$$F(a,b,c,d) = \Sigma\, m(0,1,2,3,4,5,6,8,10) + d(11,12)$$

Karnaugh map:

ab\cd	00	01	11	10
00	1	1	1	1
01	1	1	0	1
11	—	0	0	0
10	1	0	—	1

PI	EPI
$\bar{a}\,\bar{d}$	$\bar{a}\,\bar{c}$
$\bar{a}\,\bar{c}$	$\bar{a}\,\bar{d}$
$\bar{a}\,\bar{b}$	
$\bar{b}\,c$	
$\bar{c}\,\bar{d}$	
$\bar{b}\,\bar{d}$	

+6

+2

$$SOP = \bar{a}\,\bar{c} + \bar{a}\,\bar{d} + \bar{b}\,c + \begin{cases} \to \bar{c}\,\bar{d} \\ \to \bar{b}\,\bar{d} \end{cases}$$

+4

-2 for missed other form of F

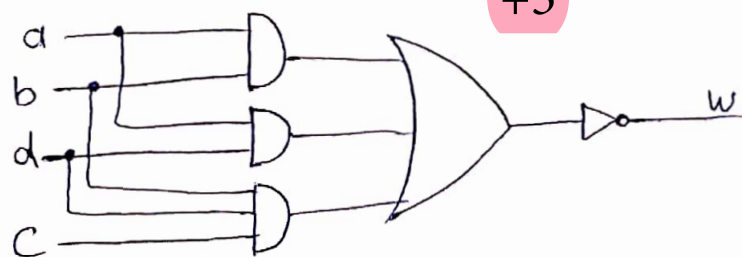$$POS = (\bar{a}+\bar{b})(\bar{b}+\bar{c}+\bar{d})(\bar{a}+\bar{d})$$

استخدم POS ثم ← NOR فقط
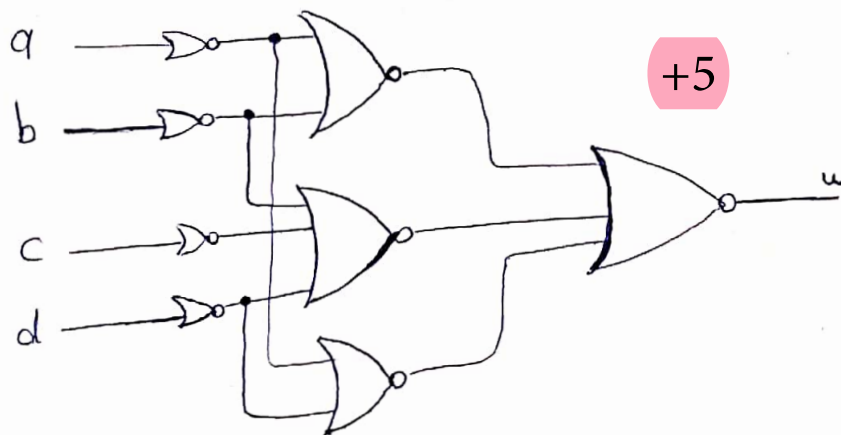
+5

AND-OR-INV

$$\overline{F} = \Sigma\, m(7,9,13,14,15) + d(11,12)$$

ab\cd	00	01	11	10
00				
01			1	
11	—	1	1	1
10		1	—	

$$SOP = ab + ad + bcd$$

+5

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$$F = \Sigma m(0,1,2,3,4,5,6,8,10) + d(11,12)$$

Column 1:
- ✓0 0000
- ✓1 0001
- ✓2 0010
- ✓4 0100
- ✓8 1000
- ✓3 0011
- ✓5 0101
- ✓6 0110
- ✓10 1010
- ✓12 1100
- 11 1011

Column 2:
- ✓000 – (0,1)
- ✓00 –0 (0,2)
- ✓0 –00 (0,4)
- ✓ –000 (0,8)
- ✓00 –1 (1,3)
- ✓0 –01 (1,5)
- ✓001 – (2,3)
- ✓0 –10 (2,6)
- ✓ –010 (2,10)
- ✓0 10 – (4,5)
- ✓01 –0 (4,6)
- ✓ –100 (4,12)
- ✓10 –0 (8,10)
- ✓1 –00 (8,12)
- ✓ –011 (3,11)
- ✓1 01 – (10,11)

Column 3:
- 00 – – (0,1,2,3)
- 0 –0 – (0,1,4,5)
- 00 – – (0,2,1,3)
- 0 – –0 (0,2,4,6)
- 0 –0 – (0,1,4,5)
- 0 – –0 (0,2,4,6)
- – –00 (0,4,8,12)
- –0 –0 (0,2,8,10)
- –0 –0 (0,2,8,10)
- – –00 (0,4,8,12)
- –01 – (2,10,3,11)
- –01 – (2,3,10,11)

+8

PI : $\bar{a}\bar{b}$, $\bar{a}\bar{c}$, $\bar{a}\bar{d}$, $\bar{c}\bar{d}$, $\bar{b}\bar{d}$, $\bar{b}c$.

+6

PI \ m_i	0	1	2	③	4	5	6	⑧	⑩
$\bar{a}\bar{b}$	×	×	×	×					
[$\bar{a}\bar{c}$]	×	×		×	⊠				
[$\bar{a}\bar{d}$]	×		×	×		⊠			
$\bar{c}\bar{d}$	×		×				×		
$\bar{b}\bar{d}$	×		×					×	×
$\bar{b}c$					×	×			×
	✓	✓	✓		✓	✓	✓		

EPI = $\bar{a}\bar{c}$, $\bar{a}\bar{d}$

+6

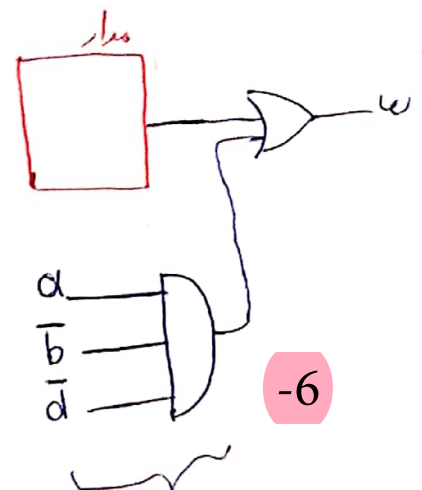$$SOP = \bar{a}\bar{c} + \bar{a}\bar{d} + \bar{b}c + \bar{c}\bar{d}$$

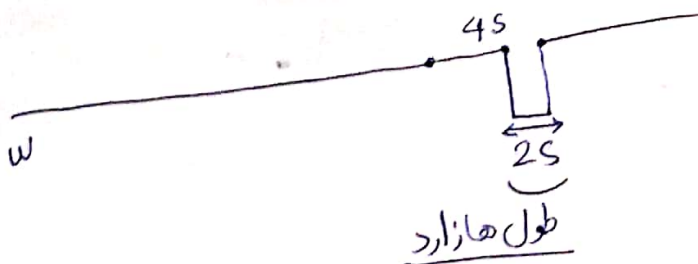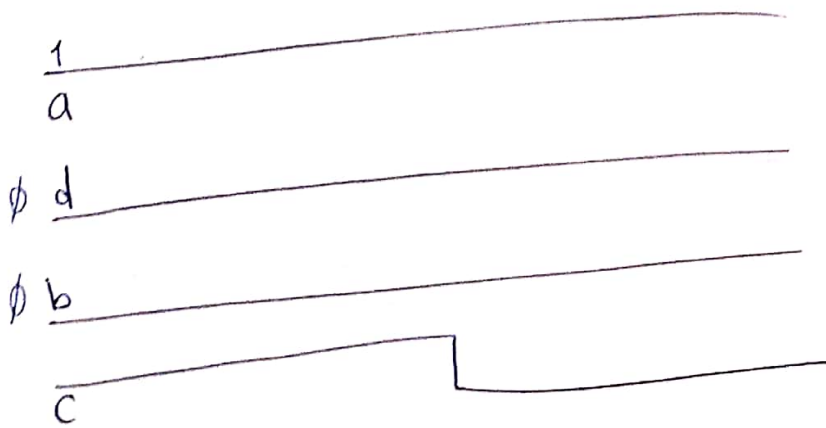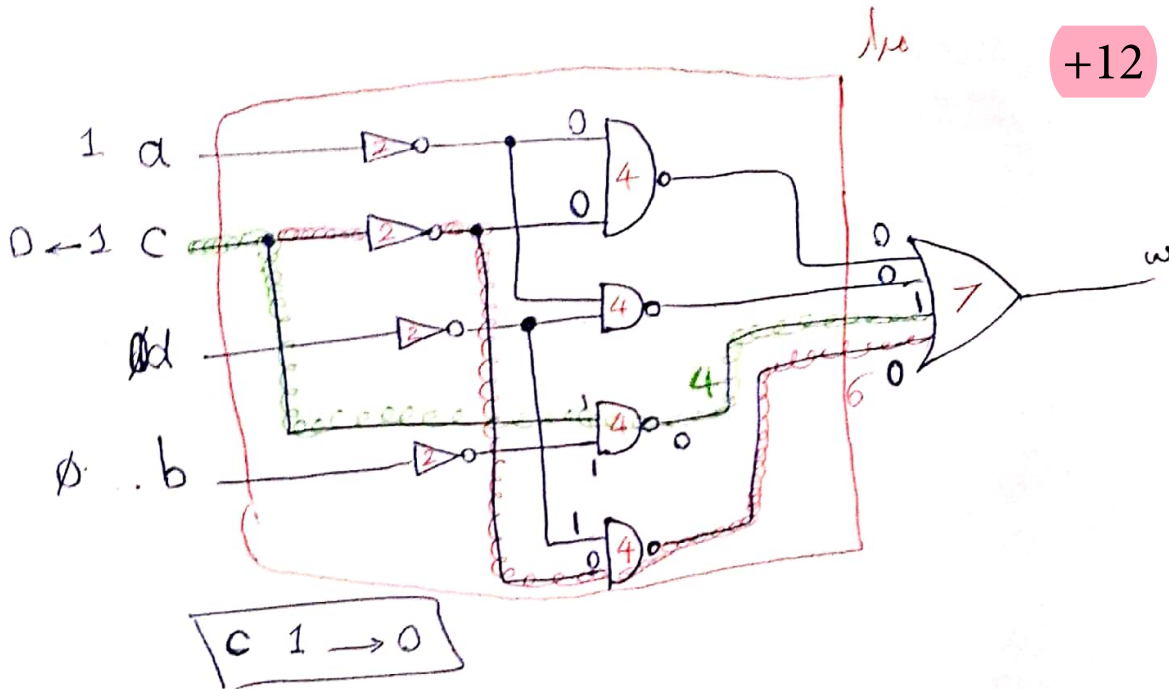SOP : $\bar{a}\bar{c} + \bar{a}\bar{d} + \bar{b}c + \bar{c}\bar{d}$

$0001 \longleftrightarrow 0011$

$1000 \longleftrightarrow 1010$

} potential Hazard

+12

1 a

0←1 C

$\emptyset$ d

$\emptyset$. b

w

C 1 → 0

1 / a

$\emptyset$ d

$\emptyset$ b

c

w

45

2S

طول هازارد

-6

a
$\bar{b}$
$\bar{d}$

گیت اضافی برای رفع هازارد

با به نظر گرفتن مینترم $a\bar{b}\bar{d}$

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