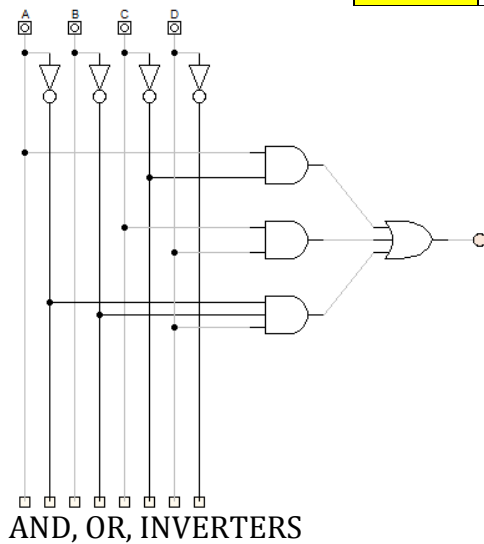


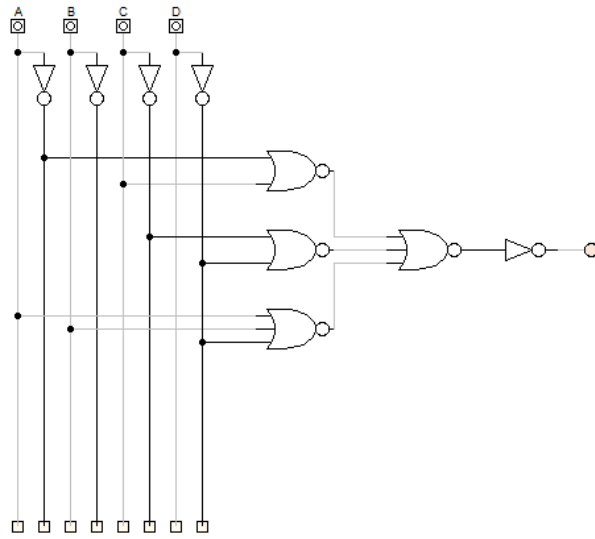
9.

$$F = AC' + B'D + A'CD + ABCD$$

	A	B	C	D	AC'	B'D	A'CD	ABCD	F
m0	0	0	0	0					
m1	0	0	0	1		1			1
m2	0	0	1	0					
m3	0	0	1	1		1	1		1
m4	0	1	0	0					
m5	0	1	0	1					
m6	0	1	1	0					
m7	0	1	1	1			1		1
m8	1	0	0	0	1				1
m9	1	0	0	1	1	1			1
m10	1	0	1	0					
m11	1	0	1	1		1			1
m12	1	1	0	0	1				1
m13	1	1	0	1	1				1
m14	1	1	1	0					
m15	1	1	1	1				1	1

AB/CD	00	01	11	10
00		1	1	
01			1	
11	1	1	1	
10	1	1	1	





NOR, INVERTERS