

논리회로 및 설계

Chapter 4

일부 이미지 저작권:
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Pearson Educations

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Commutative Laws

$$A + B = B + A$$

$$AB = BA$$

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Associative Laws

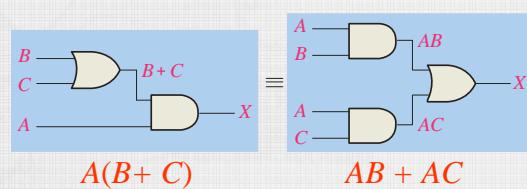
$$A + (B + C) = (A + B) + C$$

$$A(BC) = (AB)C$$

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Distributive Law

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



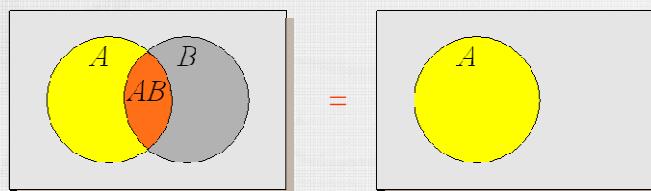
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Boolean Algebra : Rules

- | | |
|---------------------|-------------------------------|
| 1. $A + 0 = A$ | 7. $A \cdot A = A$ |
| 2. $A + 1 = 1$ | 8. $A \cdot \sim A = 0$ |
| 3. $A \cdot 0 = 0$ | 9. $\sim \sim A = A$ |
| 4. $A \cdot 1 = A$ | 10. $A + AB = A$ |
| 5. $A + A = A$ | 11. $A + \sim AB = A + B$ |
| 6. $A + \sim A = 1$ | 12. $(A + B)(A + C) = A + BC$ |

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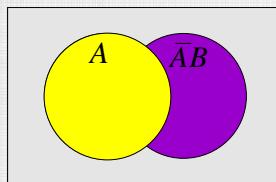
집합과 명제 = 논리



$$A + AB = A$$

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$$A + \sim AB = A + B$$

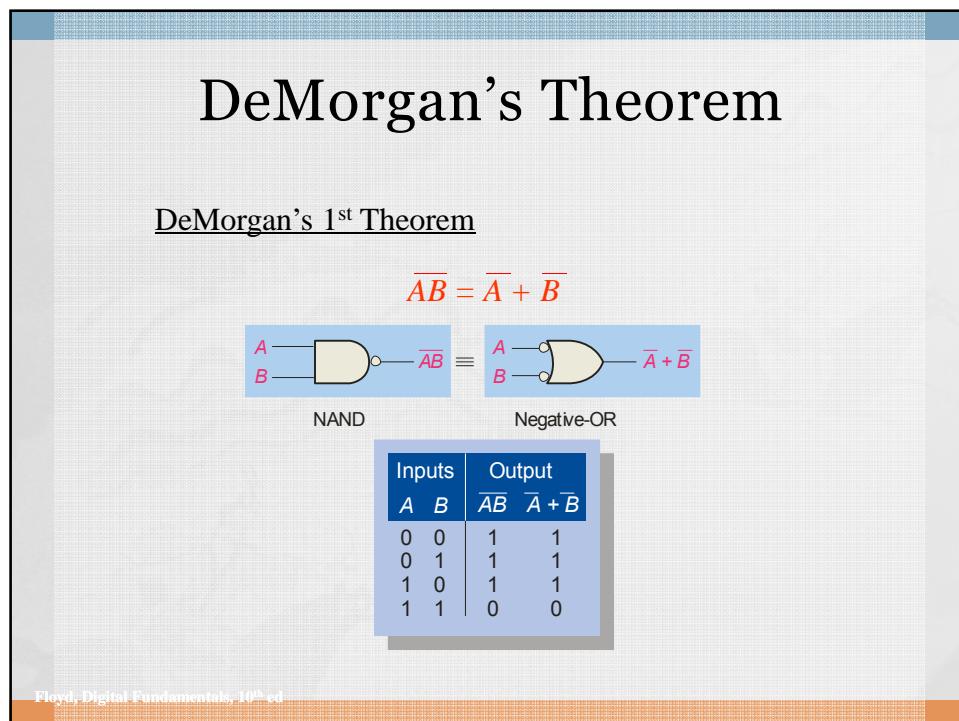
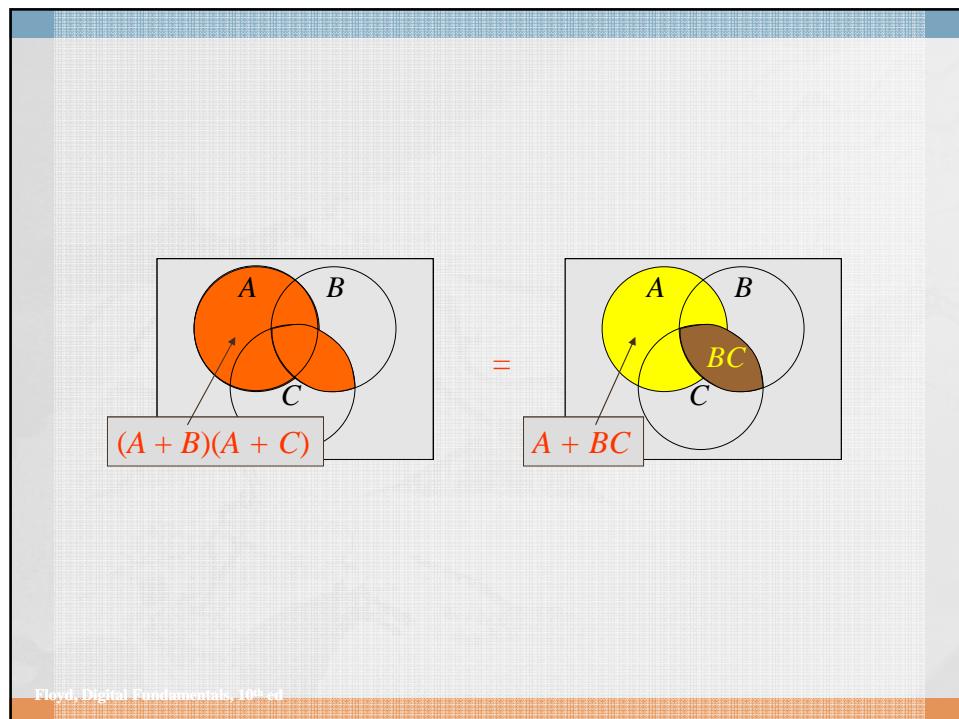


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Rules Application Ex.

$$\begin{aligned}(A + B)(A + C) &= AA + AC + AB + BC \\&= A + AC + AB + BC \\&= A(1 + C + B) + BC \\&= A \cdot 1 + BC \\&= A + BC\end{aligned}$$

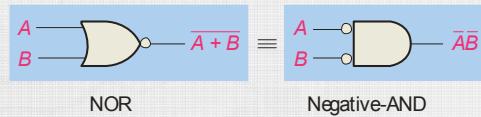
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DeMorgan's Theorem

DeMorgan's 2nd Theorem

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



NOR

Negative-AND

Inputs		Output	
A	B	$A + B$	\overline{AB}
0	0	1	1
0	1	0	0
1	0	0	0
1	1	0	0

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SoP and PoS

SoP (Sum of Products)

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

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

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

PoS (Product of Sums)

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

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

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

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SoP Standard form

SOP standard form:

every variable in the domain must appear in each term.

Convert $X = \overline{A} \overline{B} + A B C$ to standard form.

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

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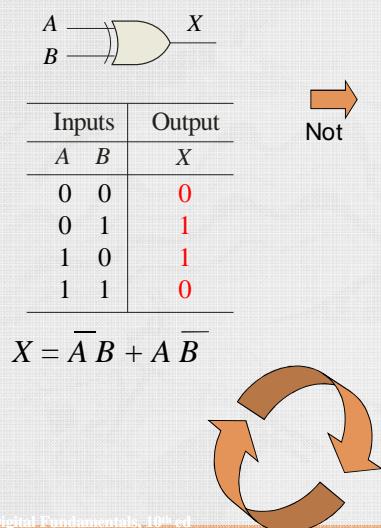
PoS Standard Form

Convert $X = (\overline{A} + \overline{B})(A + B + C)$ to standard form.

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

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SoP, PoS and Truth Table

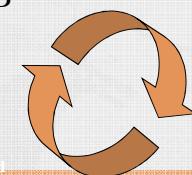


Inputs	Output	
A	B	X
0	0	1
0	1	0
1	0	0
1	1	1

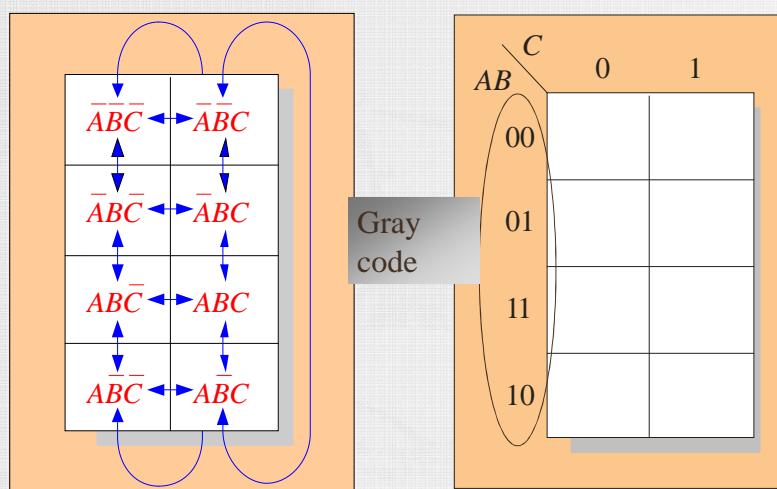
$$\overline{X} = \overline{A}\overline{B} + AB$$

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

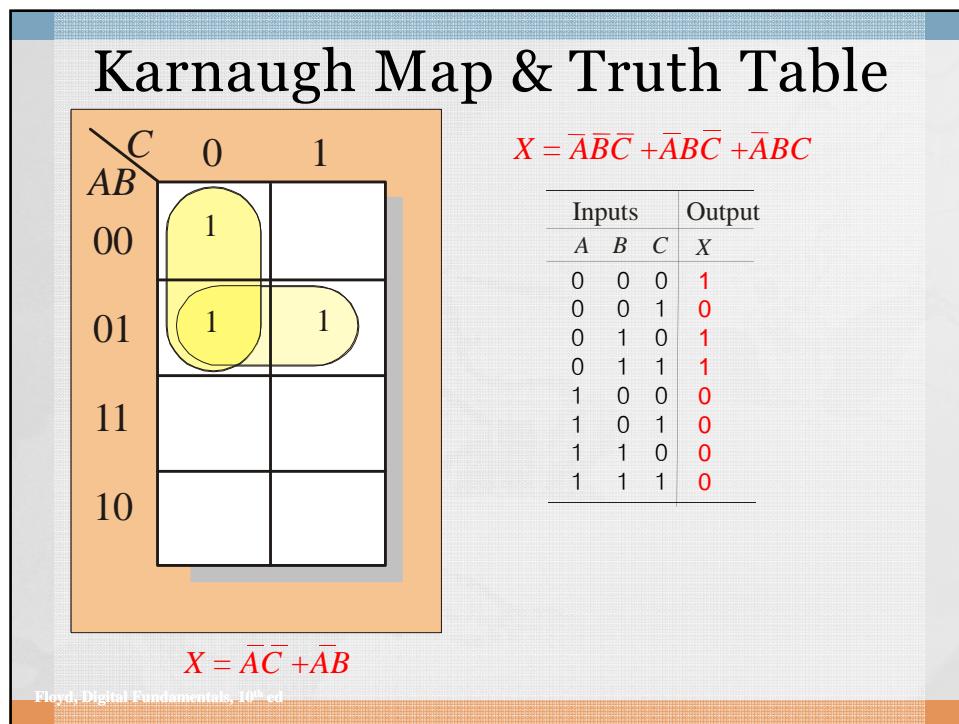
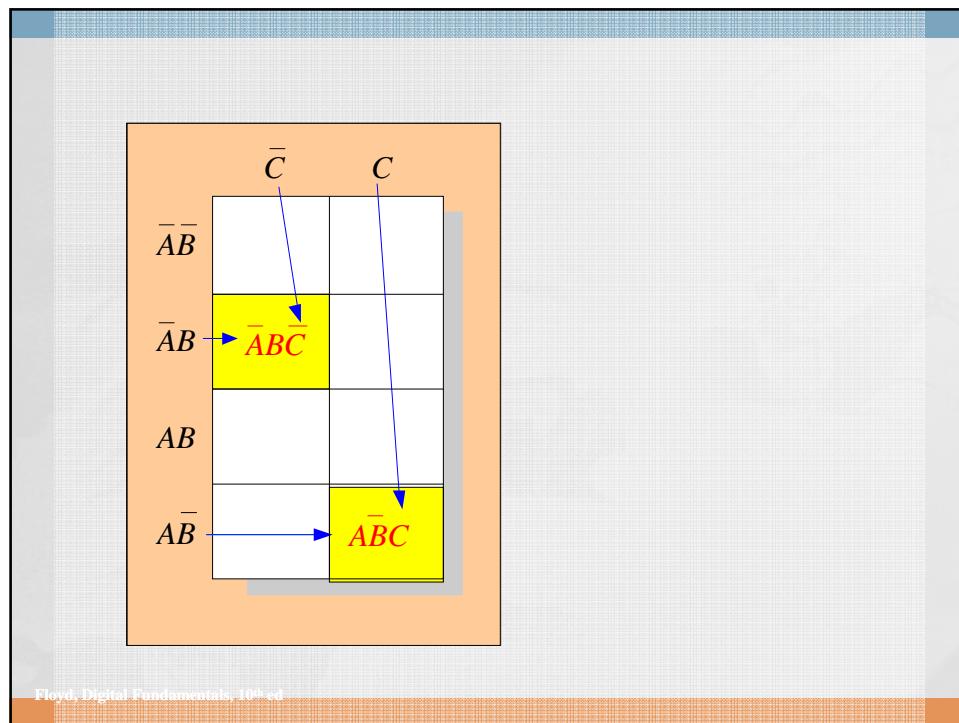
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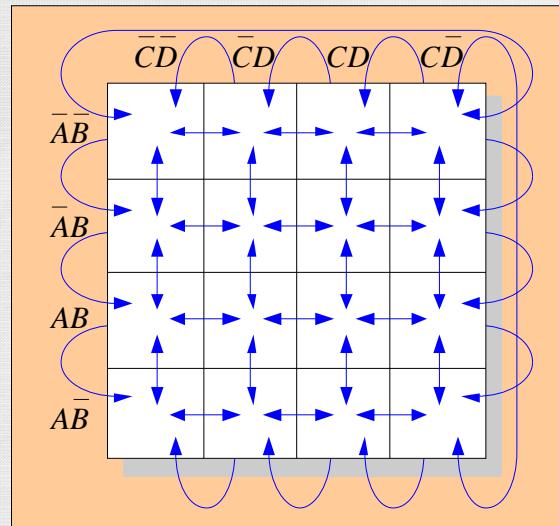
Karnaugh Map



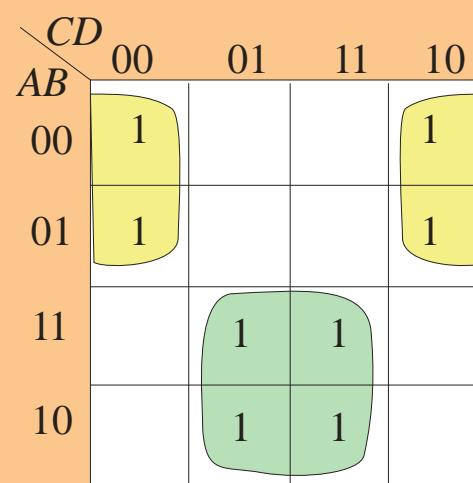
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Karnaugh Map, 4 variable



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$$X = \bar{A}\bar{D} + A\bar{D}$$

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Karnaugh Map, 5 variable ?

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Check point

- 교환, 결합, 분배법칙 : AND, OR
- 집합과 명제 : 동등
- De Morgan 법칙
- SoP, PoS 와 진리표
- Karnaugh Map 과 진리표
- 최적화

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