

처음 만나는

디지털 논리회로

# Chapter 06 논리식의 간소화

## 기출문제 풀이

# 1. 변수의 수(數)가 3이라면 카르노 맵에서 몇 개의 칸이 요구되는가?

㉠ 2칸

㉡ 4칸

㉢ 6칸

㉣ 8칸

		BC			
A		00	01	11	10
	0				
	1				

3변수 카르노 맵

## 2. 다음 진리표의 카르노 맵을 작성한 것 중 옳은 것은?

㉠

		A	
B		0	1
	0	1	1
	1	0	0

㉡

		A	
B		0	1
	0	0	0
	1	1	1

㉢

		A	
B		0	1
	0	0	1
	1	1	0

㉣

		A	
B		0	1
	0	1	0
	1	1	0

입력		출력
A	B	Y
0	0	0
0	1	1
1	0	0
1	1	1

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

		A	
B		0	1
	0	$m_0$	$m_2$
	1	$m_1$	$m_3$

### 3. 다음은 카르노 맵의 표이다. 논리식을 간소화한 것은?

- ㉠  $A$
- ㉡  $B$
- ㉢  $A+B$
- ㉣  $A \cdot B$

		$A$	
		0	1
$B$	0	0	0
	1	1	1

		$A$	
		0	1
$B$	0	0	0
	1	1	1

$B$  ←

## 4. 다음 카르노 맵을 간소화시킨 결과는?

㉠  $X_1 + \overline{X_1} \cdot X_2$

㉡  $X_1 + X_2$

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

㉣  $\overline{X_1} + \overline{X_2}$

		$X_2$	
		0	1
$X_1$	0	1	1
	1	1	0

		$X_2$	
		0	1
$X_1$	0	1	1
	1	1	0

$\overline{X_1}$  (red box) and  $\overline{X_2}$  (blue box) are highlighted on the map.

$F = \overline{X_1} + \overline{X_2}$

## 5. 다음 진리표를 간소화한 결과 $Y$ 는?

㉠  $Y = AB$

㉡  $Y = A + \bar{B}$

㉢  $Y = \overline{AB}$

㉣  $Y = \overline{A+B}$

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

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

$A \backslash B$	0	1
0	$m_0$	$m_1$
1	$m_2$	$m_3$

$A \backslash B$	0	1
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  $A$ .

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

## 6. 다음의 논리식을 카르노 맵으로 옮긴 것은?

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

㉠

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

㉡

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

㉢

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

㉣

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

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

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

## 7. 다음 카르노 맵을 간소화 하면?

- ㉠  $\bar{x}z$
- ㉡  $\bar{x}zy$
- ㉢  $x + \bar{y} + \bar{z}$
- ㉣  $\bar{x}y + y$

		$xy$			
		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

$\bar{x}z$



## 8. 다음 카르노 맵의 논리식을 간단히 하면?

㉠  $B + ABC$

㉡  $A + BC$

㉢  $BC + A\bar{C}$

㉣  $A\bar{B}\bar{C} + BC + B$

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

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

$\bar{A}\bar{C}$  (blue arrow pointing to the 1 in row 1, column 00)  
 $BC$  (red arrow pointing to the 1 in row 0, column 11)

$$F = BC + A\bar{C}$$

## 9. 다음과 같은 카르노 맵을 가장 간단한 논리식으로 나타내면?

㉠  $\overline{A}\overline{B}$

㉡  $\overline{B}$

㉢  $\overline{A}$

㉣  $\overline{A}B$

		$AB$			
		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

$\overline{B}$

## 10. 다음과 같은 카르노 맵을 간소화하면?

㉠  $\bar{B} + AC$

㉡  $B + AC$

㉢  $B + \bar{A}C$

㉣  $B + \bar{A}\bar{C}$

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

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

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

$\bar{B}$

$AC$

## 11. 다음 카르노 맵에 나타난 논리 함수를 간단히 하면?

㉠  $A + AC$

㉡  $A + \overline{A}\overline{B}$

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

㉣  $B + AC$

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

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

$B$ 
 $AC$

$$F = B + AC$$

## 12. 다음 카르노 맵(Karnaugh map)을 간소화하면?

- ㉠  $\bar{A}$
- ㉡  $\bar{A}+BC$
- ㉢  $A+\bar{B}C$
- ㉣  $ABC$

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

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

$BC$   $F = \bar{A} + BC$

### 13. 다음과 같은 카르노 맵(Karnaugh map)이 있을 때 간소화하여 얻은 논리식으로 옳은 것은?

㉠  $Y = A$

㉡  $Y = BC + AC$

㉢  $Y = \bar{C} + A$

㉣  $Y = \bar{C} + AB$

		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

$\bar{C}$   
  
 $A$

$Y = \bar{C} + A$

## 14. 다음 진리표의 논리식이 옳은 것은?

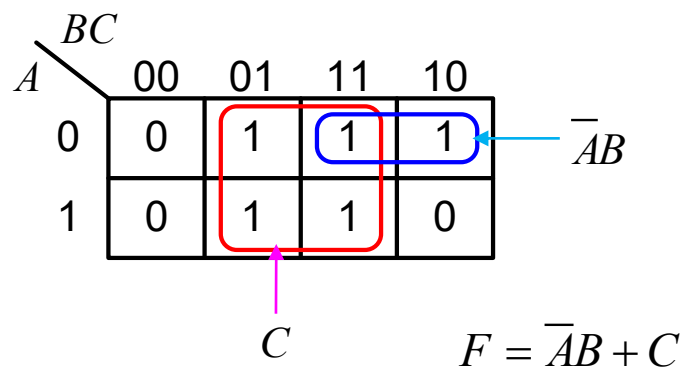
㉠  $F = AB + \overline{B}C$

㉡  $F = AB + C$

㉢  $F = \overline{A}B + C$

㉣  $F = \overline{A}C + B$

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



## 15. 다음의 진리표를 보고 논리식을 간소화하면?

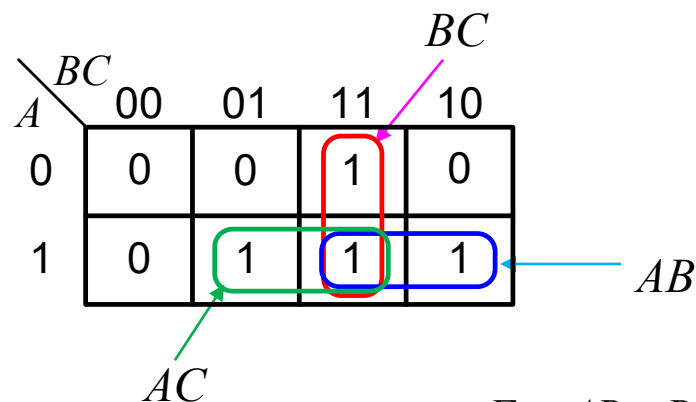
㉠  $F = AB + BC + AC$

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

㉢  $F = A + B + C$

㉣  $F = ABC$

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



$$F = AB + BC + AC$$



## 16. 다음의 진리표를 보고 논리식을 간소화하면?

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

㉡  $F = ABC + \overline{A}BC$

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

㉣  $F = ABC + \overline{A}BC$

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

		$BA$			
		00	01	11	10
$C$	0	0	0	1	0
	1	1	0	0	0

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

$AB\overline{C}$

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

## 17. 다음 카르노 맵의 함수를 간소화하면?

㉠  $AB$

㉡  $AC$

㉢  $AD$

㉣  $\overline{A}\overline{B}$

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

$AC$  ←

## 18. 다음 카르노 맵으로 표시된 함수를 간소화하면?

㉠  $AB$

㉡  $BC$

㉢  $\overline{A}D$

㉣  $A\overline{C}$

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

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

$AB$

## 19. 다음과 같은 카르노 맵에서 얻어지는 불 대수식은?

㉠  $Y = B\bar{D}$

㉡  $Y = \bar{B}D$

㉢  $Y = AB$

㉣  $Y = \bar{A}\bar{B}$

		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

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

$Y = B\bar{D}$

## 20. 다음과 같이 표시된 카르노 맵을 간소화한 함수 $F$ 는?

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

㉡  $F = \overline{B} + \overline{D}$

㉢  $F = B + \overline{D}$

㉣  $F = \overline{B} + D$

		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

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

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

## 21. 다음 카르노 맵을 간소화한 논리식은?

㉠  $Y = A$

㉡  $Y = B$

㉢  $Y = AB + \overline{CD}$

㉣  $Y = A\overline{B} + \overline{CD}$

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

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

$A$

## 22. 다음과 같은 카르노 맵의 가장 간단한 논리식은?

㉠  $A$

㉡  $B$

㉢  $C$

㉣  $D$

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

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

$B$  ←

## 23. 다음 카르노 맵을 간소화 하였을 때 얻어지는 논리식은?

㉠  $(\bar{A} + \bar{B})D$

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

㉢  $\bar{A}D + \bar{A}BD$

㉣  $\bar{A} + D$

	$AB$			
$CD$	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

$\bar{A}D$

$\bar{B}D$

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



## 24. 다음과 같은 4변수 카르노 맵을 간단히 했을 때 논리식은?

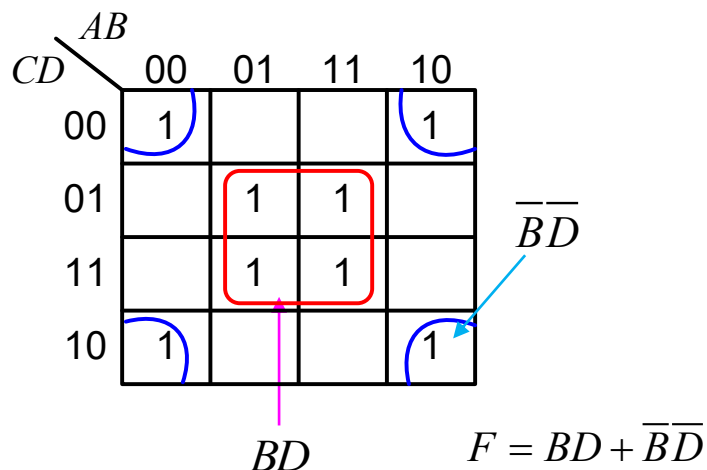
㉠  $\overline{AC} + \overline{AC}$

㉡  $\overline{AD} + \overline{BC}$

㉢  $\overline{AB} + AC$

㉣  $BD + \overline{B}\overline{D}$

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



## 25. 다음과 같은 카르노 맵을 간소화한 것은?

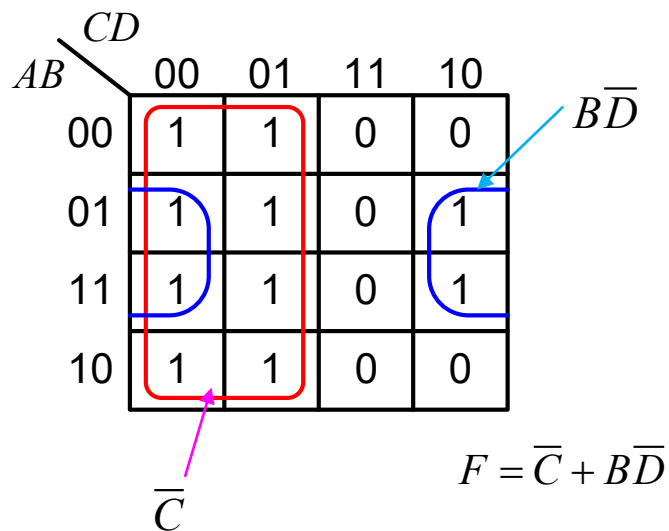
㉠  $A + BC$

㉡  $\bar{B} + AC$

㉢  $\bar{B} + C\bar{D}$

㉣  $\bar{C} + B\bar{D}$

		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



## 26. 논리식 $A + \bar{A}B$ 를 간단히 하면?

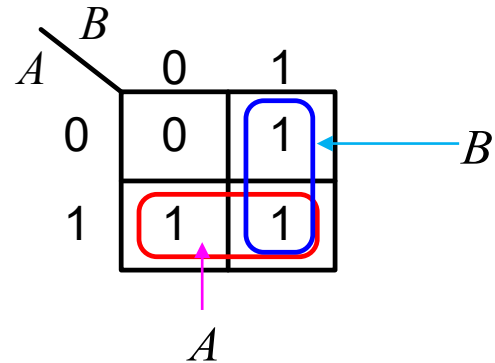
㉠  $A + B$

㉡  $\bar{A} + B$

㉢  $\bar{A} + \bar{B}$

㉣  $A$

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



## 27. 논리식 $A(A+B)$ 를 간단히 한 것은?

㉠  $A$ ㉡  $AB$ ㉢  $A+B$ ㉣  $B$ 

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### • 불 대수 이용

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

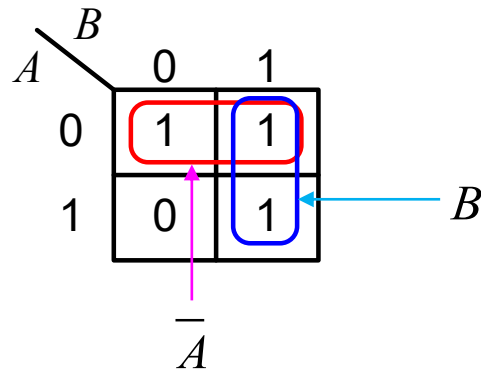
## 28. 논리식 $\overline{A}B + AB + \overline{A}\overline{B}$ 를 간소화한 식은?

㉠  $\overline{A} + \overline{B}$

㉡  $\overline{A}B$

㉢  $A + B$

㉣  $\overline{A} + B$



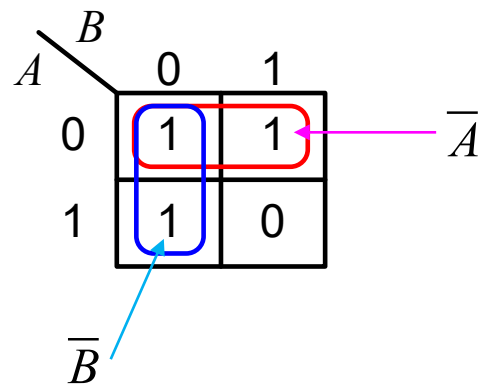
## 29. 다음 중 논리식 $Y = \overline{A}B + A\overline{B} + \overline{A}B$ 를 간소화 하면?

㉠  $Y = \overline{A}B$

㉡  $Y = \overline{A}$

㉢  $Y = \overline{B}$

㉣  $Y = \overline{A}B$



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

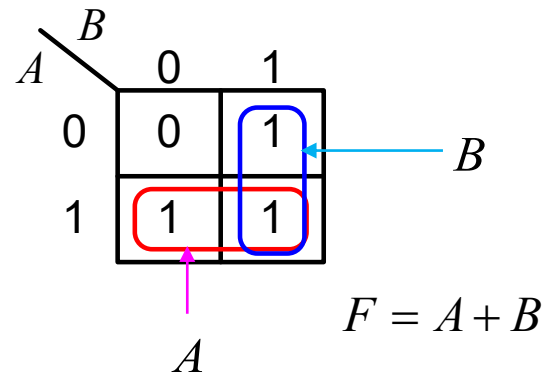
### 30. 논리식 $Y=AB+A\bar{B}+\bar{A}B$ 를 간소화 하면?

㉠  $AB$

㉡  $A+B$

㉢  $A+\bar{B}$

㉣  $A\cdot\bar{B}$



### 31. 다음 논리식을 간소화하면 어떻게 되는가?

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

㉠  $Y = \overline{A} + \overline{B}$

㉡  $Y = A + \overline{B}$

㉢  $Y = 1$

㉣  $Y = AB$

		B	
		0	1
A	0	1	1
	1	1	1

$Y = 1$



## 32. 다음 논리식을 간소화하면 어떻게 되는가?

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

㉠  $Y = \overline{A}$

㉡  $Y = 1$

㉢  $Y = \overline{B}$

㉣  $Y = \overline{A} + \overline{B}$

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

		B	
A		0	1
	0	1	1
	1	1	1

$$Y = 1$$

### 33. 논리식 $A(A+B+C)$ 를 간단히 하면 어느 것과 같은가?

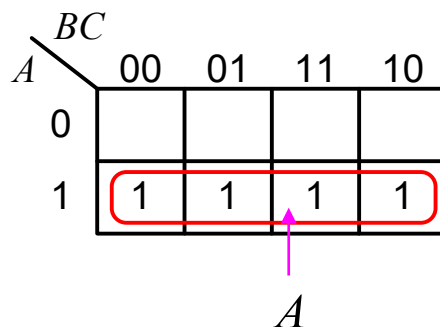
㉠ 1

㉡ 0

㉢  $B+C$

㉣  $A$

$$\begin{aligned} A(A+B+C) &= A + AB + AC \\ &= A(B + \bar{B})(C + \bar{C}) + AB(C + \bar{C}) + A(B + \bar{B})C \\ &= \bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C + A\bar{B}\bar{C} + ABC \end{aligned}$$



### 34. 다음 논리식을 간단히 하면?

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

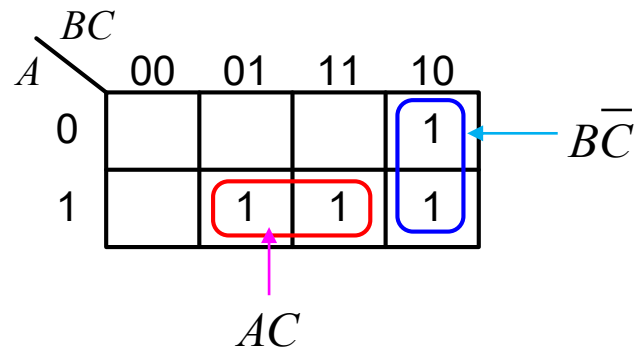
㉠  $AC + \overline{B}\overline{C}$

㉡  $AB + \overline{B}\overline{C}$

㉢  $AC + B$

㉣  $AB + C$

$$\begin{aligned} AB + AC + \overline{B}\overline{C} &= AB(C + \overline{C}) + A(B + \overline{B})C + (A + \overline{A})\overline{B}\overline{C} \\ &= \overline{A}B\overline{C} + A\overline{B}\overline{C} + AB\overline{C} + ABC \end{aligned}$$



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

㉠  $A$

㉡  $\bar{A}$

㉢  $B$

㉣  $\bar{B}$

$$\begin{aligned} Y &= AB + AC + A\bar{B}\bar{C} = AB(\bar{C} + C) + A(\bar{B} + B)C + A\bar{B}\bar{C} \\ &= AB\bar{C} + ABC + A\bar{B}C + ABC + A\bar{B}\bar{C} \\ &= A\bar{B}\bar{C} + A\bar{B}C + AB\bar{C} + ABC \end{aligned}$$

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

$A$

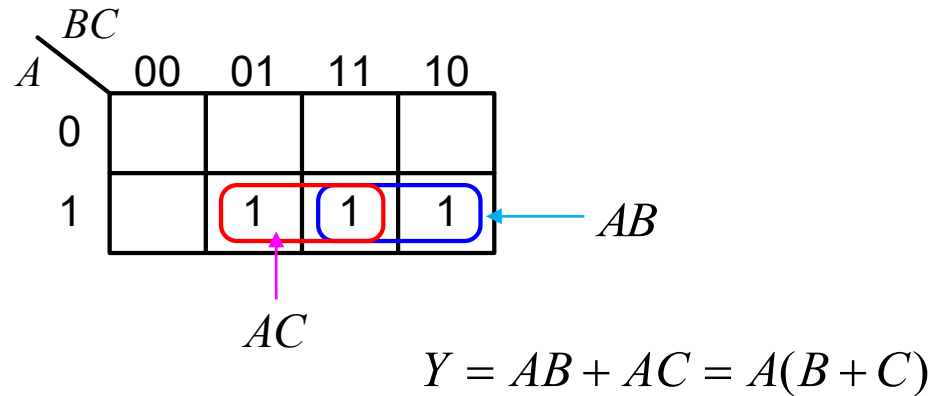
### 36. 불 대수식 $Y=ABC+\overline{A}BC+\overline{A}B\overline{C}$ 를 간단히 하면?

㉠  $A(C + \overline{B}\overline{C})$

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

㉢  $A(B + C)$

㉣  $ABC$



### 37. 논리식 $Y = \overline{A}\overline{B}\overline{C} + A\overline{B}\overline{C} + \overline{A}B\overline{C} + A\overline{B}C$ 를 간소화하면?

- ㉠  $Y = A + B$
- ㉡  $Y = \overline{B}$
- ㉢  $Y = A + B + C$
- ㉣  $Y = AB$

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

$\overline{B}$

### 38. 다음과 같은 논리함수를 카르노 맵을 이용하여 간소화한 식은?

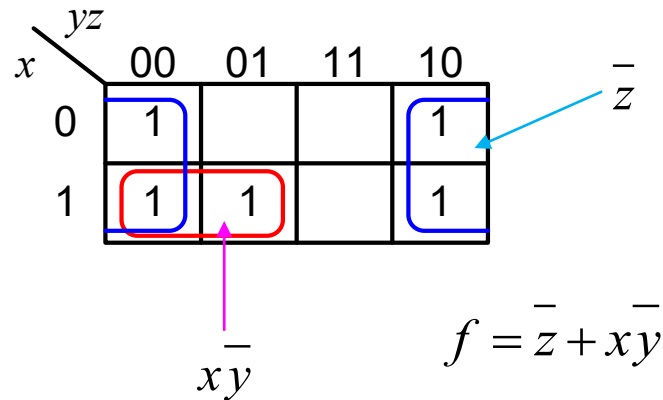
$$f = \bar{x}\bar{y}\bar{z} + x\bar{y}\bar{z} + \bar{x}y\bar{z} + x\bar{y}z + xy\bar{z}$$

㉠  $f = x\bar{y} + \bar{z}y$

㉡  $f = xy + \bar{x}\bar{z}$

㉢  $f = \bar{z} + x\bar{y}$

㉣  $f = xy + \bar{x}\bar{y}$



### 39. 다음 3변수 논리식을 간단히 하면?

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

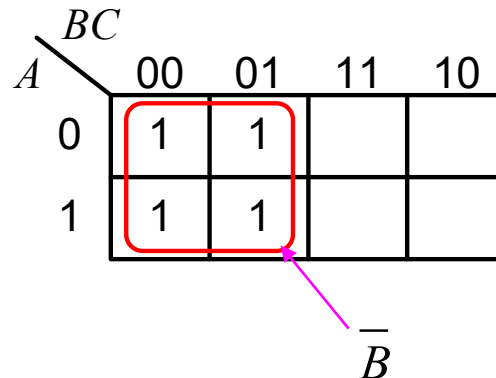
㉠  $A$

㉡  $B$

㉢  $\overline{B}$

㉣  $C$

$$\begin{aligned}\overline{A}\overline{B}\overline{C} + \overline{A}\overline{B}C + \overline{A}B\overline{C} + \overline{A}BC + \overline{B}\overline{C} &= \overline{A}\overline{B}\overline{C} + \overline{A}\overline{B}C + \overline{A}B\overline{C} + \overline{A}BC + (\overline{A} + A)\overline{B}\overline{C} \\ &= \overline{A}\overline{B}\overline{C} + \overline{A}\overline{B}C + \overline{A}B\overline{C} + \overline{A}BC + \overline{A}\overline{B}\overline{C} + A\overline{B}\overline{C} \\ &= \overline{A}\overline{B}\overline{C} + \overline{A}\overline{B}C + \overline{A}B\overline{C} + \overline{A}BC\end{aligned}$$





## 40. 다음의 논리함수를 간소화한 결과는?

$$ABC + \bar{A}B + ABC\bar{C} + \bar{A}\bar{B}C$$

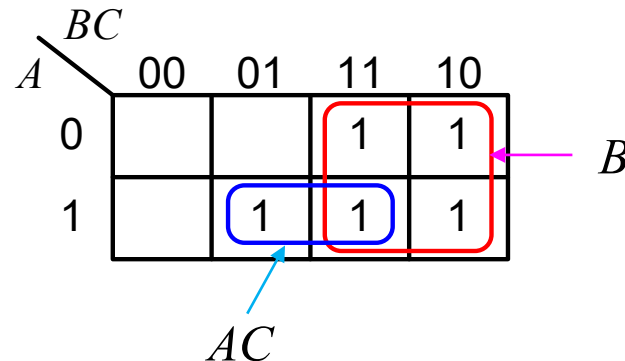
㉠  $\bar{A}B + BC + \bar{A}\bar{B}C$

㉡  $\bar{A}\bar{C} + BC + AC$

㉢  $B + AC$

㉣  $\bar{A}\bar{B}C$

$$\begin{aligned} ABC + \bar{A}B + ABC\bar{C} + \bar{A}\bar{B}C &= ABC + \bar{A}B(\bar{C} + C) + ABC\bar{C} + \bar{A}\bar{B}C \\ &= ABC + \bar{A}B\bar{C} + \bar{A}BC + ABC\bar{C} + \bar{A}\bar{B}C \\ &= \bar{A}B\bar{C} + \bar{A}BC + \bar{A}\bar{B}C + ABC\bar{C} + ABC \end{aligned}$$





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

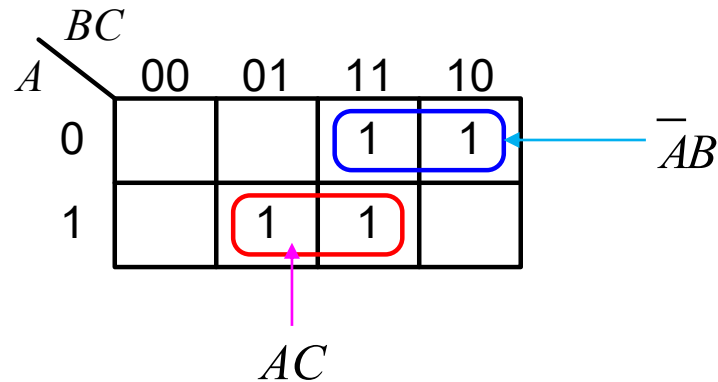
㉠  $\bar{A}B + AC$

㉡  $\bar{A}B + BC$

㉢  $AC + BC$

㉣  $\bar{A} + ABC$

$$\begin{aligned}(A+B)(\bar{A}+C) &= A\bar{A} + AC + \bar{A}B + BC \\&= A(\bar{B} + B)C + \bar{A}B(\bar{C} + C) + (\bar{A} + A)BC \\&= A\bar{B}C + ABC + \bar{A}B\bar{C} + \bar{A}BC + \bar{A}BC + ABC \\&= \bar{A}B\bar{C} + \bar{A}BC + A\bar{B}C + ABC\end{aligned}$$



43. 다음 불 함수  $Y = \overline{C}\overline{D} + A\overline{C} + C\overline{D}$  를 간소화하면?

㉠  $\overline{A}C + D$

㉡  $\overline{A}C + \overline{D}$

㉢  $A\overline{C} + \overline{D}$

㉣  $A\overline{C} + D$

---

$$\begin{aligned} Y &= \overline{C}\overline{D} + A\overline{C} + C\overline{D} \\ &= (\overline{C} + D)\overline{D} + A\overline{C} \\ &= A\overline{C} + \overline{D} \end{aligned}$$

## 44. 다음 논리식을 간소화하면?

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

㉠  $\overline{A}C + B\overline{D}$

㉡  $\overline{B}D + B\overline{D}$

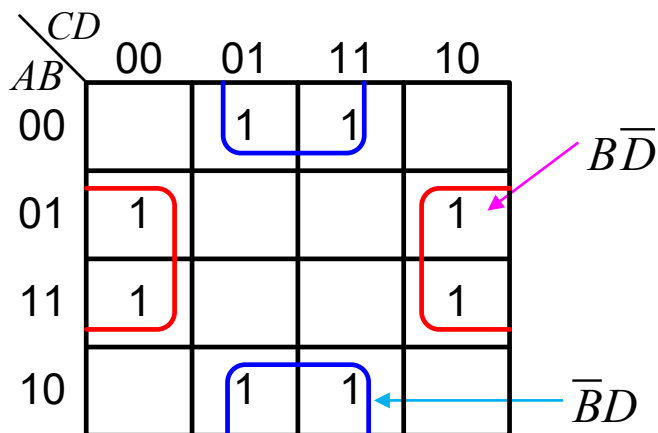
㉢  $A\overline{B} + B\overline{C}$

㉣  $AB + CD + AC$

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

$$= m_4 + m_{12} + m_1 + m_9 + m_3 + m_{11} + m_6 + m_{14}$$

$$= \sum m(1, 3, 4, 6, 9, 11, 12, 14)$$



## 45. 다음 불 함수를 간소화한 것은?

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

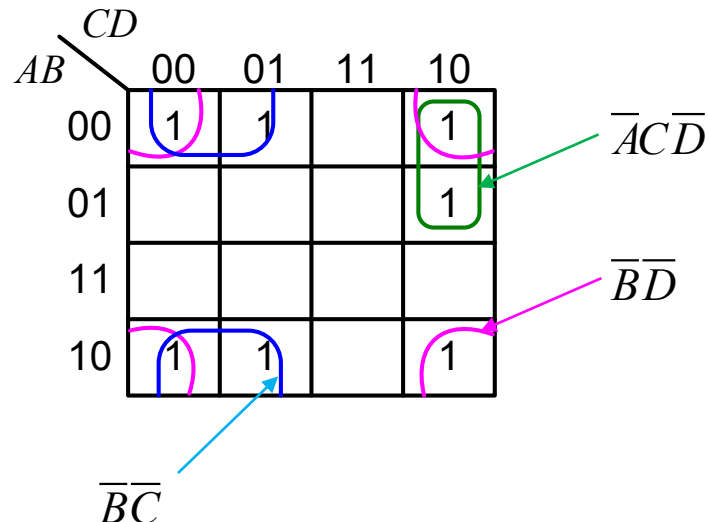
㉠  $F = \overline{B}D + \overline{B}C + A\overline{C}\overline{D}$

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

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

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

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



## 46. 다음 불 함수를 간소화하였을 때 결과식으로 옳은 것은?

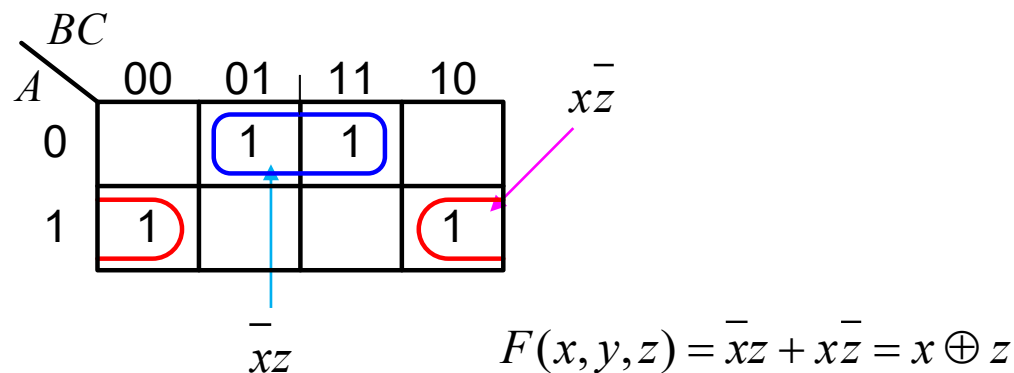
$$F(A, B, C) = \sum m(1, 3, 4, 6)$$

㉠  $F(A, B, C) = \overline{AB}$

㉡  $F(A, B, C) = AC + B$

㉢  $F(A, B, C) = A + C$

㉣  $F(A, B, C) = \overline{AC} + A\overline{C}$



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

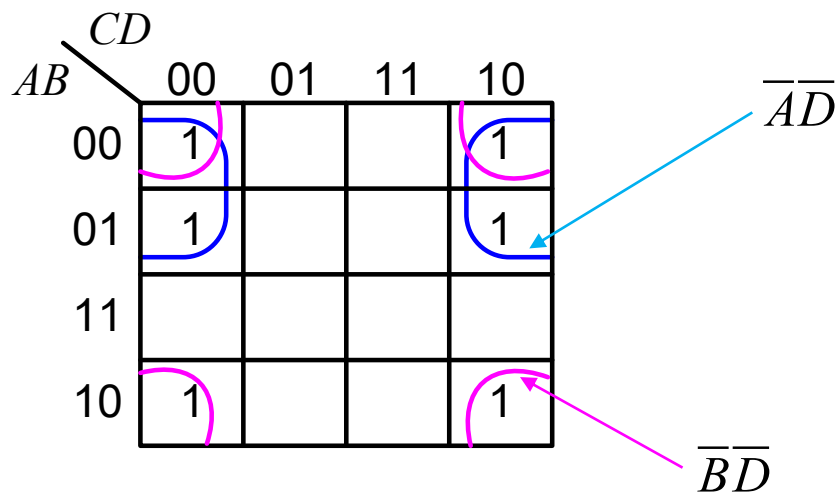
$$Y(A, B, C, D) = \sum m(0, 2, 4, 6, 8, 10)$$

㉠  $\overline{A}\overline{D} + AC$

㉡  $\overline{B}\overline{C} + CD$

㉢  $ABC$

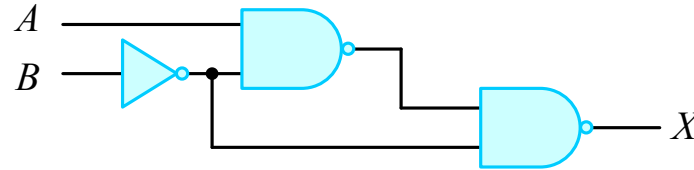
㉣  $\overline{A}\overline{D} + \overline{B}\overline{D}$



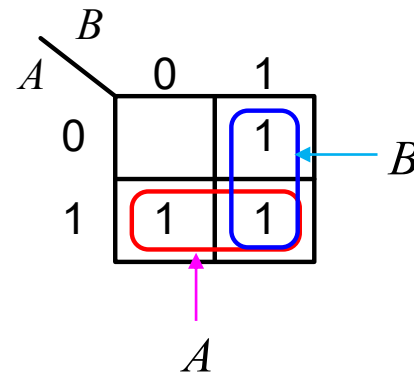


## 48. 그림에서 출력 $X$ 를 입력 $A, B$ 의 함수로 바르게 표시한 것은?

- ㉠  $X = AB$
- ㉡  $X = A + B$
- ㉢  $X = \overline{A}B + A\overline{B}$
- ㉣  $X = AB + \overline{A}\overline{B}$



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



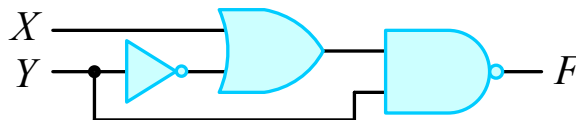
## 49. 다음과 같은 논리회로의 출력 $F$ 는?

㉠  $\overline{X} + \overline{Y}$

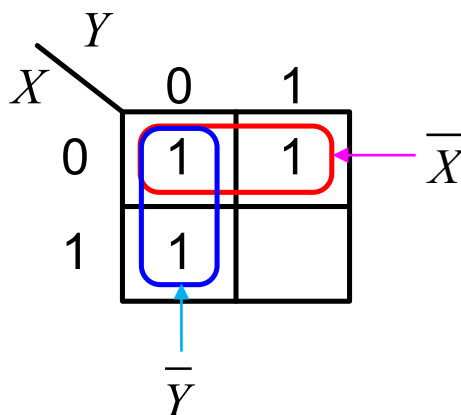
㉡  $X\overline{Y}$

㉢  $XY$

㉣  $X + Y$



$$\begin{aligned}
 F &= \overline{(X + \overline{Y})Y} \\
 &= \overline{(X + \overline{Y})} + \overline{Y} \\
 &= \overline{X}Y + \overline{Y} \\
 &= \overline{X}Y + (\overline{X} + X)\overline{Y} \\
 &= \overline{X}Y + \overline{X}\overline{Y} + X\overline{Y}
 \end{aligned}$$



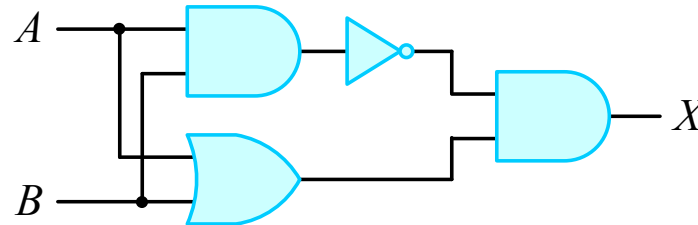
## 50. 다음과 같은 논리회로의 출력은?

㉠  $X = A + B$

㉡  $X = AB$

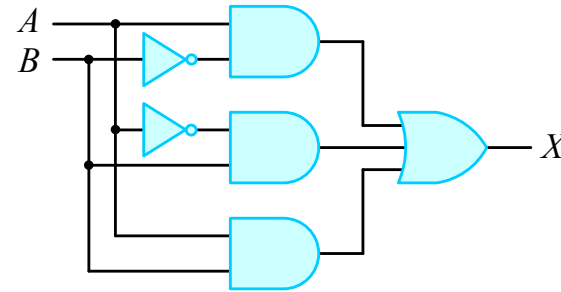
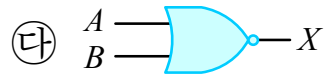
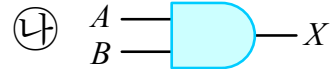
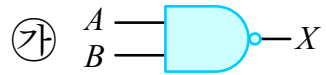
㉢  $X = \overline{A + B}$

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

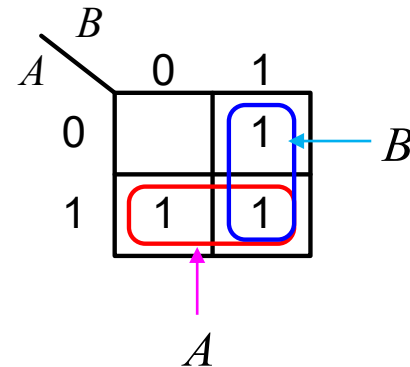


$$X = (\overline{AB})(A + B) = (\overline{A} + \overline{B})(A + B) = \overline{A}A + \overline{A}B + A\overline{B} + \overline{B}B = \overline{A}B + A\overline{B}$$

## 51. 다음과 같은 논리회로를 간단히 하면?



$$\begin{aligned} X &= \overline{A}\overline{B} + \overline{A}B + AB \\ &= A + B \end{aligned}$$



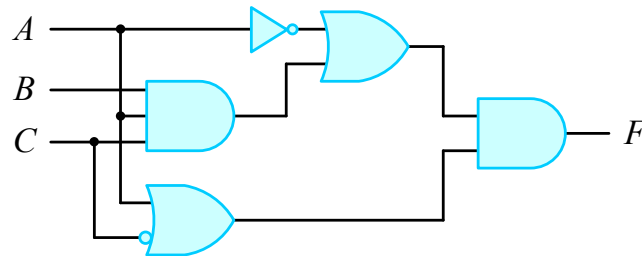
## 52. 다음과 같은 논리회로의 출력( $F$ )은?

㉠  $ABC + \overline{A}\overline{C}$

㉡  $AB + \overline{A}\overline{B}\overline{C}$

㉢  $A + B + C$

㉣  $ABC$



$$F = (\overline{A} + ABC)(A + \overline{C}) = \overline{A}A + \overline{A}\overline{C} + AABC + ABC\overline{C} = \overline{A}\overline{C} + ABC$$

### 53. 다음 중에서 논리 함수의 결과가 다른 하나는?

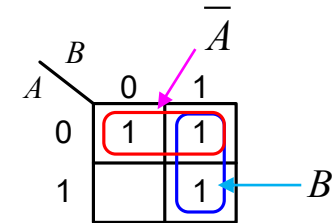
㉠  $\bar{A} + AB$

㉡  $(\bar{A} + A)(\bar{A} + B)$

㉢  $\bar{A} + B$

㉣  $B(\bar{A} + B)$

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



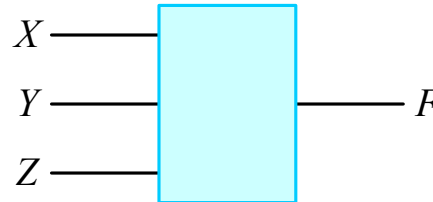
㉡  $(\bar{A} + A)(\bar{A} + B) = \bar{A}\bar{A} + \bar{A}B + A\bar{A} + AB = \bar{A} + \bar{A}B + AB = \bar{A} + (\bar{A} + A)B = \bar{A} + B$

㉢  $\bar{A} + B$

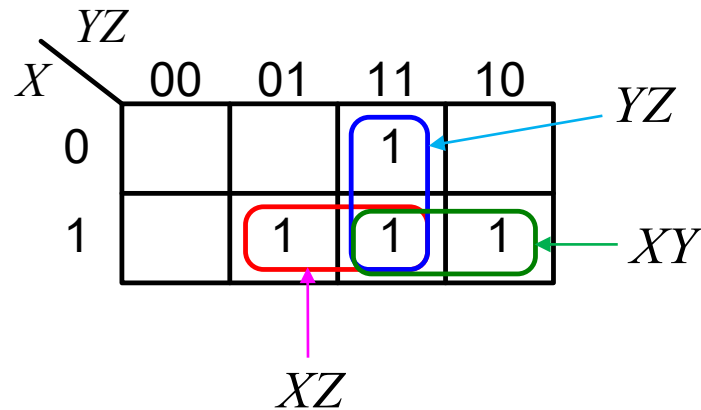
㉣  $B(\bar{A} + B) = \bar{A}B + BB = \bar{A}B + B = (\bar{A} + 1)B = B$

54. 세 입력 중( $X, Y, Z$ ) 두 입력 이상이 정논리일 때 출력이 정논리가 되는 회로를 설계할 때의 논리식은?

- ㉠  $X + Y + Z$
- ㉡  $XYZ + \overline{X}YZ + X\overline{Y}Z$
- ㉢  $\overline{X}YZ + X\overline{Y}Z + XY\overline{Z}$
- ㉣  $XY + YZ + XZ$

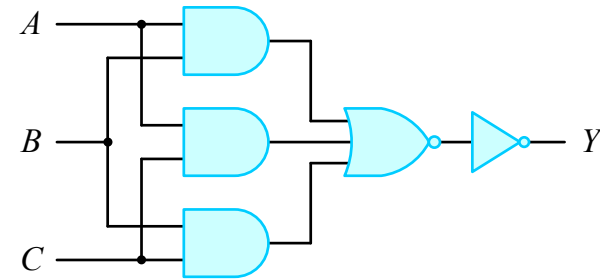


$X$	$Y$	$Z$	$F$
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1



## 55. 다음 회로 동작을 설명한 것 중 옳은 것은?

- ㉠ 다수결 회로로 동작한다.
- ㉡ multiplexer 회로로 동작한다.
- ㉢ encoder 회로로 동작한다.
- ㉣  $A=1, B=1, C=0$ 일 경우 출력  $Y=0$ 이 된다.



- 논리회로로부터 출력을 구하면  $Y = \overline{\overline{AB + AC + BC}} = AB + AC + BC$ 이다. 이 회로는 입력 중에서 둘 이상이 1일 때 출력이 1이 되는 **다수결 회로**이다.
- $A=1, B=1, C=0$ 일 경우  $Y = AB + AC + BC = 1 \cdot 1 + 1 \cdot 0 + 1 \cdot 0 = 1$ 이다.

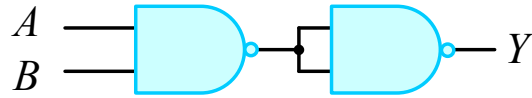


## 56. 다음 중 논리게이트의 설명으로 틀린 것은?

- ㉠ 불 대수식은 AND, OR, NOT의 연산자로 이루어진다.
- ㉡ 기본 논리회로는 AND, OR, NOT 게이트로 나타낼 수 있다.
- ㉢ 모든 불 대수식을 NAND 게이트로 나타낼 수 있다.
- ㉣ 모든 불 대수식을 XOR 게이트로 나타낼 수 있다.

---

NAND 게이트 또는 NOR 게이트를 사용하여 모든 불 대수식을 나타낼 수 있다.

57.  $A$ 와  $B$ 가 입력,  $Y$ 가 출력일 때 다음 회로의 구성은?

- ㉠ NAND 게이트를 사용하여 AND 게이트를 실현
- ㉡ NAND 게이트를 사용하여 XOR 게이트를 실현
- ㉢ NAND 게이트를 사용하여 OR 게이트를 실현
- ㉣ NAND 게이트를 사용하여 XNOR 게이트를 실현

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

NAND 게이트를 사용하여 AND 게이트를 실현하는 회로이다.

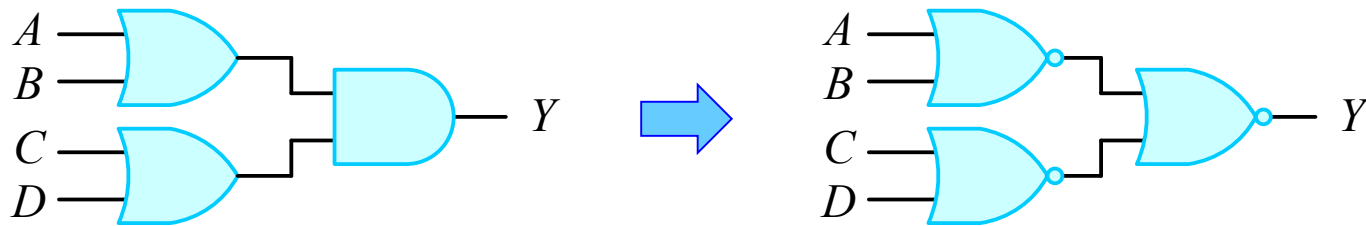
58. 논리식  $Y=(A+B)(C+D)$ 를 NOR 게이트만을 사용하여 표시할 때 몇 개의 NOR 게이트가 필요한가?

㉠ 2개

㉡ 3개

㉢ 4개

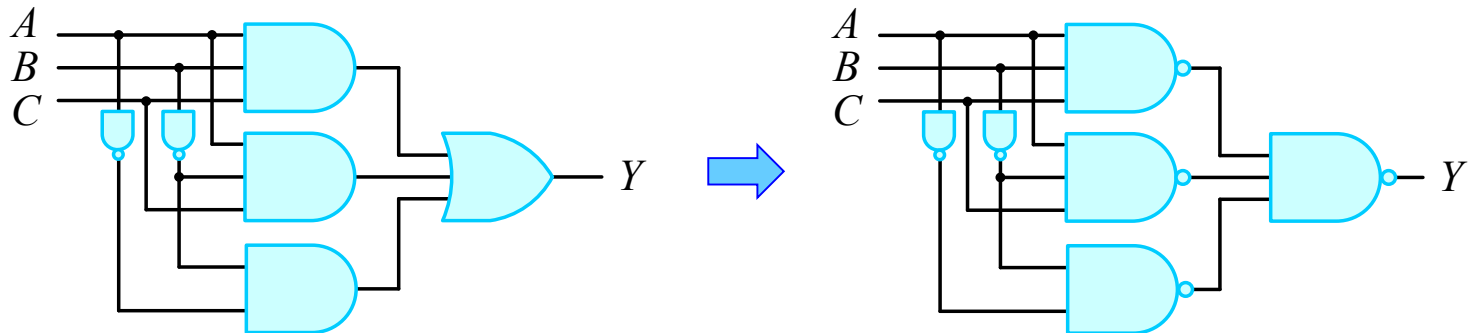
㉣ 5개



59. 다음의 논리식을 최소의 NAND 게이트만으로 구성하기 위해 필요로 하는 NAND 게이트의 종류와 개수가 옳은 것은? (단, 인버터는 2입력 NAND 게이트를 사용함)

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

- ㉠ 2입력 NAND 3개, 3입력 NAND 4개
- ㉡ 2입력 NAND 3개, 3입력 NAND 3개
- ㉢ 2입력 NAND 4개, 3입력 NAND 3개
- ㉣ 2입력 NAND 2개, 3입력 NAND 4개



60. 다음 중 XOR 게이트에 대한 논리식이 **아닌** 것은? (단,  $Y$ 는 출력이고,  $A$ 와  $B$ 는 입력임)

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

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

㉢  $Y = A \oplus B$

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

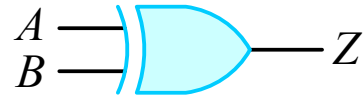
㉠  $Y = \overline{A}\overline{B} + \overline{A}B$

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

㉢  $Y = A \oplus B$

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

## 61. 다음과 같은 논리회로의 출력 논리식이 아닌 것은?



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

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

㉢  $Z = (A + B)\overline{A \cdot B}$

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

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

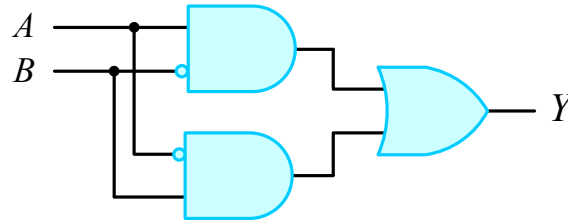
㉡  $Z = \overline{A}B + A\overline{B} = A \oplus B$

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

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

## 62. 다음과 같은 논리회로의 명칭은?

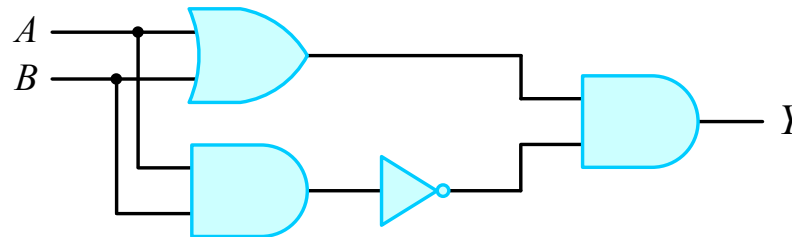
- ㉠ XOR
- ㉡ AND
- ㉢ NOR
- ㉣ NAND



$$Y = A\bar{B} + \bar{A}B = A \oplus B$$

## 63. 다음과 같은 논리회로의 기능은 어떤 게이트인가?

- ㉠ AND 게이트
- ㉡ OR 게이트
- ㉢ NAND 게이트
- ㉣ XOR 게이트

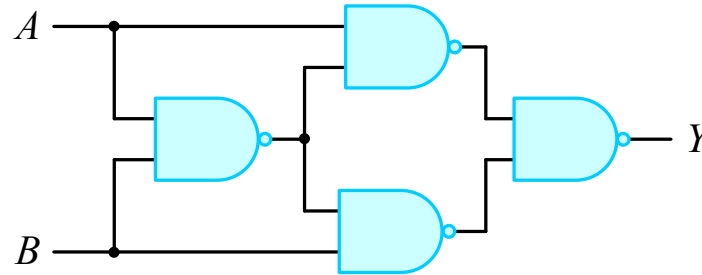


$$\begin{aligned}
 Y &= (A + B)(\overline{AB}) \\
 &= (A + B)(\overline{A} + \overline{B}) \\
 &= A\overline{A} + A\overline{B} + \overline{A}B + B\overline{B} \\
 &= A\overline{B} + \overline{A}B = A \oplus B
 \end{aligned}$$



64. 그림에서 NAND 게이트로 구성된 논리회로의 기능은 어느 게이트와 같은가? (단,  $A, B$ 는 입력단자  $Y$ 는 출력단자이다.)

- ㉠ AND 게이트
- ㉡ NOR 게이트
- ㉢ NAND 게이트
- ㉣ XOR 게이트



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

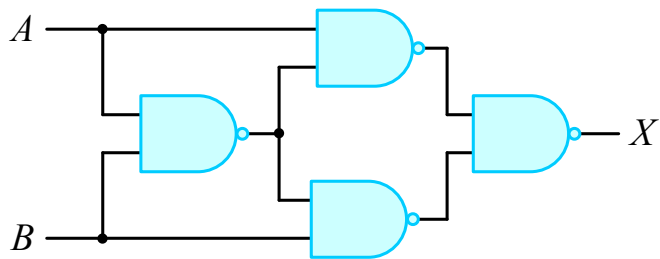
## 65. 다음 논리회로의 출력 $X$ 를 진리표 내에서 바르게 나타낸 것은?

가 ①

나 ②

다 ③

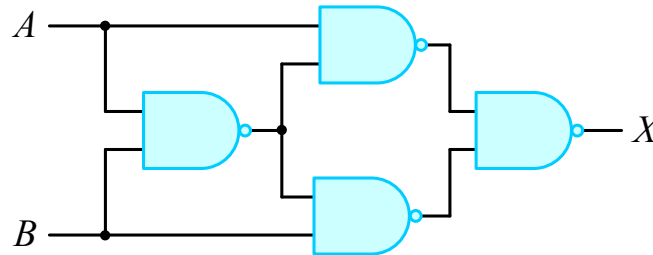
라 ④



입력 $A B$	출력 $X$			
	①	②	③	④
0 0	1	0	0	0
0 1	0	1	1	0
1 0	1	1	1	0
1 1	0	1	0	1

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

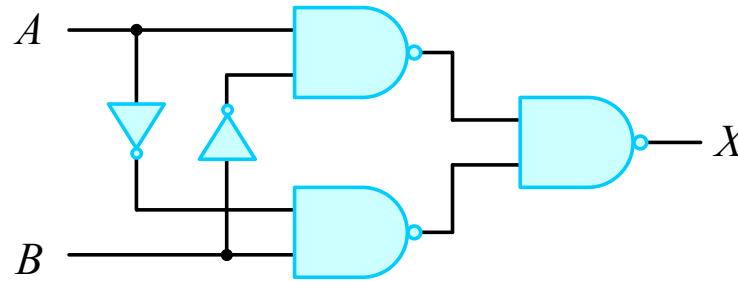
## 66. 다음 논리회로의 출력은?

㉠  $(A+B)$ ㉡  $AB$ ㉢  $A \oplus B$ ㉣  $A \odot B$ 

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

## 67. 다음과 같은 논리회로의 출력 $X$ 는?

- ㉠  $A \oplus B$
- ㉡  $AB + \overline{A}\overline{B}$
- ㉢  $\overline{A}\overline{B}$
- ㉣  $\overline{A + B}$



$$\begin{aligned}
 X &= \overline{\overline{A}\overline{B}} \cdot \overline{\overline{A}\overline{B}} = \overline{\overline{A}\overline{B}} + \overline{\overline{A}\overline{B}} \\
 &= A\overline{B} + \overline{A}B = A \oplus B
 \end{aligned}$$