

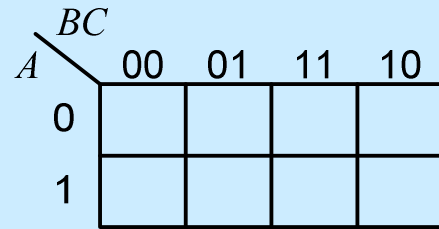
처음 만나는 디지털 논리회로

제06장 논리식의 간소화

기출문제 풀이

01. 변수의 수가 3이라면 카르노 맵에서 몇 개의 칸이 요구되는가?

- ① 2칸 ② 4칸
③ 6칸 ④ 8칸



3변수 카르노 맵

02. 다음 진리표의 카르노 맵을 작성한 것 중 옳은 것은?

①

		A	
		0	1
B	0	1	1
	1	0	0

②

		A	
		0	1
B	0	0	0
	1	1	1

입력		출력
A	B	Y
0	0	0
0	1	1
1	0	0
1	1	1

③

		A	
		0	1
B	0	0	1
	1	1	0

④

		A	
		0	1
B	0	1	0
	1	1	0

$$Y(A,B) = m_1 + m_3 = \sum m(1,3)$$

		A	
		0	1
B	0	m_0	m_2
	1	m_1	m_3

03. 다음 카르노 맵에 의한 논리식은?

① A

② B

③ AB

④ $A+B$

		A	
		0	1
B	0	0	1
	1	0	1

		A	
		0	1
B	0	0	1
	1	0	1

A →

04. 다음 카르노 맵을 간소화시킨 결과는?

① $X_1 + \overline{X_1} \cdot X_2$

② $X_1 + X_2$

③ $\overline{X_1} + X_1 \cdot \overline{X_2}$

④ $\overline{X_1} + \overline{X_2}$

$X_1 \backslash X_2$	0	1
0	1	1
1	1	0

$X_1 \backslash X_2$	0	1
0	1	1
1	1	0

Diagram illustrating the simplification process on the Karnaugh map. A red rectangle highlights the top row (where $X_1 = 0$), labeled $\overline{X_1}$. A blue rectangle highlights the first column (where $X_2 = 0$), labeled $\overline{X_2}$.

05. 다음 진리표를 간소화한 결과 Y 는?

① $Y = A + \bar{B}$

② $Y = \bar{A} + B$

③ $Y = \bar{A} + \bar{B}$

④ $Y = AB$

A	B	Y
0	0	1
0	1	0
1	0	1
1	1	1

$$Y(A,B) = m_1 + m_3 = \Sigma m(0,2,3)$$

	B		
		0	1
A	0	m_0	m_1
	1	m_2	m_3

	B		
		0	1
A	0	1	0
	1	1	1

Diagram illustrating the Karnaugh map for $Y(A,B)$. The map shows the values of Y for each combination of A and B . The cells containing 1 are circled: a blue circle around the cell (0,0) and a red circle around the cells (1,0) and (1,1). A blue arrow points to the cell (0,0) with the label $\bar{B}$, and a pink arrow points to the cell (1,1) with the label A .

06. 다음의 논리식을 카르노 맵으로 옮긴 것은?

$$Y = \overline{A}BC + A\overline{B}C + ABC + \overline{A}\overline{B}C$$

①

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

②

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

③

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

④

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

$$Y = \overline{A}BC + A\overline{B}C + ABC + \overline{A}\overline{B}C = m_3 + m_5 + m_7 + m_1 = \Sigma m(1,3,5,7)$$

		BC			
A		00	01	11	10
0		m_0	m_1	m_3	m_2
1		m_4	m_5	m_7	m_6

07. 다음 카르노 맵을 간소화하면?

- ① $\bar{x}z$
- ② $\bar{x}zy$
- ③ $x + \bar{y} + \bar{z}$
- ④ $\bar{x}y + y$

		xy			
		00	01	11	10
z	0	0	0	0	0
	1	1	1	0	0

		xy			
		00	01	11	10
z	0	0	0	0	0
	1	1	1	0	0

$\bar{x}z$

08. 다음 카르노 맵을 가장 간단한 논리식으로 나타내면?

- ① $AB + \overline{BC}$
- ② $(A + C)\overline{B}$
- ③ $A\overline{B} + BC$
- ④ $(B + C)\overline{A}$

		AB			
		00	01	11	10
C	0	0	0	0	1
	1	1	0	0	1

		AB				
		C	00	01	11	10
C	0	0	0	0	0	1
	1	1	0	0	0	1

$\overline{BC}$ (blue circle around the 1 in row 1, column 00)

$A\overline{B}$ (red circle around the 1 in row 0, column 10)

$$A\overline{B} + \overline{BC} = (A + C)\overline{B}$$

09. 다음과 같이 표시된 카르노 맵을 간소화한 식은?

- ① $\bar{B}C$
- ② BC
- ③ C
- ④ $\bar{A}C$

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

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

C

10. 다음과 같은 카르노 맵을 가장 간단한 논리식으로 나타내면?

① $\overline{A}\overline{B}$

② $\overline{B}$

③ $\overline{A}$

④ $\overline{A}B$

	AB			
	00	01	11	10
C				
0	1	0	0	1
1	1	0	0	1

	AB			
	00	01	11	10
C				
0	1	0	0	1
1	1	0	0	1

$\overline{B}$

11. 다음 카르노 맵에 나타난 논리 함수를 간단히 하면?

- ① $A + AC$
- ② $A + \overline{A}\overline{B}$
- ③ $\overline{B} + \overline{A}\overline{B}$
- ④ $B + AC$

		AB			
		00	01	11	10
C	0	0	1	1	0
	1	0	1	1	1

		AB			
		00	01	11	10
C	0	0	1	1	0
	1	0	1	1	1

B AC

$$B + AC$$

12. 다음 카르노 맵(Karnaugh map)을 간략화하면?

- ① $\overline{A}$
- ② $\overline{A} + BC$
- ③ $A + \overline{BC}$
- ④ ABC

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

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

$$\overline{A} + BC$$

13. 카르노 맵이 그림과 같을 경우 간략화한 결과 Y 는?

- ① $Y = ABC$
- ② $Y = A + B + C$
- ③ $Y = A + \overline{BC}$
- ④ $Y = \overline{A}B + \overline{C}$

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

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

$\overline{A}B$ (blue box around 11, 10 for A=0)
 $\overline{C}$ (red box around 00, 01 for A=0 and 1)

$$Y = \overline{A}B + \overline{C}$$

14. 그림과 같은 카르노 맵(Karnaugh Map)이 있을 때 간소화하여 얻은 논리식으로 옳은 것은?

- ① $Y = A$
- ② $Y = BC + AC$
- ③ $Y = \overline{C} + A$
- ④ $Y = \overline{C} + AB$

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

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

Diagram showing groupings on the Karnaugh Map:
 - A red circle groups the 1s in the first column (A=0, BC=00 and A=1, BC=00).
 - A red circle groups the 1s in the last column (A=0, BC=10 and A=1, BC=10).
 - A blue circle groups the 1s in the first row (A=0, BC=00 and A=0, BC=10).
 - A blue circle groups the 1s in the second row (A=1, BC=00 and A=1, BC=01).
 - A pink arrow points to the top-right corner (A=0, BC=10) with the label $\overline{C}$.
 - A blue arrow points to the bottom-middle (A=1, BC=01) with the label A .

$$Y = \overline{C} + A$$

15. 다음 진리표에서 출력 Y 를 최소화하면?

- ① $Y = \overline{A}B$
- ② $Y = AB$
- ③ $Y = A + \overline{B}$
- ④ $Y = \overline{C}$

입력			출력
A	B	C	Y
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

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

$$Y = \overline{C}$$

16. 다음 진리표의 논리식이 옳은 것은?

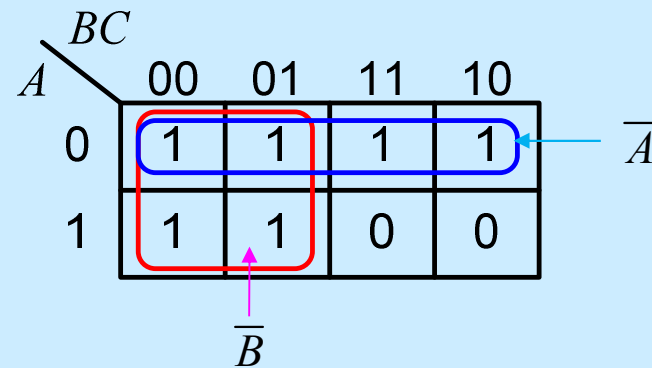
① $X = \overline{B} + \overline{C}$

② $X = \overline{A} + \overline{B}$

③ $X = A + B$

④ $X = \overline{B} + C$

A	B	C	X
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	0



$$X = \overline{A} + \overline{B}$$

17. 다음의 진리표를 보고 논리식을 최소화하면?

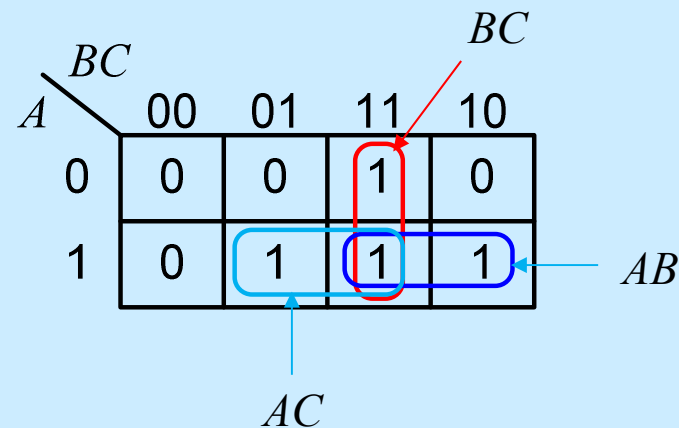
① $F = AB + BC + AC$

② $F = \overline{A}B + B\overline{C} + A\overline{B}$

③ $F = A + B + C$

④ $F = ABC$

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



$$F = AB + BC + AC$$

18. 다음 카르노 맵의 함수를 간소화하면?

- ① AB
- ② AC
- ③ AD
- ④ $\overline{AB}$

		CD			
		$\overline{C}\overline{D}$	$\overline{C}D$	$C\overline{D}$	CD
AB	$\overline{A}\overline{B}$	0	0	0	0
	$\overline{A}B$	0	0	0	0
AB	$A\overline{B}$	0	0	1	1
	AB	0	0	1	1

		CD			
		$\overline{C}\overline{D}$	$\overline{C}D$	$C\overline{D}$	CD
AB	$\overline{A}\overline{B}$	0	0	0	0
	$\overline{A}B$	0	0	0	0
AB	$A\overline{B}$	0	0	1	1
	AB	0	0	1	1

AC

19. 다음 카르노 맵으로 표시된 함수를 간소화하면?

- ① AB
- ② BC
- ③ $\overline{AD}$
- ④ $A\overline{C}$

		CD			
		$\overline{C}\overline{D}$	$\overline{C}D$	$C\overline{D}$	CD
AB	$\overline{A}\overline{B}$	0	0	0	0
	$\overline{A}B$	0	0	0	0
AB	$A\overline{B}$	1	1	1	1
	AB	0	0	0	0

		CD			
		$\overline{C}\overline{D}$	$\overline{C}D$	$C\overline{D}$	CD
AB	$\overline{A}\overline{B}$	0	0	0	0
	$\overline{A}B$	0	0	0	0
AB	$A\overline{B}$	1	1	1	1
	AB	0	0	0	0

AB

20. 그림과 같은 카르노 맵에서 얻어지는 불 대수식은?

① $Y = B\bar{D}$

② $Y = \bar{B}D$

③ $Y = AB$

④ $Y = \bar{A}\bar{B}$

		CD			
		$\bar{C}\bar{D}$	$\bar{C}D$	CD	$C\bar{D}$
AB	$\bar{A}\bar{B}$	0	0	0	0
	$\bar{A}B$	1	0	0	1
	AB	1	0	0	1
	$A\bar{B}$	0	0	0	0

AB		CD			
		$\bar{C}\bar{D}$	$\bar{C}D$	CD	$C\bar{D}$
	$\bar{A}\bar{B}$	0	0	0	0
	$\bar{A}B$	1	0	0	1
	AB	1	0	0	1
	$A\bar{B}$	0	0	0	0

$Y = B\bar{D}$

21. 다음 그림과 같이 표시된 카르노 맵을 최소화한 함수 F 는?

- ① $F = \overline{B} \cdot \overline{D}$
- ② $F = \overline{B} + \overline{D}$
- ③ $F = B + \overline{D}$
- ④ $F = \overline{B} + D$

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

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

$\overline{B}\overline{D}$

$$F = \overline{B} \cdot \overline{D}$$

22. 다음 카르노 맵을 간소화하였을 때 얻어지는 논리식은?

- ① $(\bar{A} + \bar{B})D$
- ② $\bar{A}\bar{B}D + \bar{A}BD + A\bar{B}D$
- ③ $\bar{A}D + A\bar{B}D$
- ④ $\bar{A} + D$

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

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

$\bar{A}D$

$\bar{B}D$

$$\bar{A}D + \bar{B}D = (\bar{A} + \bar{B})D$$

23. 다음 카르노 맵을 간략화하였을 때 얻어지는 논리식은?

- ① $\overline{A} + D$
- ② $\overline{A}D + \overline{B}D$
- ③ $\overline{A}D + A\overline{B}$
- ④ $\overline{A}\overline{B}D + \overline{A}BD + A\overline{B}D$

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

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

$\overline{A}D$

$\overline{A}D + \overline{B}D$

$\overline{B}D$

24. 그림과 같은 4변수 카르노 맵을 간단히 했을 때 논리식은?

① $A\bar{C} + \bar{A}C$

② $A\bar{D} + \bar{B}C$

③ $A\bar{B} + AC$

④ $BD + \bar{B}\bar{D}$

	AB			
$CD \backslash$	00	01	11	10
00	1			1
01		1	1	
11		1	1	
10	1			1

	AB			
$CD \backslash$	00	01	11	10
00	1			1
01		1	1	
11		1	1	
10	1			1

$BD + \bar{B}\bar{D}$

25. 다음 카르노 맵을 간소화한 결과는?

- ① $\overline{\overline{A}}\overline{B}D + AC + C\overline{D}$
- ② $\overline{\overline{A}}\overline{B}D + A\overline{C} + CD$
- ③ $\overline{\overline{A}}\overline{B}D + A\overline{C} + C\overline{D}$
- ④ $\overline{\overline{A}}\overline{B}D + AC + CD$

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

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

$\overline{\overline{A}}\overline{B}D$ (green box)
 $A\overline{C}$ (red box)
 $C\overline{D}$ (blue box)

$$\overline{\overline{A}}\overline{B}D + A\overline{C} + C\overline{D}$$

26. 다음 카르노 맵을 논리식으로 간소화한 결과식은?

① $\bar{A}B + BC + \bar{B}\bar{D}$

② $\bar{A}B + BD + \bar{B}\bar{D}$

③ $\bar{A}B + AC + \bar{B}\bar{D}$

④ $A\bar{B} + \bar{B}\bar{D} + \bar{A}\bar{C}$

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

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

$\bar{A}B + BD + \bar{B}\bar{D}$

27. 다음 카르노 맵으로 된 논리 함수를 최소화할 경우 맞는 것은?

① $\overline{AB} + \overline{BD} + \overline{BCD}$

② $\overline{AB} + \overline{D} + BCD$

③ $\overline{AB} + \overline{BD} + BCD$

④ $\overline{AB} + D + \overline{BCD}$

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

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

Annotations:

- $\overline{BD}$ (pink circle around 1s at (00,00), (01,00), (10,00), (10,10))
- $\overline{AB}$ (red rectangle around 1s at (01,00), (01,01), (01,11), (01,10))
- BCD (blue circle around 1s at (11,01), (11,11), (11,10))

$$\overline{AB} + \overline{BD} + BCD$$

28. 다음 카르노 맵에 대한 간소화된 논리 함수는?

① $\overline{A}\overline{B}\overline{C} + \overline{A}\overline{C}D + ABC + \overline{A}CD$

② $BD + \overline{C}\overline{D} + C\overline{D} + \overline{A}\overline{B}$

③ $BD + \overline{A}\overline{B} + \overline{C}D + C\overline{D}$

④ $\overline{A}\overline{B}\overline{C} + ACD + ABC + \overline{A}CD$

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

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

$\overline{A}\overline{B}\overline{C}$ (pink arrow to cell 01,00)
 $\overline{A}CD$ (red arrow to cell 11,00)
 ABC (green arrow to cell 11,11)
 $\overline{A}\overline{C}D$ (blue arrow to cell 10,01)

$$\overline{A}\overline{B}\overline{C} + \overline{A}\overline{C}D + ABC + \overline{A}CD$$

29. 다음 카르노 맵을 간소화한 논리식은?

① $Y = A$

② $Y = B$

③ $Y = AB + \overline{CD}$

④ $Y = A\overline{B} + \overline{C}D$

		CD			
		$\overline{C}\overline{D}$	$\overline{C}D$	$C\overline{D}$	CD
AB	$\overline{A}\overline{B}$	0	0	0	0
	$\overline{A}B$	0	0	0	0
AB	$A\overline{B}$	1	1	1	1
	AB	1	1	1	1

		CD			
		$\overline{C}\overline{D}$	$\overline{C}D$	$C\overline{D}$	CD
AB	$\overline{A}\overline{B}$	0	0	0	0
	$\overline{A}B$	0	0	0	0
AB	$A\overline{B}$	1	1	1	1
	AB	1	1	1	1

A

$Y = A$

30. 다음과 같은 카르노 맵을 간소화한 것은?

① $A + BC$

② $\overline{B} + AC$

③ $\overline{B} + C\overline{D}$

④ $\overline{C} + B\overline{D}$

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

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

$\overline{C}$ (red box) and $B\overline{D}$ (blue box) are circled.

$\overline{C} + B\overline{D}$

31. 다음의 카르노 맵을 간략화한 논리식으로 옳은 것은?

① $AB + \overline{BC} + \overline{AD}$

② $AB + \overline{BC} + \overline{AD}$

③ $AB + \overline{BC} + \overline{A}$

④ $AB + \overline{BC} + \overline{D}$

$CD \backslash AB$	00	01	11	10
00	1	1	1	1
01			1	
11	1		1	1
10	1	1	1	1

$CD \backslash AB$	00	01	11	10
00	1	1	1	1
01			1	
11	1		1	1
10	1	1	1	1

$$AB + \overline{BC} + \overline{D}$$

32. 다음 카르노 맵을 간략화하면?

- ① $\overline{AD} + \overline{AC} + \overline{BD}$
- ② $\overline{BD} + \overline{AC} + AD$
- ③ $B\overline{D} + A\overline{C} + \overline{CD}$
- ④ $\overline{AD} + B\overline{D} + ABD$

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

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

$$\overline{AD} + \overline{AC} + \overline{BD}$$

33. 4변수들에 대한 카르노 맵이 그림과 같이 주어졌을 경우 이를 불 대수식으로 표현하면?

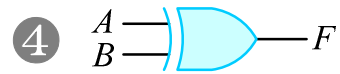
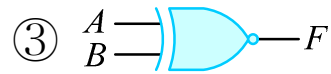
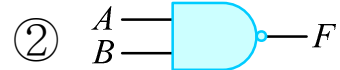
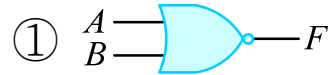
- ① $A \oplus B \oplus C \oplus D$
- ② $(A + B) \oplus (C + D)$
- ③ $(A \oplus B) + (C \oplus D)$
- ④ $AB \oplus CD$

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

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

$$\begin{aligned}
 F &= \overline{A}\overline{B}\overline{C}\overline{D} + \overline{A}\overline{B}\overline{C}D + \overline{A}\overline{B}C\overline{D} + \overline{A}\overline{B}CD + \overline{A}B\overline{C}\overline{D} + \overline{A}B\overline{C}D + \overline{A}BC\overline{D} + \overline{A}BCD \\
 &= \overline{A}\overline{B}(\overline{C}\overline{D} + C\overline{D}) + \overline{A}\overline{B}(\overline{C}D + CD) + \overline{A}B(\overline{C}\overline{D} + C\overline{D}) + \overline{A}B(\overline{C}D + CD) \\
 &= \overline{A}\overline{B}(C \oplus D) + \overline{A}\overline{B}(\overline{C \oplus D}) + \overline{A}B(\overline{C \oplus D}) + \overline{A}B(C \oplus D) \\
 &= (C \oplus D)(\overline{A}\overline{B} + \overline{A}B) + (\overline{C \oplus D})(\overline{A}\overline{B} + \overline{A}B) \\
 &= (C \oplus D)(\overline{A \oplus B}) + (\overline{C \oplus D})(A \oplus B) \\
 &= A \oplus B \oplus C \oplus D
 \end{aligned}$$

34. 다음 카르노 맵을 간단히 한 논리식 F 와 같은 게이트는?



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

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

$\overline{A}B$

$A\overline{B}$

$$F = \overline{A}B + A\overline{B} = A \oplus B$$

35. 논리식 $A + \overline{A}B$ 를 간단히 하면?

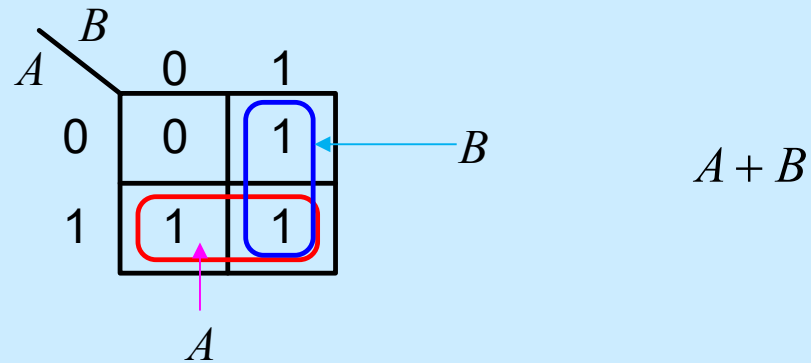
① $A + B$

② $\overline{A} + B$

③ $\overline{A} + \overline{B}$

④ A

$$A + \overline{A}B = A(\overline{B} + B) + \overline{A}B = A\overline{B} + AB + \overline{A}B = \Sigma m(1, 2, 3)$$



36. 논리식 $B(A+B)$ 를 간단히 한 것은?

- ① A ② B
 ③ 1 ④ AB

• 카르노 맵 이용

$$\begin{aligned} B(A+B) &= AB + BB = AB + B \\ &= AB + (\bar{A} + A)B = AB + \bar{A}B = \Sigma m(1,3) \end{aligned}$$

		B	
		0	1
A	0	0	1
	1	0	1

B (arrow pointing to the column with 1s)

• 불 대수 이용

$$B(A+B) = AB + BB = AB + B = (A+1)B = B$$

37. 논리식 $\overline{A}B + AB + \overline{A}\overline{B}$ 를 간소화한 식은?

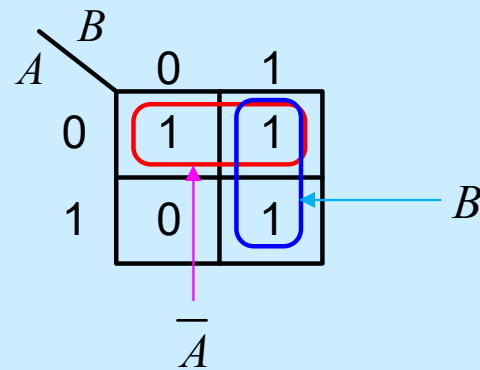
① $A + B$

② $\overline{A} + B$

③ $A + \overline{B}$

④ $\overline{A} + \overline{B}$

$$\overline{A}B + AB + \overline{A}\overline{B} = \Sigma m(0,1,3)$$



$$\overline{A} + B$$

38. 논리식 $Y = AB + A\bar{B} + \bar{A}B$ 를 간소화하면?

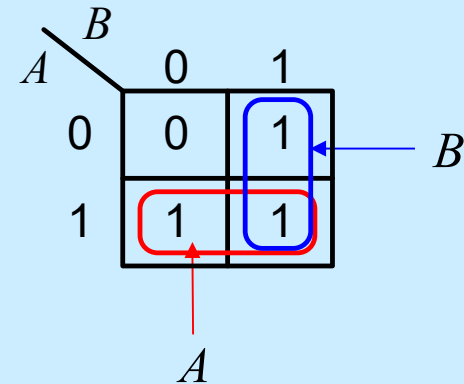
① $A + B$

② AB

③ $A + \bar{B}$

④ $A \cdot \bar{B}$

$$Y = AB + A\bar{B} + \bar{A}B = \sum m(1, 2, 3)$$



$$Y = A + B$$

39. 다음 논리식을 간소화하면 어떻게 되는가?

$$Y = \overline{A} + \overline{B} + A \cdot B$$

① $Y = \overline{A}$

② $Y = 1$

③ $Y = \overline{B}$

④ $Y = \overline{A} \cdot \overline{B}$

$$Y = \overline{A} + \overline{B} + A \cdot B = \overline{A}(\overline{B} + B) + (\overline{A} + A)\overline{B} + AB = \overline{A}\overline{B} + \overline{A}B + A\overline{B} + AB = 1$$

		B	
		0	1
A	0	1	1
	1	1	1

1

40. 논리식 $A \cdot \bar{B} + B + A \cdot C$ 를 간단히 하면?

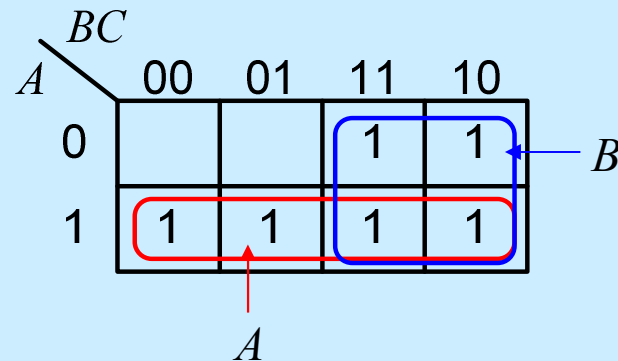
① $A + B$

② $\bar{A} + B$

③ $A + \bar{B}$

④ $\bar{A} + \bar{B}$

$$\begin{aligned} A \cdot \bar{B} + B + A \cdot C &= A\bar{B}(\bar{C} + C) + (\bar{A} + A)B(\bar{C} + C) + A(\bar{B} + B)C \\ &= \bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C + A\bar{B}\bar{C} + A\bar{B}C + AB\bar{C} + ABC = \Sigma m(2, 3, 4, 5, 6, 7) \end{aligned}$$



$A + B$

41. 다음 논리식을 간단히 하면?

$$AB + AC + B\bar{C}$$

① $AC + B\bar{C}$

② $AB + \bar{B}C$

③ $AC + B$

④ $AB + C$

$$\begin{aligned} AB + AC + B\bar{C} &= AB(\bar{C} + C) + A(\bar{B} + B)C + (\bar{A} + A)B\bar{C} \\ &= \bar{A}B\bar{C} + \bar{A}BC + AB\bar{C} + ABC = \Sigma m(2, 5, 6, 7) \end{aligned}$$

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

$B\bar{C}$

AC

$$AC + B\bar{C}$$

42. 논리식 $Y=AB+AC+A\bar{B}\bar{C}$ 를 간단히 하면?

① A

② $\bar{A}$

③ B

④ $\bar{B}$

$$\begin{aligned} Y &= AB + AC + A\bar{B}\bar{C} = AB(\bar{C} + C) + A(\bar{B} + B)C + A\bar{B}\bar{C} \\ &= AB\bar{C} + ABC + A\bar{B}C + ABC + A\bar{B}\bar{C} \\ &= A\bar{B}\bar{C} + A\bar{B}C + AB\bar{C} + ABC = \Sigma m(4, 5, 6, 7) \end{aligned}$$

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

A

43. 논리식 $\bar{x}\bar{y}z + \bar{x}yz + x\bar{y}$ 를 간소화하면?

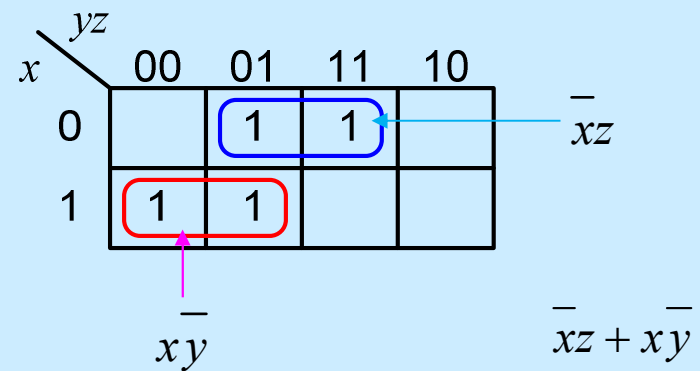
① $\bar{x}z + x\bar{y}$

② $x\bar{z} + x\bar{y}$

③ $\bar{x}\bar{z} + x\bar{y}$

④ $\bar{x}z + xy$

$$\begin{aligned}\bar{x}\bar{y}z + \bar{x}yz + x\bar{y} &= \bar{x}\bar{y}z + \bar{x}yz + x\bar{y}(\bar{z} + z) \\ &= \bar{x}\bar{y}z + \bar{x}yz + x\bar{y}\bar{z} + x\bar{y}z \\ &= \Sigma m(1, 3, 4, 5)\end{aligned}$$



44. 불 대수식 $Y=ABC+A\bar{B}C+AB\bar{C}$ 를 간단히 하면?

① AB

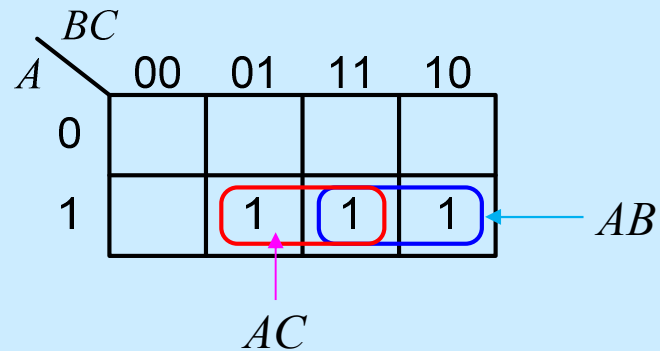
② AC

③ ABC

④ $A(B+C)$

$$Y = ABC + A\bar{B}C + AB\bar{C}$$

$$= \Sigma m(5, 6, 7)$$



$$Y = AB + AC = A(B + C)$$

45. 다음과 같은 논리 함수를 카르노 맵을 이용하여 간소화한 식은?

$$f = \overline{\overline{x}}\overline{\overline{y}}\overline{\overline{z}} + \overline{\overline{x}}\overline{\overline{y}}\overline{\overline{z}} + \overline{\overline{x}}\overline{\overline{y}}\overline{\overline{z}} + \overline{\overline{x}}\overline{\overline{y}}\overline{\overline{z}} + \overline{\overline{x}}\overline{\overline{y}}\overline{\overline{z}}$$

① $f = \overline{x}\overline{y} + \overline{z}y$

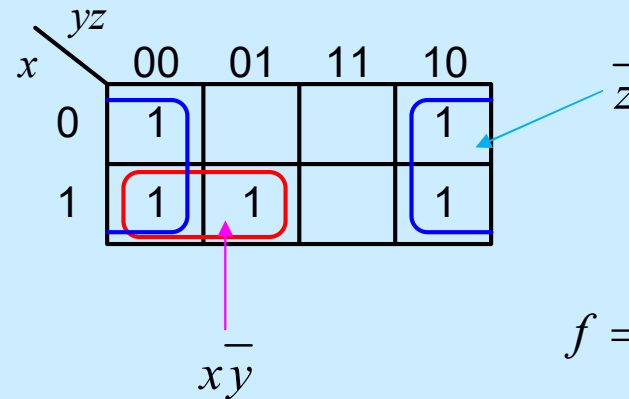
② $f = xy + \overline{x}\overline{z}$

③ $f = \overline{z} + x\overline{y}$

④ $f = xy + \overline{x}\overline{y}$

$$f = \overline{\overline{x}}\overline{\overline{y}}\overline{\overline{z}} + \overline{\overline{x}}\overline{\overline{y}}\overline{\overline{z}} + \overline{\overline{x}}\overline{\overline{y}}\overline{\overline{z}} + \overline{\overline{x}}\overline{\overline{y}}\overline{\overline{z}} + \overline{\overline{x}}\overline{\overline{y}}\overline{\overline{z}}$$

$$= \Sigma m(0, 2, 4, 5, 6)$$



$$f = \overline{z} + \overline{x}\overline{y}$$

46. 논리식 $Y=ABC+\bar{A}BC+A\bar{B}C+B\bar{C}$ 를 간단히 하면?

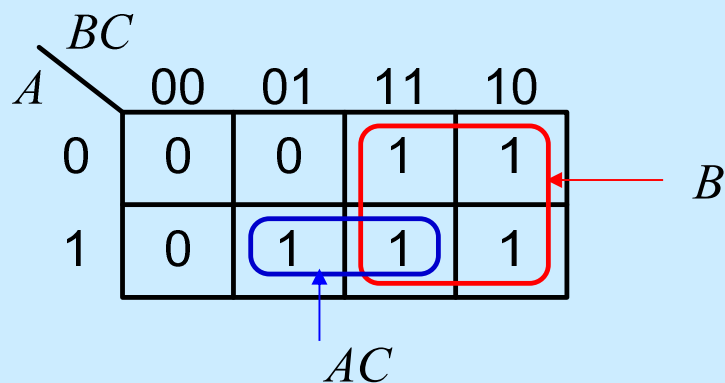
① $AB+C$

② $AC+B$

③ ABC

④ $A+BC$

$$\begin{aligned} Y &= ABC + \bar{A}BC + A\bar{B}C + B\bar{C} = ABC + \bar{A}BC + A\bar{B}C + (\bar{A} + A)B\bar{C} \\ &= ABC + \bar{A}BC + A\bar{B}C + \bar{A}B\bar{C} + AB\bar{C} \\ &= \bar{A}B\bar{C} + \bar{A}BC + A\bar{B}C + AB\bar{C} + ABC = \Sigma m(2,3,5,6,7) \end{aligned}$$



47. 다음 $\overline{A}C + \overline{A}B + A\overline{B}C + BC$ 의 식을 간소화한 것은?

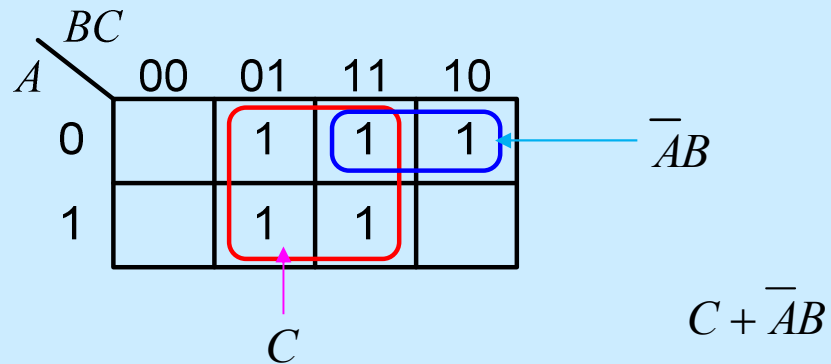
① $\overline{A}\overline{B} + \overline{A}C$

② $C + \overline{A}B$

③ $\overline{A} + \overline{B}C$

④ $B + \overline{A}C$

$$\begin{aligned}\overline{A}C + \overline{A}B + A\overline{B}C + BC &= \overline{A}(\overline{B} + B)C + \overline{A}B(\overline{C} + C) + A\overline{B}C + (\overline{A} + A)BC \\ &= \overline{A}\overline{B}C + \overline{A}BC + \overline{A}B\overline{C} + \overline{A}BC + A\overline{B}C + \overline{A}BC + ABC \\ &= \overline{A}\overline{B}C + \overline{A}B\overline{C} + \overline{A}BC + A\overline{B}C + ABC = \Sigma m(1, 2, 3, 5, 7)\end{aligned}$$



48. 다음 중 논리식 $(A+B)(\bar{A}+C)$ 를 간단히 하면?

① $\bar{A}B + AC$

② $\bar{A}B + BC$

③ $AC + BC$

④ $\bar{A} + ABC$

$$\begin{aligned}(A+B)(\bar{A}+C) &= \bar{A}A + AC + \bar{A}B + BC = \bar{A}B + AC + BC \\&= \bar{A}B(\bar{C} + C) + A(\bar{B} + B)C + (\bar{A} + A)BC \\&= \bar{A}B\bar{C} + \bar{A}BC + A\bar{B}C + ABC + \bar{A}BC + ABC \\&= \bar{A}B\bar{C} + \bar{A}BC + A\bar{B}C + ABC = \Sigma m(2,3,5,7)\end{aligned}$$

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

AC

$\bar{A}B + AC$

49. 다음 논리식을 간단히 하면?

$$(A + B)(C + A) + ABC$$

① BC

② 1

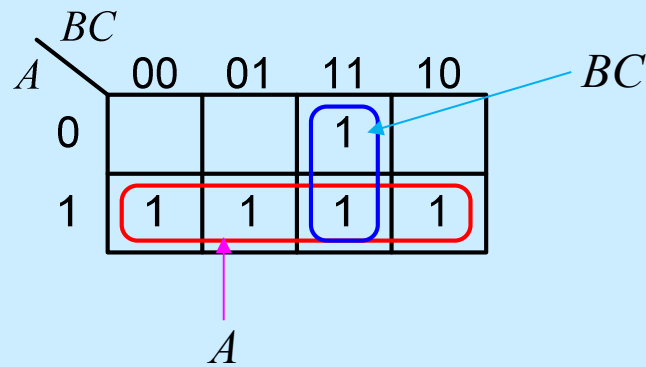
③ $A+BC$

④ $A+B+C$

$$(A + B)(C + A) + ABC = AC + A + BC + AB + ABC$$

$$= A(\bar{B} + B)C + A(\bar{B} + B)(\bar{C} + C) + (\bar{A} + A)BC + AB(\bar{C} + C) + ABC$$

$$= \bar{A}BC + \bar{A}\bar{B}C + \bar{A}BC + A\bar{B}C + ABC = \Sigma m(3, 4, 5, 6, 7)$$



50. 다음 불 함수를 간소화한 것은?

$$F = \overline{A}\overline{B}\overline{C} + \overline{B}C\overline{D} + \overline{A}BC\overline{D} + A\overline{B}\overline{C}$$

① $F = \overline{B}D + \overline{B}C + A\overline{C}D$

② $F = BD + \overline{B}C + \overline{A}CD$

③ $F = \overline{B}D + \overline{B}C + \overline{A}C\overline{D}$

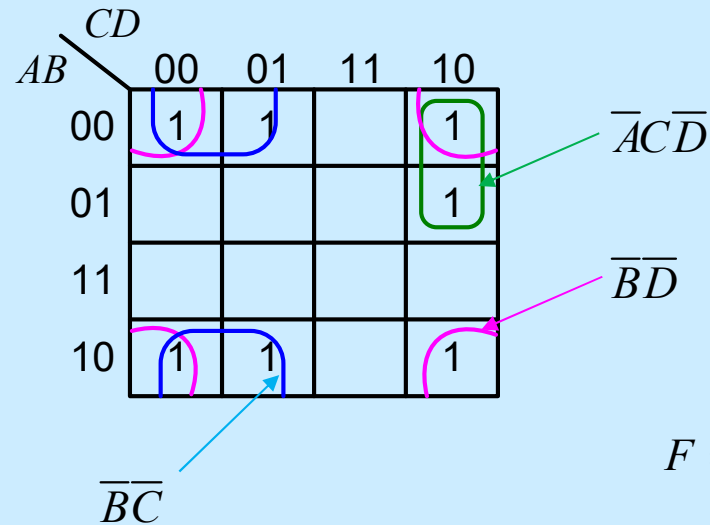
④ $F = B\overline{D} + BC + \overline{A}CD$

$$F = \overline{A}\overline{B}\overline{C} + \overline{B}C\overline{D} + \overline{A}BC\overline{D} + A\overline{B}\overline{C}$$

$$= \overline{A}\overline{B}\overline{C}(\overline{D} + D) + (\overline{A} + A)\overline{B}C\overline{D} + \overline{A}BC\overline{D} + A\overline{B}\overline{C}(\overline{D} + D)$$

$$= \overline{A}\overline{B}\overline{C}\overline{D} + \overline{A}\overline{B}\overline{C}D + \overline{A}BC\overline{D} + A\overline{B}C\overline{D} + \overline{A}BCD + A\overline{B}CD + A\overline{B}\overline{C}D$$

$$= \Sigma m(0,1,2,6,8,9,10)$$



$$F = \overline{B}D + \overline{B}C + \overline{A}C\overline{D}$$

51. 다음 논리 함수를 간소화하면?

$$F(A,B,C,D) = \overline{A}\overline{B}C + \overline{A}BD + A\overline{C}(\overline{B}C + \overline{C}D) + A\overline{B}D$$

- ① $F(A,B,C,D) = \overline{A}\overline{C} + \overline{A}\overline{B} + \overline{A}BD$
- ② $F(A,B,C,D) = \overline{A}\overline{C} + \overline{A}\overline{B} + \overline{A}BD + \overline{A}BC$
- ③ $F(A,B,C,D) = \overline{A}\overline{C} + \overline{A}\overline{B} + \overline{A}BD + \overline{B}CD$
- ④ $F(A,B,C,D) = \overline{A}\overline{C} + \overline{A}\overline{B} + \overline{A}BD + BD$

$$\begin{aligned} F(A,B,C,D) &= \overline{A}\overline{B}C + \overline{A}BD + A\overline{C}(\overline{B}C + \overline{C}D) + A\overline{B}D \\ &= \overline{A}\overline{B}C(\overline{D} + D) + \overline{A}B(\overline{C} + C)D + A\overline{B}C(\overline{D} + D) + A(\overline{B} + B)\overline{C}D + \overline{A}B(\overline{C} + C)D \\ &= \overline{A}\overline{B}C\overline{D} + \overline{A}\overline{B}CD + \overline{A}B\overline{C}D + \overline{A}BCD + A\overline{B}C\overline{D} + A\overline{B}CD + A\overline{B}\overline{C}D + A\overline{B}CD + \overline{A}B\overline{C}D + \overline{A}BCD \\ &= \overline{A}\overline{B}C\overline{D} + \overline{A}\overline{B}CD + \overline{A}B\overline{C}D + \overline{A}BCD + A\overline{B}C\overline{D} + A\overline{B}CD + A\overline{B}\overline{C}D + A\overline{B}CD \\ &= \Sigma m(5,7,8,9,10,11,12,13) \end{aligned}$$

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

$\overline{A}BD$

$A\overline{C}$

$A\overline{B}$

$$F(A,B,C,D) = \overline{A}\overline{C} + \overline{A}\overline{B} + \overline{A}BD$$

52. 다음 불 대수식을 간단히 하면?

$$ABC\bar{C} \oplus \bar{B}C \oplus (\bar{A}C + B\bar{C}) \oplus A\bar{B}$$

① $AB + \bar{A}C + A\bar{B}C$

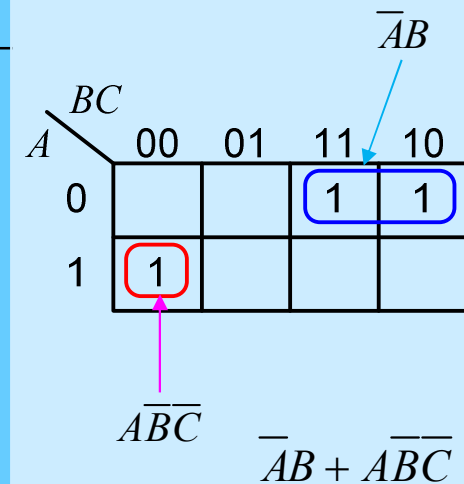
② $AB + BC + A\bar{B}C$

③ $\bar{A}B + A\bar{B}C$

④ $\bar{A}B + B\bar{C} + A\bar{C}$

$$ABC\bar{C} \oplus \bar{B}C \oplus (\bar{A}C + B\bar{C}) \oplus A\bar{B} = \Sigma m(2,3,4)$$

A B C	$ABC\bar{C}$	$\bar{B}C$	$\bar{A}C$	$B\bar{C}$	$\bar{A}C+B\bar{C}$	$A\bar{B}$	전체
0 0 0	0	0	0	0	0	0	0
0 0 1	0	1	1	0	1	0	0
0 1 0	0	0	0	1	1	0	1
0 1 1	0	0	1	0	1	0	1
1 0 0	0	0	0	0	0	1	1
1 0 1	0	1	0	0	0	1	0
1 1 0	1	0	0	1	1	0	0
1 1 1	0	0	0	0	0	0	0



53. 다음 불 함수를 간소화하였을 때 결과식으로 옳은 것은?

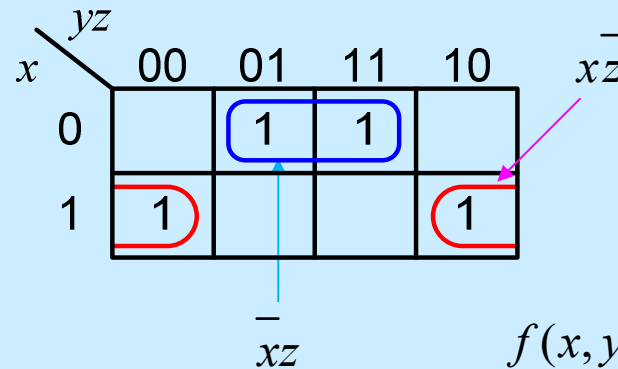
$$f(x, y, z) = \sum m(1, 3, 4, 6)$$

① $f(x, y, z) = \bar{x}y$

② $f(x, y, z) = \bar{y}z$

③ $f(x, y, z) = x$

④ $f(x, y, z) = \bar{x}z + x\bar{z}$



$$f(x, y, z) = \bar{x}z + x\bar{z} = x \oplus z$$

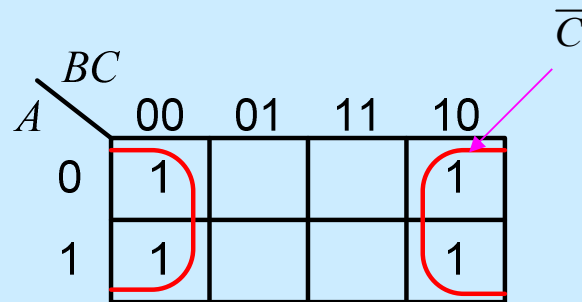
54. $F(A, B, C) = \sum m(0, 2, 4, 6)$ 의 최소항으로 표시된 논리식을 간소화하면?

① $\bar{A}$

② A

③ $\bar{C}$

④ C



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

55. $f(x, y, z) = \sum m(1, 3, 4, 5, 7)$ 를 간단히 나타내면?

① $f = \bar{x}y + z$

② $f = x\bar{y} + z$

③ $f = xyz$

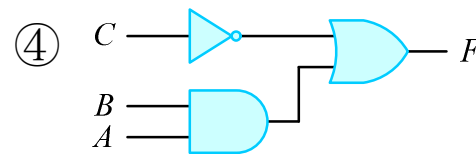
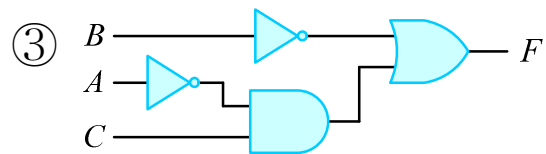
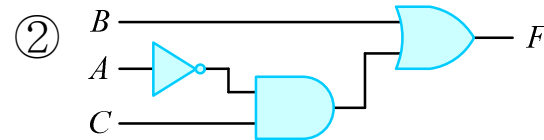
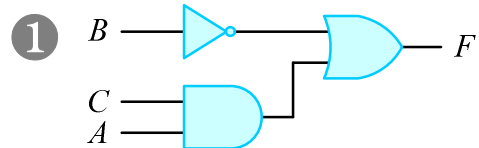
④ $f = x + yz$

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

Diagram illustrating the Karnaugh map for $f(x, y, z) = \sum m(1, 3, 4, 5, 7)$. The map shows the function values for combinations of x, y, z . The variables x, y, z are indicated by arrows pointing to the corresponding axes of the map.

$$f(x, y, z) = x\bar{y} + z$$

56. $F(A, B, C) = \sum m(0, 1, 4, 5, 7)$ 로 주어질 때, 간소화하여 논리회로를 구성하면?

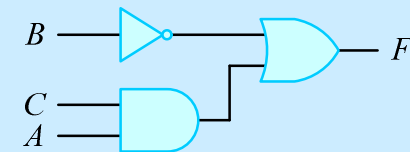


		BC			
		00	01	11	10
A	0	1	1		
	1	1	1	1	

$\bar{B}$

AC

$$F = AC + \bar{B}$$



57. 다음 표준형 불 함수(sum of minterms)를 카르노 맵을 이용하여 간소화한 것 중 옳은 것은?

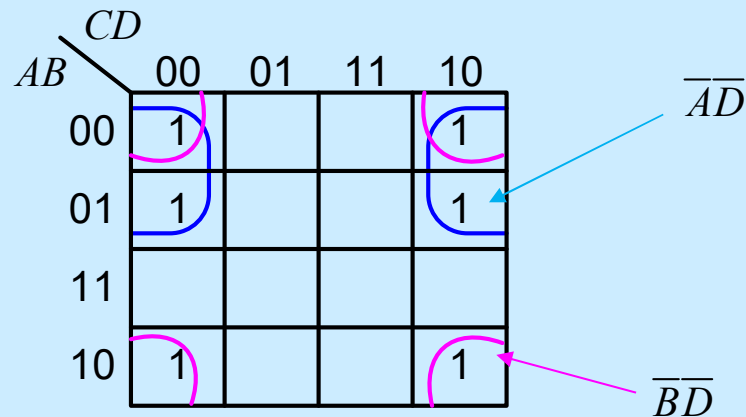
$$Y(A,B,C,D) = \Sigma m(0,2,4,6,8,10)$$

① $\overline{A}\overline{D} + AC$

② $\overline{B}\overline{C} + CD$

③ ABC

④ $\overline{A}\overline{D} + \overline{B}\overline{D}$



$$Y = \overline{A}\overline{D} + \overline{B}\overline{D}$$

58. 다음 불 함수를 간단히 하면?

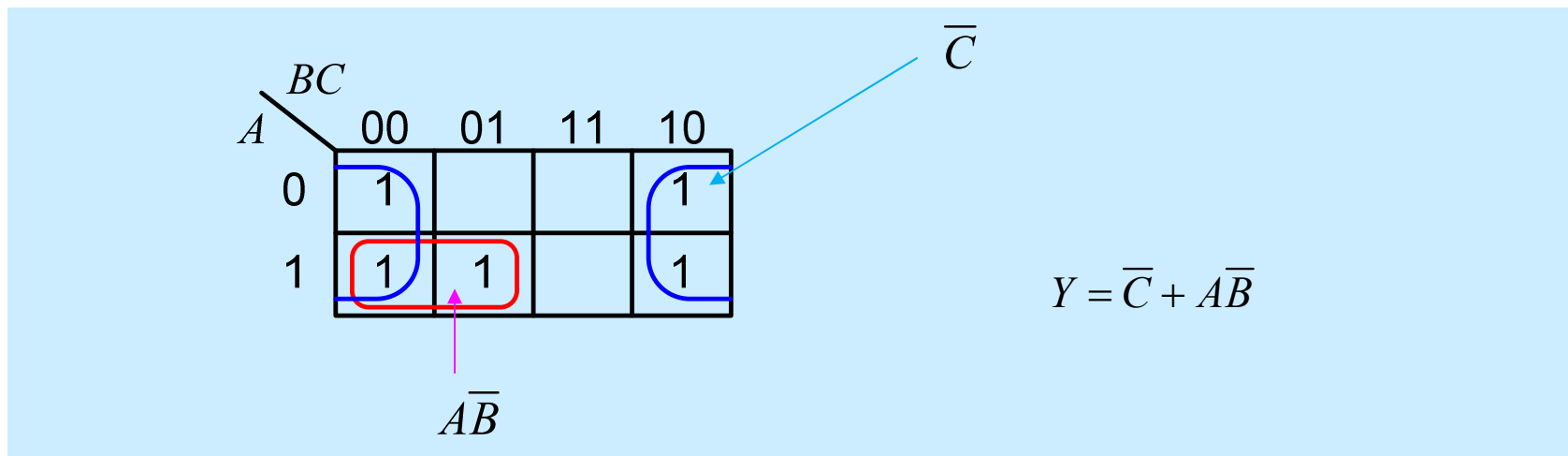
$$F(A, B, C) = \Sigma m(0, 2, 4, 5, 6)$$

① $A\bar{B} + BC + \bar{B}\bar{C}$

② $A + B + \bar{C}$

③ $\bar{A}B + B\bar{C}$

④ $\bar{C} + A\bar{B}$



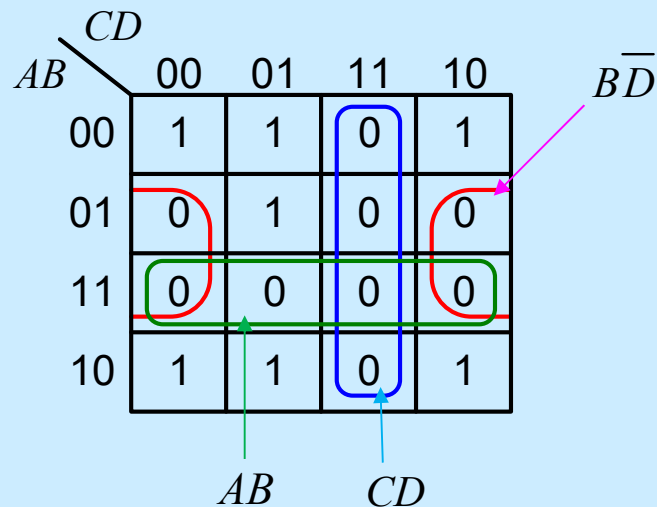
59. $F(A, B, C, D) = \sum m(0, 1, 2, 5, 8, 9, 10)$ 을 maxterm(product of sums)으로 간소화한 것은?

① $F = \overline{B}\overline{D} + \overline{B}\overline{C} + \overline{A}CD$

② $F = AB + CD + B\overline{D}$

③ $F = (\overline{A} + \overline{B})(\overline{C} + \overline{D})(\overline{B} + D)$

④ $F = (B + D)(B + C)(A + C + \overline{D})$



$$\overline{F} = AB + CD + B\overline{D}$$

$$F = \overline{AB + CD + B\overline{D}} = (\overline{A} + \overline{B})(\overline{C} + \overline{D})(\overline{B} + D)$$

60. 다음 논리식 중 등식이 성립되지 않는 것은?

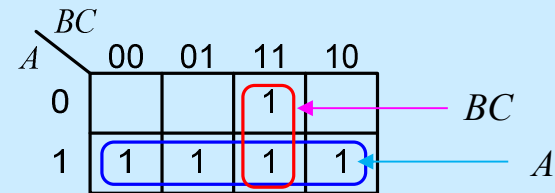
① $A + \overline{A}BC = A + BC$

② $AB + \overline{A}\overline{B} = A$

③ $AB + \overline{A}C + BC = AB + \overline{A}C$

④ $\overline{A}\overline{B} + \overline{A}B = (A + B)(\overline{A} \cdot \overline{B})$

$$\begin{aligned} \text{① } A + \overline{A}BC &= A(\overline{B} + B)(\overline{C} + C) + \overline{A}BC \\ &= \overline{A}\overline{B}\overline{C} + \overline{A}\overline{B}C + \overline{A}B\overline{C} + \overline{A}BC + \overline{A}BC \\ &= \Sigma m(3, 4, 5, 6, 7) = A + BC \end{aligned}$$



② $AB + \overline{A}\overline{B} = A(B + \overline{B}) = A$

③ 합의의 정리(consensus theorem)

④ $(A + B)(\overline{A} \cdot \overline{B}) = \overline{A}\overline{A}\overline{B} + B\overline{A}\overline{B} = 0 + 0 = 0$

61. 다음 논리식 중 틀린 것은?

① $(A + C)(\bar{A} + B) = AB + \bar{A}C$

② $A + \bar{A}B = A + B$

③ $(A + B)(A + C) = A + BC$

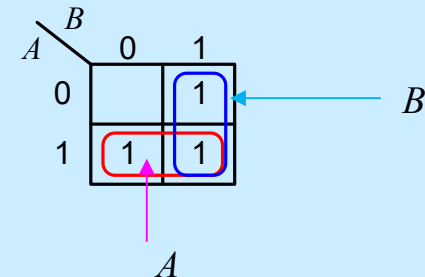
④ $A(A + B) = A + B$

① $(A + C)(\bar{A} + B) = A\bar{A} + AB + \bar{A}C + BC = AB + \bar{A}C + BC = AB + \bar{A}C$ (← 합의의 정리)

② $A + \bar{A}B = A(\bar{B} + B) + \bar{A}B = A\bar{B} + AB + \bar{A}B = A + B$

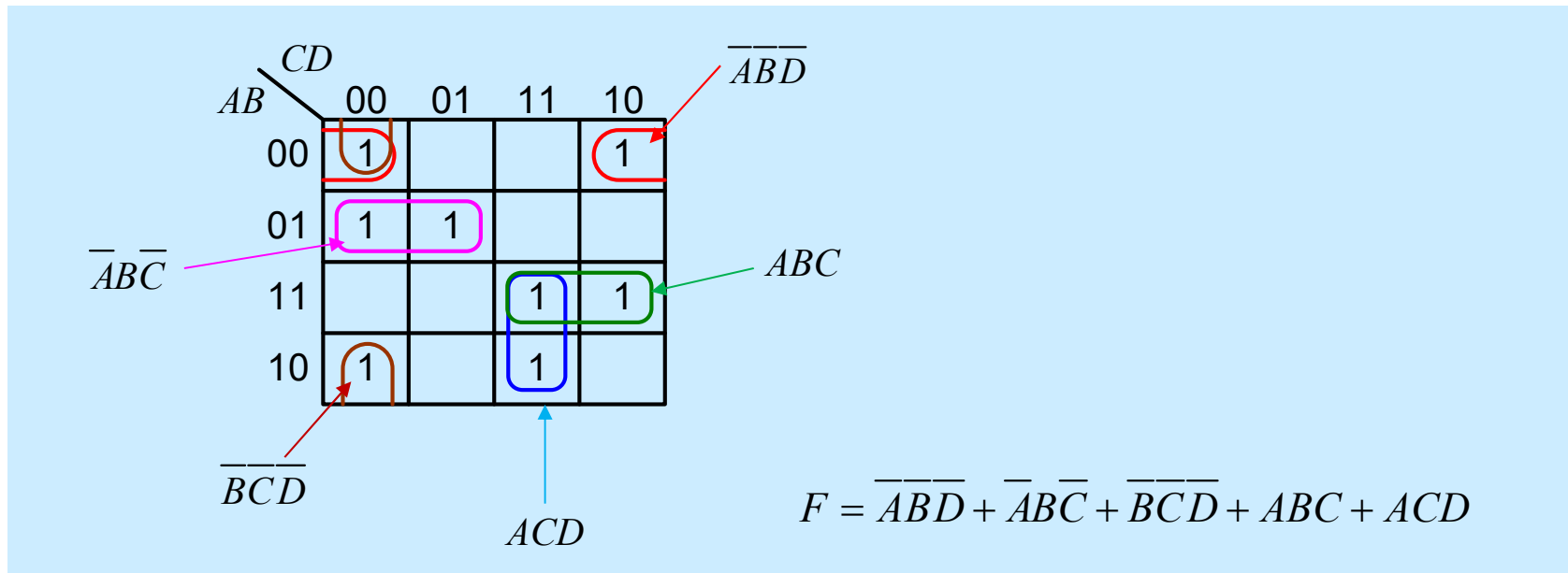
③ $(A + B)(A + C) = AA + AC + AB + BC$
 $= A + AC + AB + BC$
 $= A(1 + C + B) + BC$
 $= A + BC$

④ $A(A + B) = AA + AB = A + AB = A(1 + B) = AB$



62. 논리 함수식 $F(A, B, C, D) = \sum m(0, 2, 4, 5, 8, 11, 14, 15)$ 를 간소화하였을 때 옳은 것은?

- ① $F = \overline{ABD} + \overline{ACD} + \overline{ABC} + \overline{BCD} + ABC + ACD$
- ② $F = \overline{ABD} + \overline{ACD} + \overline{ABC} + ABC + ACD$
- ③ $F = \overline{ABD} + \overline{ABC} + \overline{BCD} + ABC + ACD$
- ④ $F = \overline{ACD} + \overline{ABC} + \overline{BCD} + ABC + ACD$



63. 다음의 민텀의 합형으로 표현된 불 함수를 카르노 맵을 이용하여 간소화한 것 중 가장 간단한 논리식은?

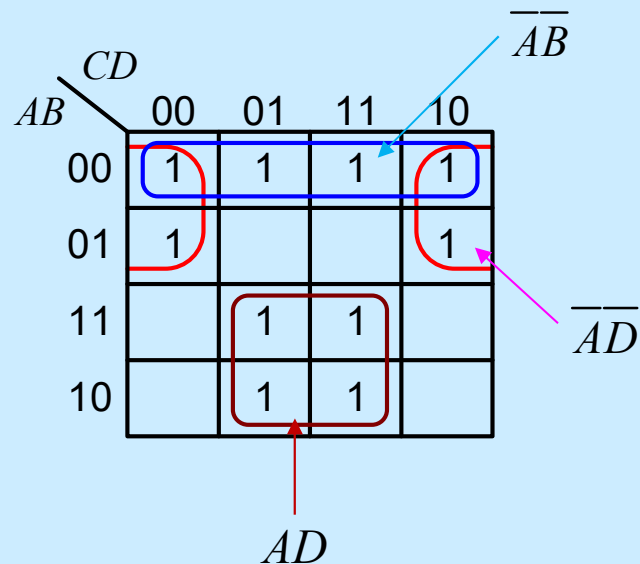
$$Y(A, B, C, D) = \Sigma m(0, 1, 2, 3, 4, 6, 9, 11, 13, 15)$$

① $ABC + BCD$

② $BC + ABD + ABC$

③ $\overline{AB} + \overline{AD} + AD$

④ $A + BCD$



$$Y = \overline{AB} + \overline{AD} + AD$$

64. 다음 불 함수를 간소화한 결과는?

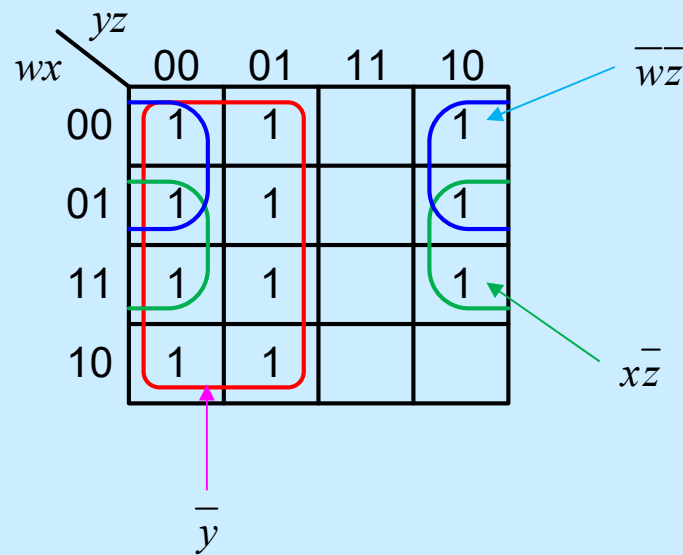
$$f(w, x, y, z) = \sum m(0, 1, 2, 4, 5, 6, 8, 9, 12, 13, 14)$$

① $f = x + y + wz$

② $f = \bar{y} + \bar{z} + xy$

③ $f = \bar{y} + \bar{w}z + x\bar{z}$

④ $f = x + z$



$$f = \bar{y} + \bar{w}z + x\bar{z}$$

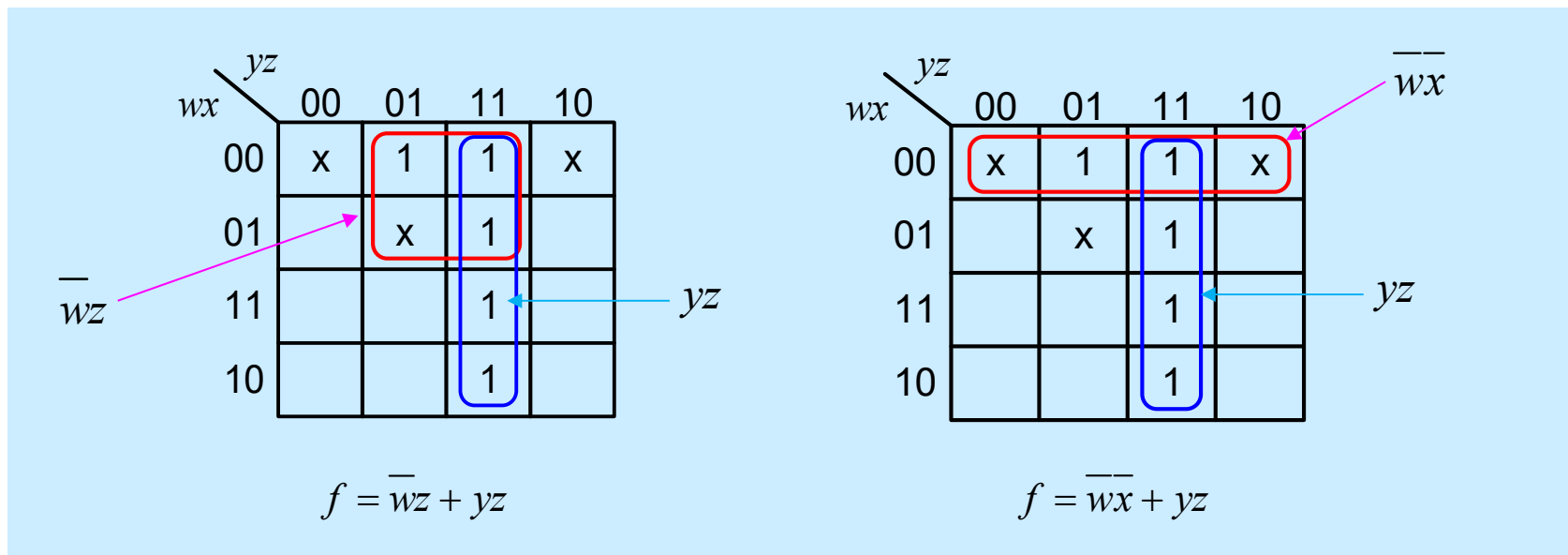
65. $f(w, x, y, z) = \sum m(1, 3, 7, 11, 15)$ 이며, 무관(don't care) 조건이 $d(w, x, y, z) = \sum d(0, 2, 5)$ 인 불 함수를 간소화한 결과는?

① $f = x + y + z$

② $f = wx + y$

③ $f = \overline{w}z + yz$

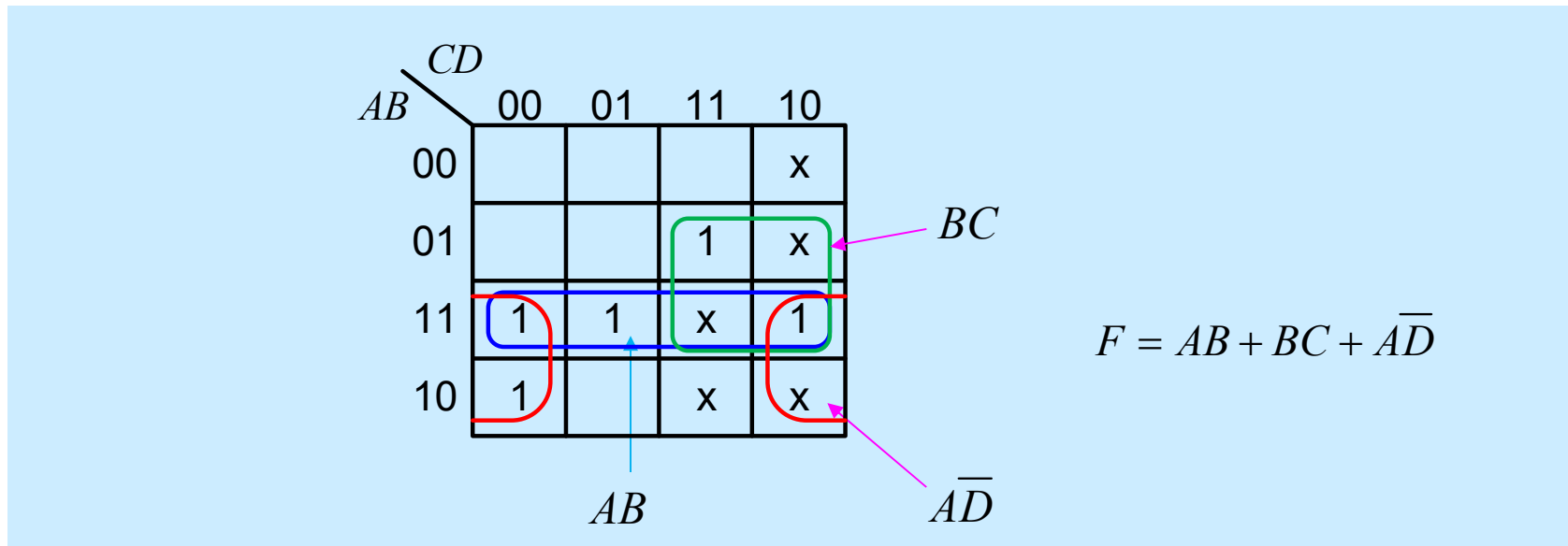
④ $f = z(w + y)$



66. 다음 논리식을 가장 간단히 나타낸 것은? 단, d 는 무정의 조건(don't care)이다.

$$F(A, B, C, D) = \sum m(7, 8, 12, 13, 14) + \sum d(2, 6, 10, 11, 15)$$

- ① $AB + BC$ ② $AB + BC + ACD$
 ③ $AB + BC + \overline{AD}$ ④ $AB + BC + BD$



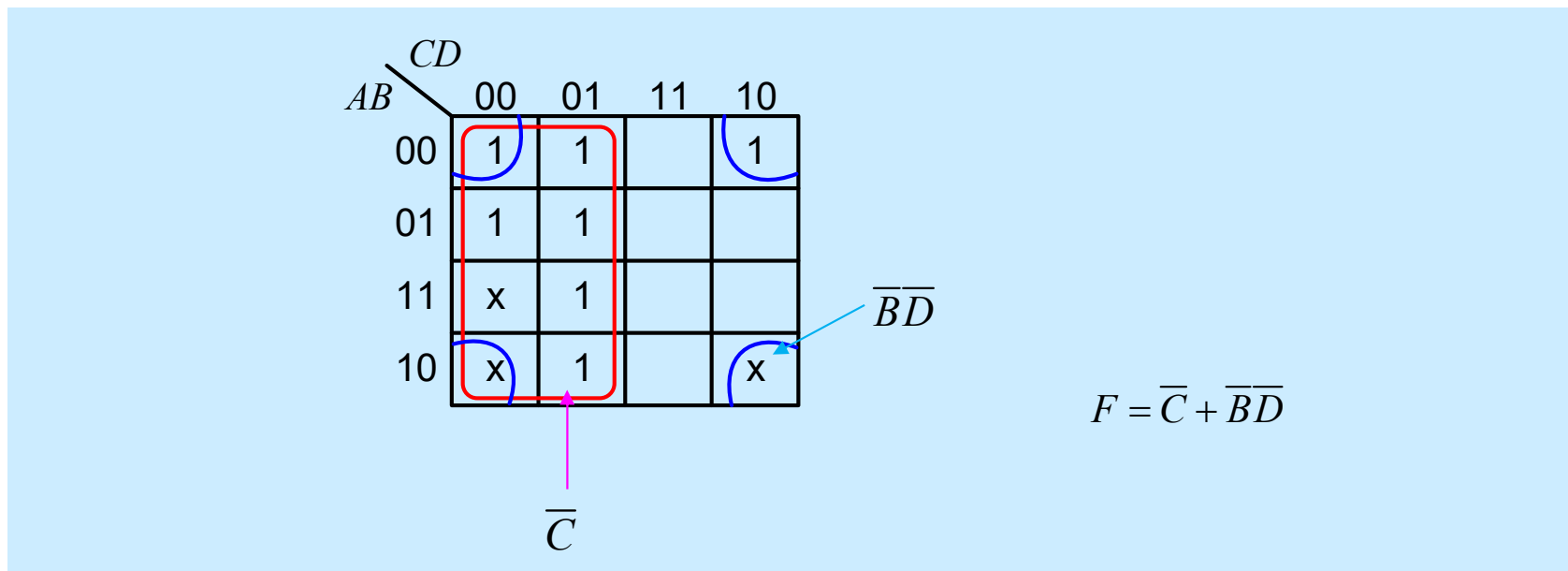
67. 논리 함수 $F(A, B, C, D) = \sum m(0, 1, 2, 4, 5, 9, 13) + \sum d(8, 10, 12, 14)$ 을 간소화하면? 단, $\sum d$ 는 무관항을 가리킨다.

① $\overline{AC} + \overline{CD} + \overline{ABD}$

② $A + \overline{C}$

③ $\overline{AC} + \overline{BC} + \overline{ABD}$

④ $\overline{C} + \overline{BD}$



68. 다음 제시된 조건에 따라 간략화한 F 의 값은?

$$F(A, B, C, D) = \Sigma m(0, 1, 2, 5, 8, 9, 10) + \Sigma d(3, 11, 13, 15)$$

① $F = \overline{B} + \overline{CD}$

② $F = \overline{B} + D$

③ $F = \overline{AB} + AD + \overline{CD} + AB$

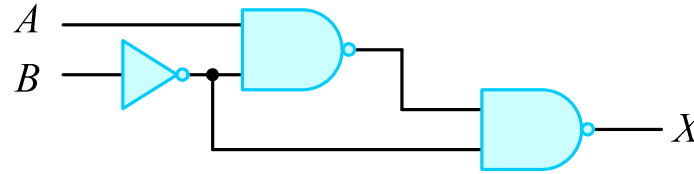
④ $F = \overline{BD} + \overline{BC} + \overline{ACD}$

		CD			
AB		00	01	11	10
00		1	1	x	1
01			1		
11			x	x	
10		1	1	x	1

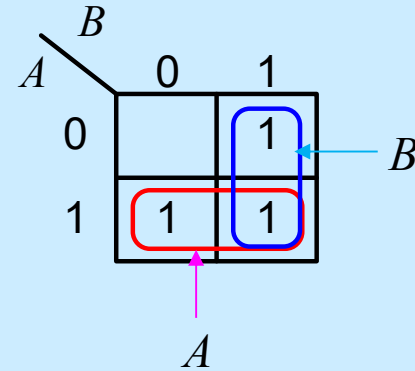
$$F = \overline{B} + \overline{CD}$$

69. 그림에서 출력 X 를 입력 A, B 의 함수로 바르게 표시한 것은?

- ① $X = AB$
- ② $X = A + B$
- ③ $X = \overline{A}B + A\overline{B}$
- ④ $X = AB + \overline{A}\overline{B}$

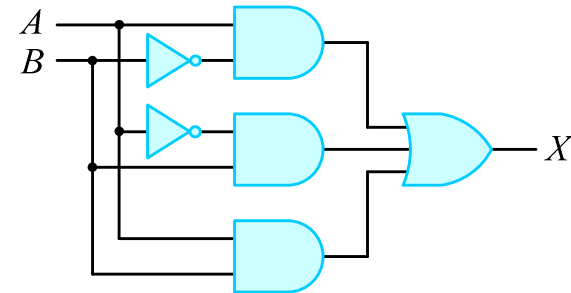
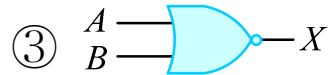
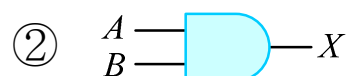
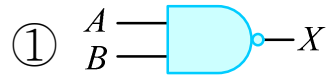


$$\begin{aligned}
 X &= \overline{\overline{A}B} \cdot \overline{B} = \overline{\overline{A}B} + \overline{B} = A\overline{B} + B \\
 &= A\overline{B} + (\overline{A} + A)B \\
 &= A\overline{B} + \overline{A}B + AB \\
 &= \Sigma m(1, 2, 3)
 \end{aligned}$$

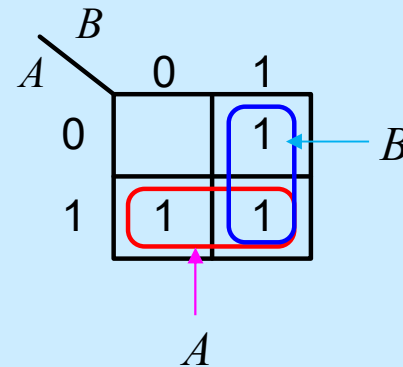


$$X = A + B$$

70. 그림과 같은 논리회로를 간단히 하면?

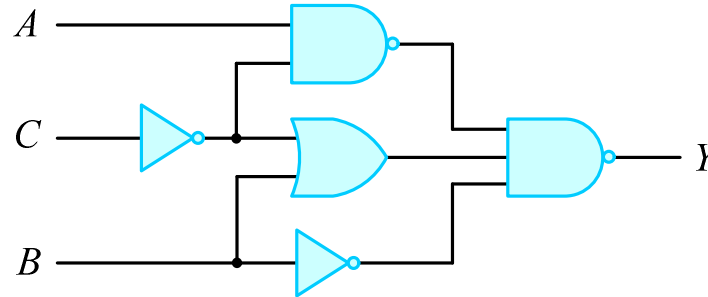


$$\begin{aligned}
 X &= \overline{A}\overline{B} + \overline{A}B + AB \\
 &= \Sigma m(1, 2, 3) \\
 &= A + B \\
 &\text{OR 게이트}
 \end{aligned}$$

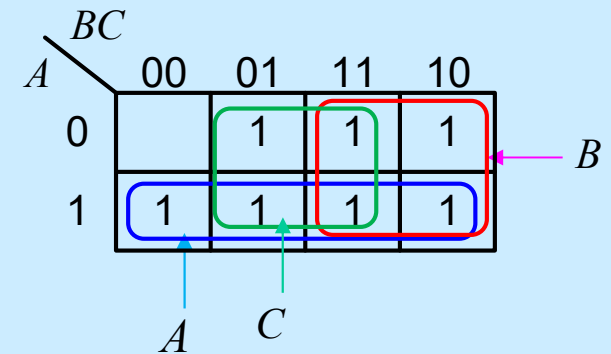


71. 다음 중 그림과 같은 회로의 논리식은?

- ① ABC
- ② $AB + C$
- ③ $A + B + C$
- ④ $\overline{ABC}$



$$\begin{aligned}
 Y &= \overline{\overline{A}\overline{C}} \cdot (\overline{C} + B) \cdot \overline{B} = \overline{\overline{A}\overline{C}} + (\overline{C} + B) + \overline{B} = A\overline{C} + \overline{B}C + B \\
 &= A(\overline{B} + B)\overline{C} + (\overline{A} + A)\overline{B}C + (\overline{A} + A)B(\overline{C} + C) \\
 &= A\overline{B}\overline{C} + AB\overline{C} + \overline{A}\overline{B}C + A\overline{B}C + \overline{A}B\overline{C} + \overline{A}BC + AB\overline{C} + ABC \\
 &= \overline{A}\overline{B}C + \overline{A}B\overline{C} + \overline{A}BC + A\overline{B}\overline{C} + A\overline{B}C + AB\overline{C} + ABC \\
 &= \Sigma m(1, 2, 3, 4, 5, 6, 7)
 \end{aligned}$$



$$Y = A + B + C$$

72. 어떤 논리회로에서 입력은 A, B, C 이며 출력은 입력 중에서 둘 이상이 1 일 때 출력 Y 가 1이 된다면 이 논리회로의 논리식은?

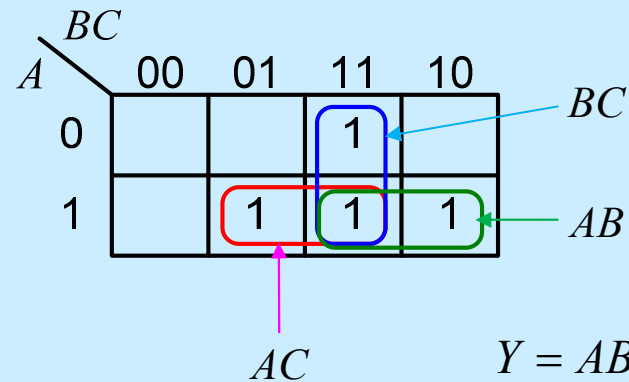
① $Y = A\bar{B} + B\bar{C} + \bar{C}A$

② $Y = AB + \bar{B}C + \bar{C}A$

③ $Y = \bar{A}B + \bar{B}C + \bar{C}A$

④ $Y = AB + BC + CA$

A	B	C	Y
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1



73. 다음 불 대수식 Y 의 보수를 취하여 간단히 한 것은?

$$Y = \overline{X_1} \overline{X_2} X_3 + X_1 (X_2 + \overline{X_3})$$

① $\overline{Y} = \overline{X_1} \overline{X_3}$

② $\overline{Y} = X_1 \overline{X_2}$

③ $\overline{Y} = X_1 \overline{X_3}$

④ $\overline{Y} = \overline{X_1} \overline{X_2}$

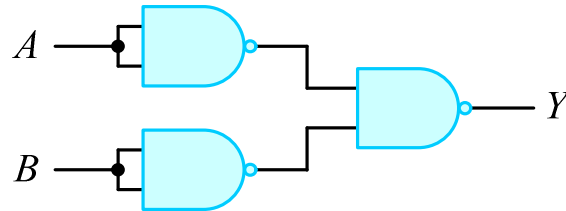
$$\begin{aligned} Y &= \overline{X_1} \overline{X_2} X_3 + X_1 (X_2 + \overline{X_3}) = (\overline{X_1} + \overline{X_2}) X_3 + X_1 (X_2 + \overline{X_3}) \\ &= \overline{X_1} X_3 + \overline{X_2} X_3 + X_1 X_2 + X_1 \overline{X_3} \\ &= \overline{X_1} (\overline{X_2} + X_2) X_3 + (\overline{X_1} + X_1) \overline{X_2} X_3 + X_1 X_2 (\overline{X_3} + X_3) + X_1 (\overline{X_2} + X_2) \overline{X_3} \\ &= \overline{X_1} \overline{X_2} X_3 + \overline{X_1} X_2 X_3 + \overline{X_1} \overline{X_2} X_3 + X_1 \overline{X_2} X_3 + X_1 X_2 \overline{X_3} + X_1 X_2 X_3 + X_1 \overline{X_2} \overline{X_3} + X_1 X_2 \overline{X_3} \\ &= \sum m(1, 3, 4, 5, 6, 7) \end{aligned}$$

		$X_2 X_3$			
		00	01	11	10
X_1	0		1	1	
	1	1	1	1	1

Diagram illustrating the Karnaugh map for the function $Y = X_1 + X_3$. The map shows the function value (1 or 0) for each combination of X_1 and $X_2 X_3$. The function is 1 for the minterms $m(1, 3, 4, 5, 6, 7)$. The map is simplified to $Y = X_1 + X_3$ by grouping the 1s into two groups: a group of four 1s (minterms 1, 3, 5, 7) and a group of two 1s (minterms 4, 6).

$$Y = X_1 + X_3 \leftrightarrow \overline{Y} = \overline{X_1} \cdot \overline{X_3}$$

76. 다음 논리회로의 구성에 대한 설명으로 옳은 것은?

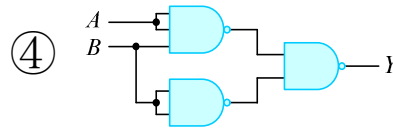
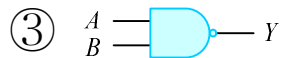
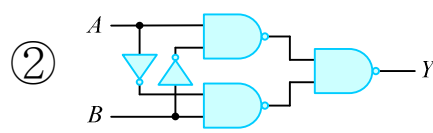
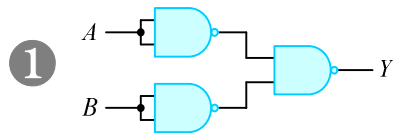
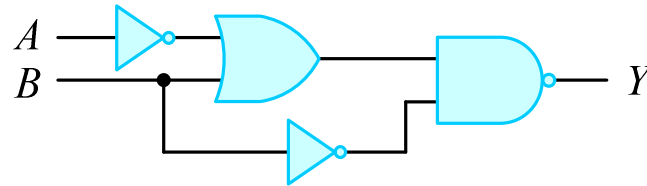


- ① NAND 게이트를 연결하여 NOR 게이트를 구성하였다.
- ② NAND 게이트를 연결하여 XOR 게이트를 구성하였다.
- ③ NAND 게이트를 연결하여 OR 게이트를 구성하였다.
- ④ NAND 게이트를 연결하여 AND 게이트를 구성하였다.

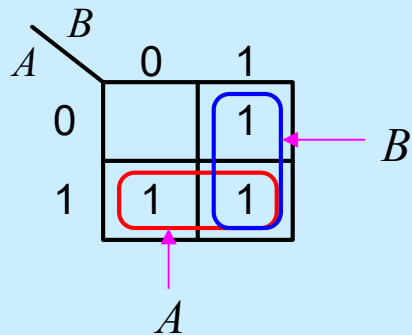
$$Y = \overline{\overline{A} \cdot \overline{B}} = \overline{\overline{A}} + \overline{\overline{B}} = A + B$$

OR 게이트

77. 다음 회로를 NAND 게이트만을 사용하여 구성하면?



$$Y = \overline{(\overline{A} + B)} \cdot \overline{B} = (\overline{A} + B) + \overline{B} = \overline{A}B + B = \overline{A}B + (\overline{A} + A)B = \overline{A}B + \overline{A}B + AB = A + B$$



① $Y = \overline{\overline{A} \cdot \overline{B}} = \overline{\overline{A}} + \overline{\overline{B}} = A + B$

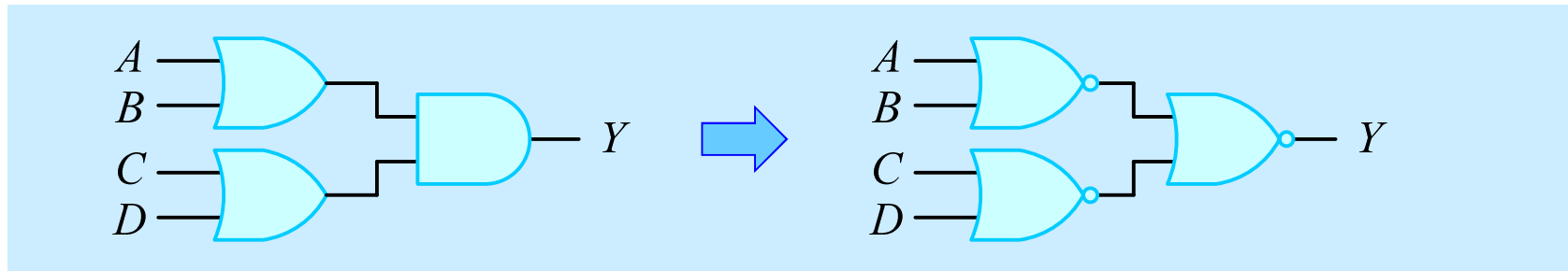
② $Y = \overline{\overline{A}B \cdot \overline{A}B} = \overline{\overline{A}B} + \overline{\overline{A}B} = \overline{\overline{A}}\overline{B} + \overline{\overline{A}}B$

③ $Y = \overline{AB}$

④ $Y = \overline{\overline{A}B \cdot \overline{B}} = \overline{\overline{A}B} + \overline{\overline{B}} = \overline{\overline{A}}\overline{B} + B$

78. 논리식 $Y=(A+B)(C+D)$ 를 NOR 게이트만을 사용하여 표시할 때 몇 개의 NOR 게이트가 필요한가?

- ① 2개 ② 3개 ③ 4개 ④ 5개



79. 입력이 A, B, C 인 다음 논리식을 입력이 2개인 NAND 게이트만으로 구성할 경우 최소 몇 개의 NAND 게이트가 필요한가?

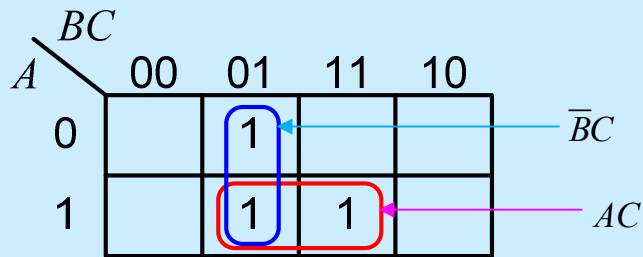
$$F = \overline{A}\overline{B}C + A\overline{B}C + ABC$$

① 6개

② 5개

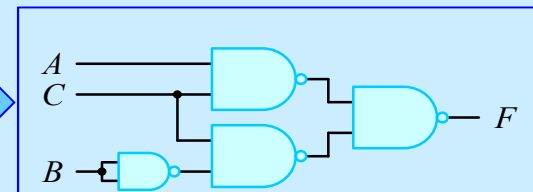
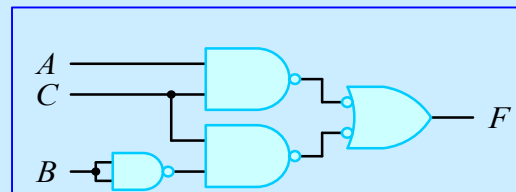
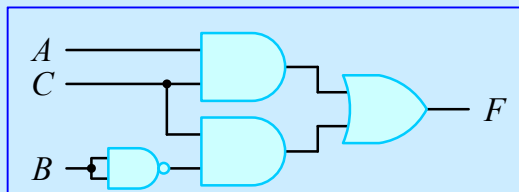
③ 4개

④ 3개



$$F = \overline{A}\overline{B}C + A\overline{B}C + ABC$$

$$= \Sigma m(1,5,7) = AC + \overline{B}C$$



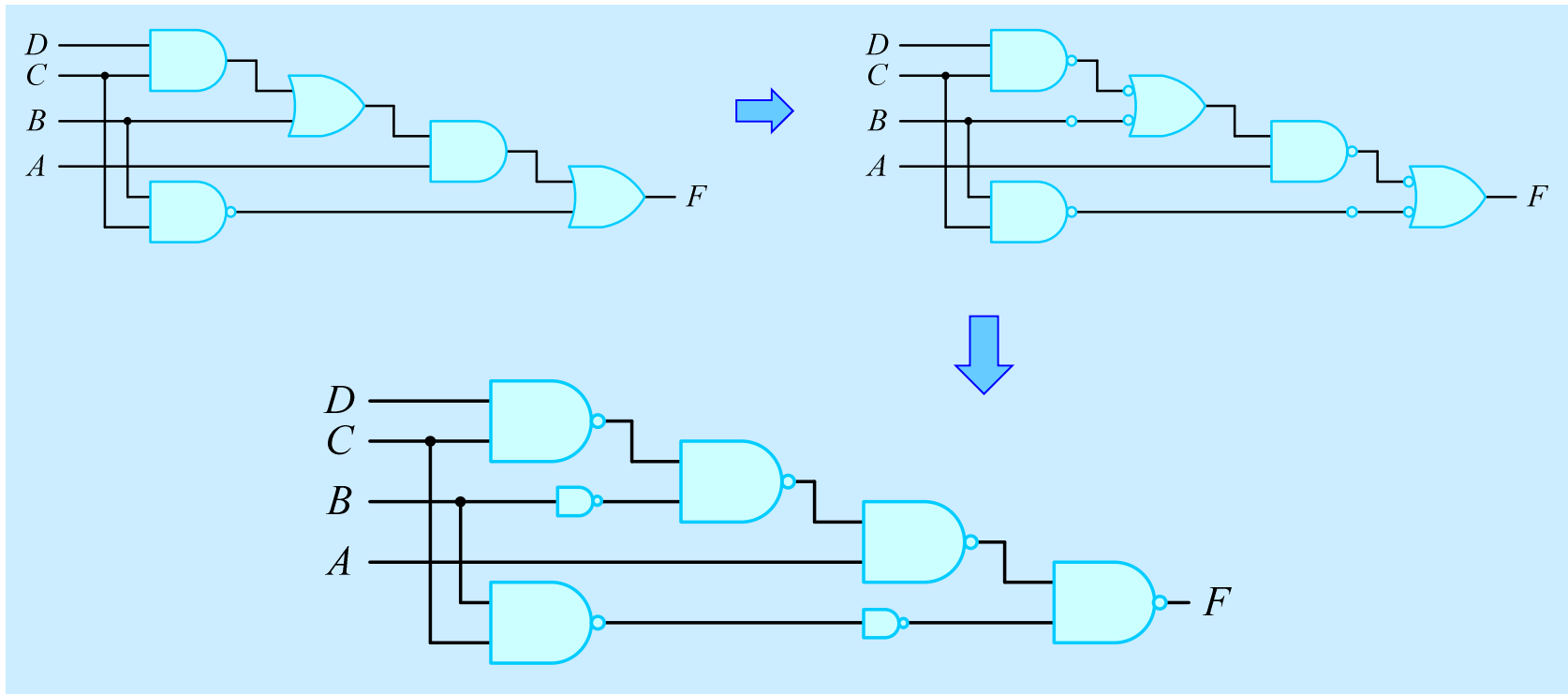
80. 불 함수가 $F=A(B+CD)+\overline{B}C$ 일 때, NAND 게이트만을 사용하여 조합논리회로를 구성한다면 필요한 게이트의 수는? 단, 모든 NAND 게이트는 2입력 NAND 게이트이다.

① 6개

② 7개

③ 8개

④ 9개



81. 다음에 주어진 논리식 F_1, F_2, F_3 을 2입력 NAND 게이트로 구현할 경우, 모두 몇 개의 게이트가 필요한가?

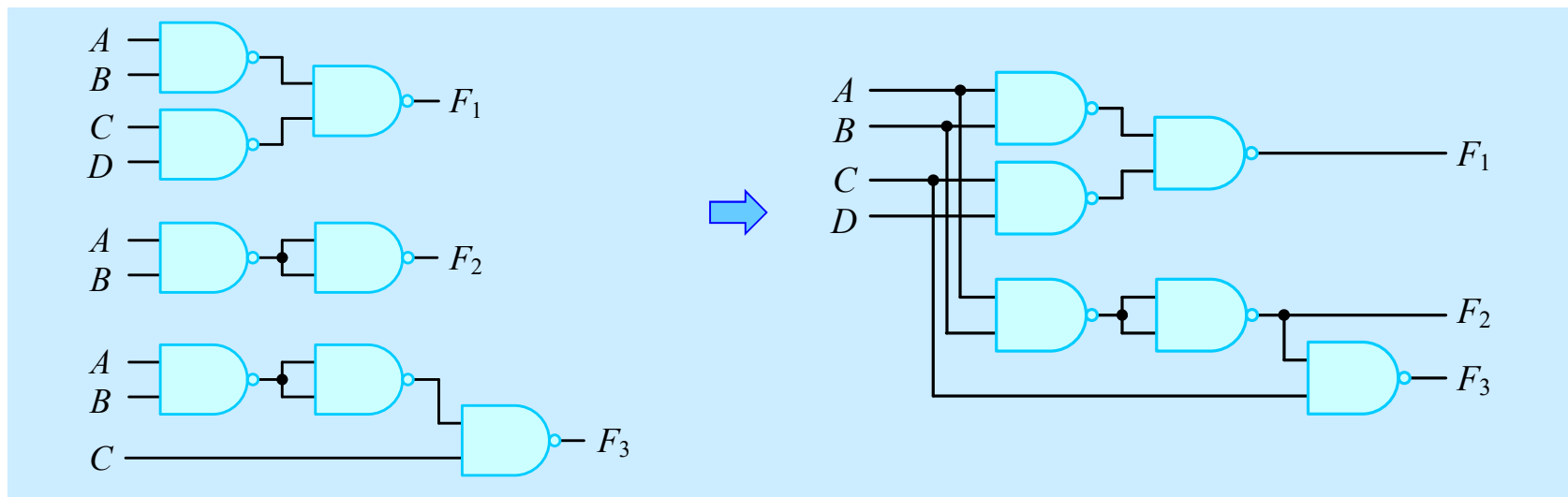
$$F_1 = AB + CD \quad F_2 = AB \quad F_3 = ABC$$

① 4개

② 5개

③ 6개

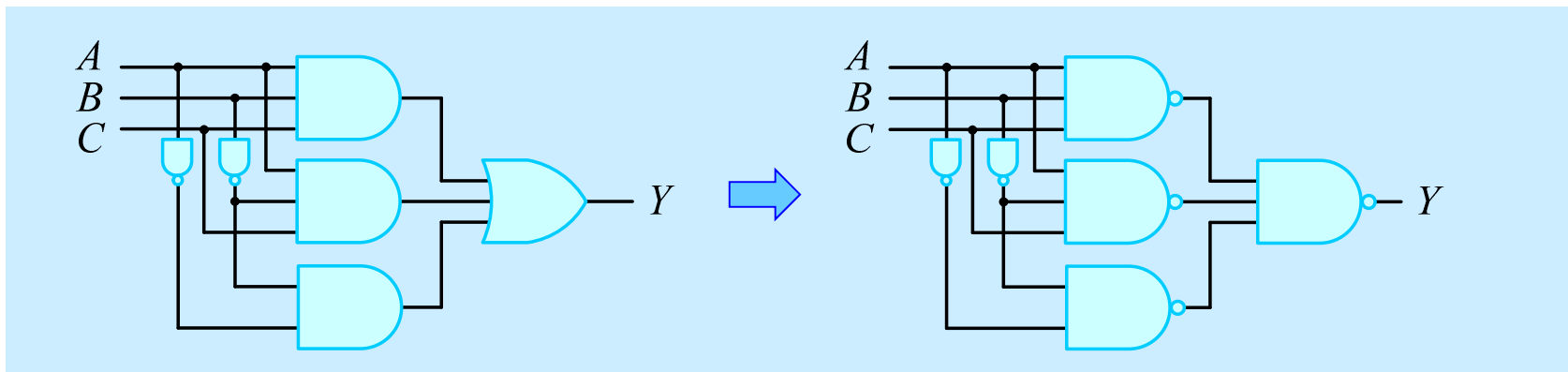
④ 7개



82. 다음의 논리식을 최소의 NAND 게이트만으로 구성하기 위해 필요로 하는 NAND 게이트의 종류와 개수가 옳은 것은? 단, 인버터는 2입력 NAND 게이트를 사용한다.

$$Y = ABC + \overline{A}\overline{B}C + \overline{A}\overline{B}\overline{C}$$

- ① 2입력 NAND 3개, 3입력 NAND 4개
- ② 2입력 NAND 3개, 3입력 NAND 3개
- ③ 2입력 NAND 4개, 3입력 NAND 3개
- ④ 2입력 NAND 2개, 3입력 NAND 4개



83. 불 함수 $f = wx + \bar{x}y + z$ 를 NAND 게이트로 구성하기 위한 식은?

① $f = \overline{\overline{wx} \cdot \overline{\bar{x}y} \cdot \bar{z}}$

② $f = \overline{wx} \cdot (\bar{x} \cdot \bar{y}) \cdot \bar{z}$

③ $f = \overline{\overline{wx} + (\bar{x} \cdot \bar{y}) + \bar{z}}$

④ $f = \overline{wx} + (\bar{x} \cdot \bar{y}) + \bar{z}$

$$f = wx + \bar{x}y + z = \overline{\overline{wx} \cdot \overline{\bar{x}y} \cdot \bar{z}}$$

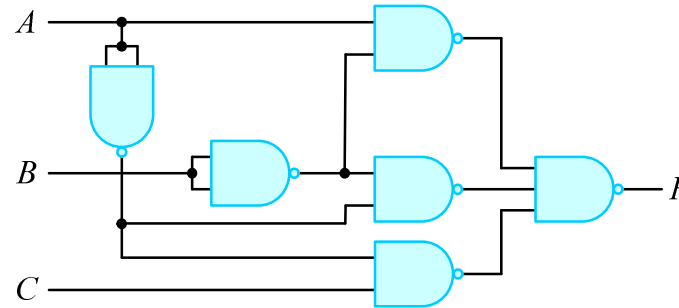
84. 다음과 같은 논리회로가 주어졌을 때 출력 F 의 값으로 가장 옳은 것은?

① $F = \overline{A}B + A\overline{B} + \overline{A}\overline{B}$

② $F = A\overline{B} + \overline{A}\overline{B} + \overline{A}C$

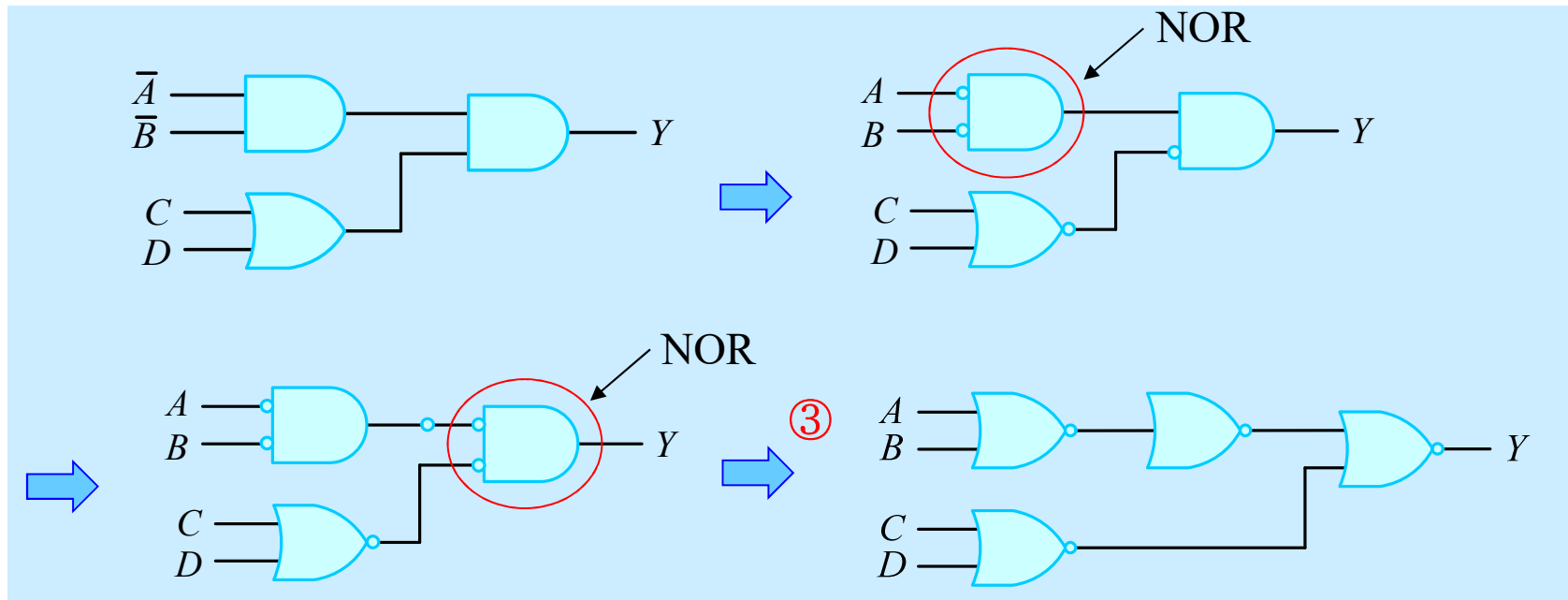
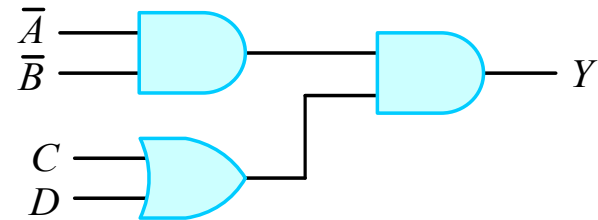
③ $F = AB + \overline{B}C + A\overline{C}$

④ $F = \overline{A}B + B\overline{C} + \overline{A}C$



$$F = \overline{\overline{A}B \cdot A\overline{B} \cdot \overline{A}C} = \overline{\overline{A}B} + \overline{A\overline{B}} + \overline{\overline{A}C} = A\overline{B} + \overline{A}\overline{B} + \overline{A}C$$

85. 다음 회로를 NOR 회로로 변경한 것으로 옳은 것은?



86. 다음 중 나머지 셋과 다른 논리값을 갖는 것은?

① $(A+B)(\bar{A}+\bar{B})$

② $(A+B)(\overline{AB})$

③ $\bar{A}B + A\bar{B}$

④ $\overline{(A+\bar{B})(A+B)}$

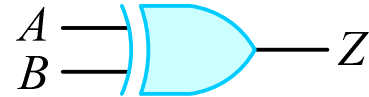
① $(A+B)(\bar{A}+\bar{B}) = A\bar{A} + A\bar{B} + \bar{A}B + B\bar{B} = A\bar{B} + \bar{A}B = A \oplus B$

② $(A+B)(\overline{AB}) = (A+B)(\bar{A}+\bar{B}) = A\bar{A} + A\bar{B} + \bar{A}B + B\bar{B} = A\bar{B} + \bar{A}B = A \oplus B$

③ $\bar{A}B + A\bar{B} = A \oplus B$

④ $\overline{(A+\bar{B})(A+B)} = \overline{(A+\bar{B})} + \overline{(A+B)} = \bar{A}B + \bar{A}\bar{B} = \bar{A}(B+\bar{B}) = \bar{A}$

87. 그림과 같은 회로의 출력 논리식이 아닌 것은?



① $Z = \overline{(A \cdot B + (\overline{A + B}))}$

② $Z = A \cdot \overline{B} + \overline{A}B$

③ $Z = (A + B)\overline{A \cdot B}$

④ $Z = (\overline{A + B})(A \cdot B)$

① $Z = \overline{(A \cdot B + (\overline{A + B}))} = \overline{AB} \cdot \overline{(\overline{A + B})} = (\overline{A} + \overline{B})(A + B) = \overline{A}A + \overline{A}B + A\overline{B} + B\overline{B} = \overline{A}B + A\overline{B}$

② $Z = \overline{A}B + A\overline{B} = A \oplus B$

③ $Z = (A + B)\overline{A \cdot B} = (A + B)(\overline{A} + \overline{B}) = \overline{A}A + \overline{A}B + A\overline{B} + B\overline{B} = \overline{A}B + A\overline{B}$

④ $Z = (\overline{A + B})(A \cdot B) = \overline{A}\overline{A}B\overline{B} = 0 \cdot 0 = 0$

88. XOR와 XNOR에 해당하는 논리식을 상호 변환한 아래의 식 중에서 틀린 것은?

① $(\bar{A} + B)(A + \bar{B}) = \overline{A \oplus B}$

② $(\bar{A} \cdot B) + (A \cdot \bar{B}) = A \oplus B$

③ $(\bar{A} + \bar{B})(A + B) = A \oplus B$

④ $(\bar{A} \cdot \bar{B})(A + B) = \overline{A \oplus B}$

① $(\bar{A} + B)(A + \bar{B}) = \bar{A}A + \bar{A}\bar{B} + AB + B\bar{B} = \bar{A}\bar{B} + AB = \overline{A \oplus B}$

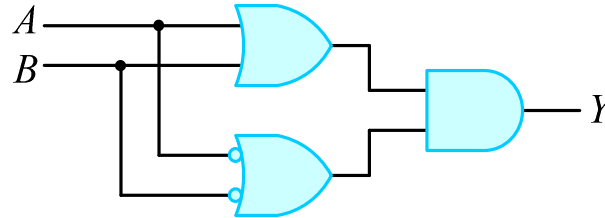
② $(\bar{A} \cdot B) + (A \cdot \bar{B}) = \bar{A}B + A\bar{B} = A \oplus B$

③ $(\bar{A} + \bar{B})(A + B) = \bar{A}A + \bar{A}B + \bar{A}\bar{B} + \bar{B}B = \bar{A}\bar{B} + \bar{A}B = A \oplus B$

④ $(\bar{A} \cdot \bar{B})(A + B) = \bar{A}\bar{B}A + \bar{A}\bar{B}B = 0$

89. 그림과 같은 논리회로의 출력은?

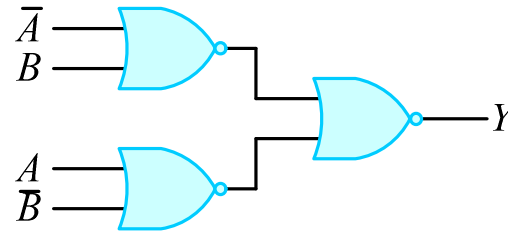
- ① $Y = AB$
- ② $Y = \bar{A}B + AB$
- ③ $Y = AB + A\bar{B}$
- ④ $Y = \bar{A}\bar{B} + A\bar{B}$



$$Y = (A + B)(\bar{A} + \bar{B}) = \bar{A}A + A\bar{B} + \bar{A}B + B\bar{B} = A\bar{B} + \bar{A}B$$

90. 그림과 같은 논리회로에서 Y 는 어떻게 표시되는가?

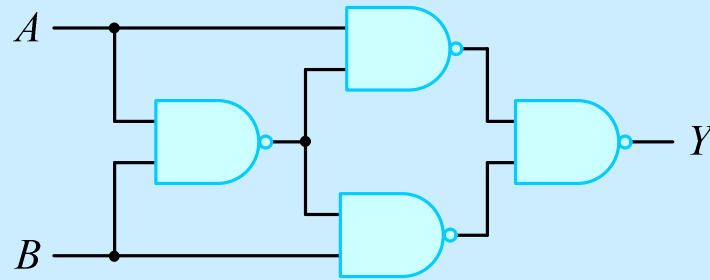
- ① $Y = \overline{A}\overline{B}$
- ② $Y = \overline{A}B + AB$
- ③ $Y = A\overline{B} + \overline{A}B$
- ④ $Y = AB + \overline{A}\overline{B}$



$$\begin{aligned}
 Y &= \overline{\overline{A+B}} + \overline{\overline{A+B}} = \overline{\overline{A+B}} \cdot \overline{\overline{A+B}} = (\overline{A+B})(\overline{A+B}) \\
 &= \overline{A}A + \overline{A}\overline{B} + A\overline{B} + \overline{B}B = \overline{A}\overline{B} + AB
 \end{aligned}$$

91. XOR 기능을 수행하기 위하여 필요한 NAND 게이트의 수는?

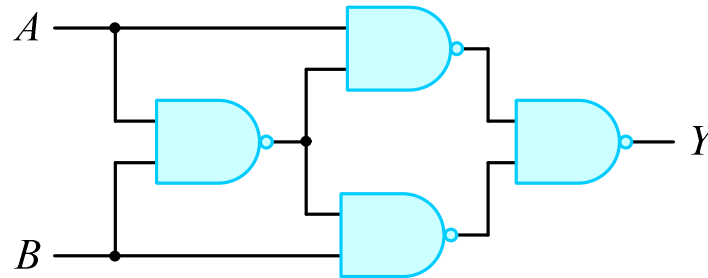
- ① 2개
- ② 3개
- ③ 4개
- ④ 5개



NAND 게이트를 이용한 XOR 게이트

92. 그림에서 NAND 게이트로 구성된 논리회로의 기능은 어느 게이트와 같은가? 단, A, B 는 입력 단자 Y 는 출력 단자이다.

- ① AND 게이트
- ② NOR 게이트
- ③ XOR 게이트
- ④ XNOR 게이트



$$\begin{aligned}
 Y &= \overline{\overline{A(\overline{AB})} \cdot \overline{B(\overline{AB})}} = A(\overline{AB}) + B(\overline{AB}) \\
 &= A(\overline{A} + \overline{B}) + B(\overline{A} + \overline{B}) = A\overline{A} + A\overline{B} + \overline{A}B + B\overline{B} \\
 &= A\overline{B} + \overline{A}B = A \oplus B
 \end{aligned}$$

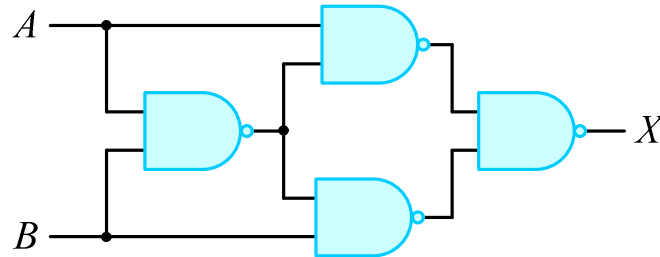
93. 다음 논리회로의 출력은?

① $(A + B)(\overline{A} + \overline{B})$

② $AB \cdot \overline{AB}$

③ $\overline{AB}(A + B)$

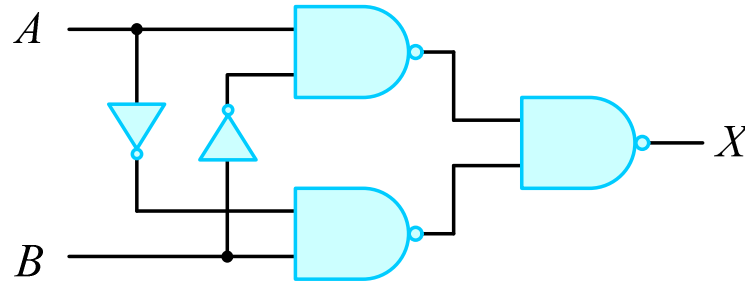
④ AB



$$\begin{aligned}
 Y &= \overline{\overline{A(\overline{AB})} \cdot \overline{B(\overline{AB})}} = A(\overline{AB}) + B(\overline{AB}) \\
 &= (A + B)(\overline{AB}) = (A + B)(\overline{A} + \overline{B})
 \end{aligned}$$

94. 그림과 같은 논리회로의 출력 X 는?

- ① $A \oplus B$
- ② $AB + \overline{AB}$
- ③ $A\overline{B}$
- ④ $\overline{A+B}$



$$X = \overline{\overline{A}B} \cdot \overline{A\overline{B}} = \overline{\overline{A}B} + \overline{A\overline{B}} = A\overline{B} + \overline{A}B = A \oplus B$$