Logic Circuit Design Homework #02			
Due date	Apr. 15th, 2024	Instructor	Yoo, Younghwan
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1. Write a Boolean equation in sum-of-products canonical form for each of the truth tables.

(a)

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

(b)

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

(c)

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

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

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

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

2. Minimize each of the Boolean equations from Problem 1 using Boolean theorems. Show the minimization process.

(a)

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

(b)

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

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

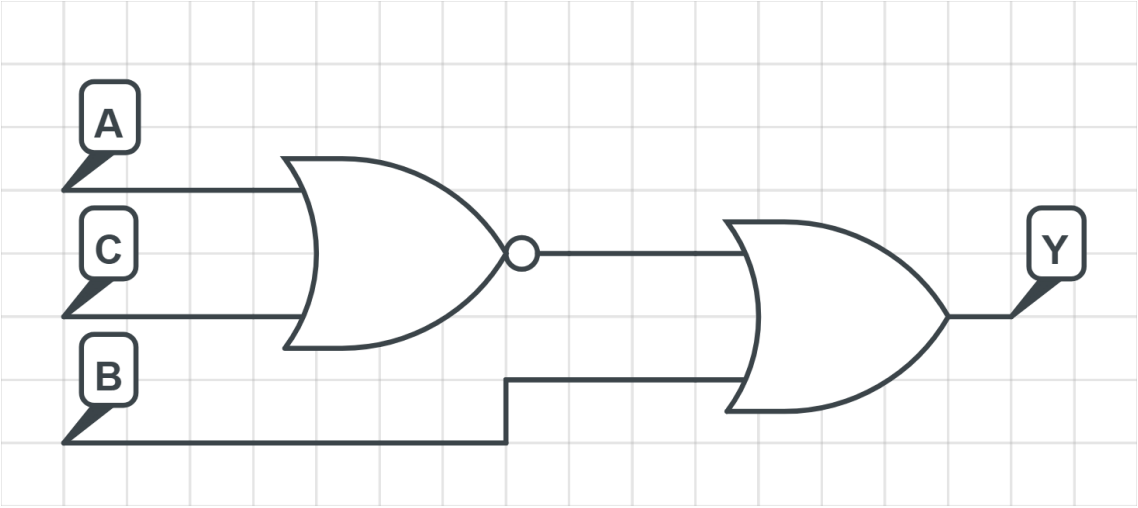
(c)

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

3. Simplify each of the following Boolean equations. Sketch a combinational circuit implementing the simplified equation.

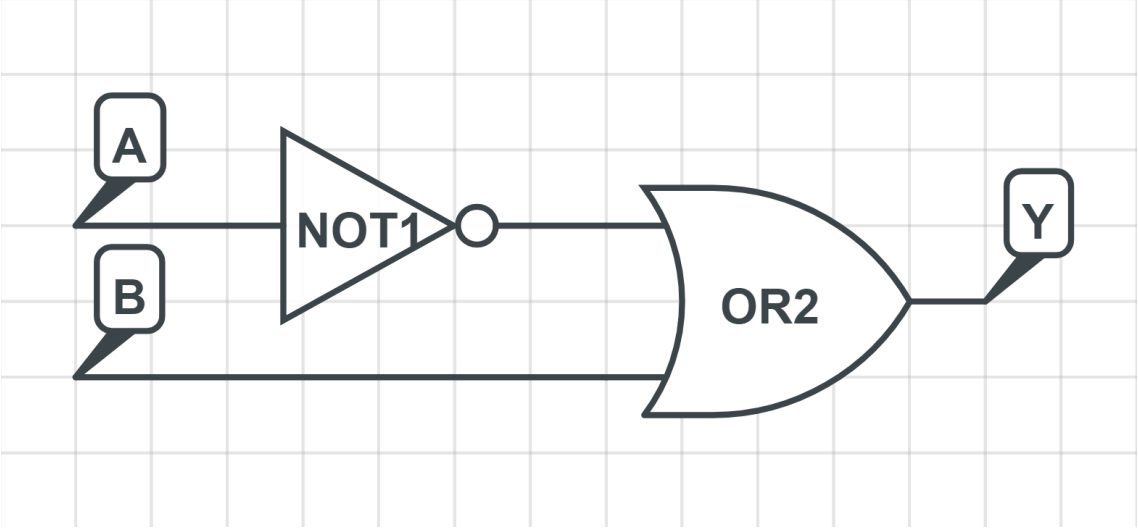
(a) $Y = BC + \bar{A}\bar{B}\bar{C} + B\bar{C}$

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

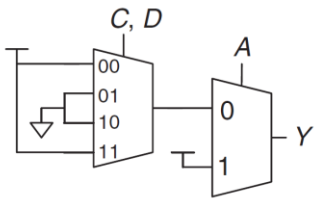


(b) $Y = \overline{A + \bar{A}B + \bar{A}\bar{B}} + \overline{A + \bar{B}}$

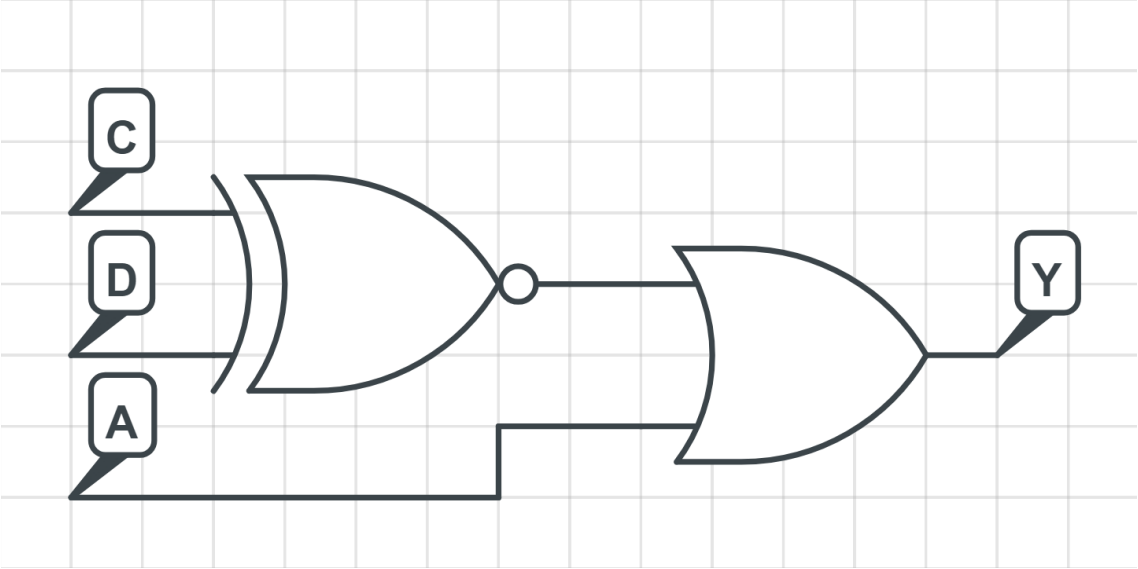
$$Y = \overline{A + \bar{A}(B + \bar{B})} + \bar{A}\bar{\bar{B}}$$
$$= \overline{A + \bar{A}} + \bar{A}B$$
$$= \bar{1} + \bar{A}B$$
$$= \bar{A}B$$



4. Write a minimized Boolean equation for the function performed by the circuit in the figure below:



$Y = A + CD + \bar{C}\bar{D}$


C
D
A
Y