24/7 AREA GLASS BOARD #1

① Is following distribution law valid? $A \oplus BC = (A \oplus B)(A \oplus C)$

A B C	$A \oplus BC$	$(A \oplus B)(A \oplus C)$
0 0 0	0	0
0 0 1	0	0
0 1 0	0	0
0 1 1	1	1
1 0 0	1	1
1 0 1	1	0

different, so the distribution law is not held valid

② A) If $A+B=C$ then $AD'+BD'=CD'$

$\rightarrow AD'+BD' = (A+B)D' = CD' = CD' = \text{TRUE}$

B) If $A'B+A'C = A'D$, then $B+C=D$

$\rightarrow A'B+A'C = \frac{\cancel{A'}(B+C)}{\cancel{A'}} = \frac{\cancel{A'}D}{\cancel{A'}} \Big\} B+C=D = \text{TRUE}$

C) If $A+B=C$, then $A+B+D=C+D$

$A+B+D = (A+B)+D \rightarrow (C)+D \Rightarrow C+D = C+D = \text{TRUE}$

D) If $A+B+C = C+D$, then $A+B=D$

$$\left.\begin{array}{l} A+B+C = C+D \\ \quad -C \quad -C \end{array}\right\} A+B=D \equiv A+B=D = \text{TRUE}$$

③ $F_1 = \sum m(0,4,5,6)$ + $F_2 = \sum m(0,3,6,7)$

Ⓐ Find minterm expression for $F_1 + F_2$

Ⓑ State a general rule for finding $F_1 + F_2$

Ⓒ Prove answer by using general form of minterm expr...

$F_1 = m_0 + m_4 + m_5 + m_6$

$F_2 = m_0 + m_3 + m_6 + m_7$

$F_1 + F_2 = m_0 + m_0 + m_3 + m_4 + m_5 + m_6 + m_6 + m_7$

$m_0 + m_0 = m_0$

$m_6 + m_6 = m_6$

$F_1 + F_2 = m_0 + m_3 + m_4 + m_5 + m_6 + m_7 = \sum m(0,3,4,5,6,7)$

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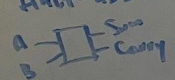
(4) inputs ABCD + outputs XYZ, representing # of 1s in ABCD. If ABCD = 1011, XYZ = 011
minterm expression for X, Y, Z?

$$XYZ = \sum m(0,1,3,7,15)$$

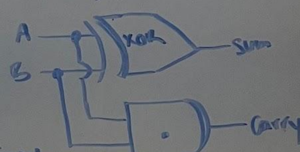
A B C D	Base 10	XYZ	minterms
0 0 0 0	0	000	$X'Y'Z' = \cancel{m_0}$
0 0 0 1	1	001	$X'Y'Z = \cancel{m_1}$
0 0 1 0	1	001	$X'Y'Z = \cancel{m_2}$
0 0 1 1	2	010	$X'YZ' = \cancel{m_3}$
0 1 0 0	1	001	$X'Y'Z = \cancel{m_4}$
0 1 0 1	2	010	$X'YZ' = \cancel{m_5}$
0 1 1 0	2	010	$X'YZ' = \cancel{m_6}$
0 1 1 1	3	011	$X'YZ = \cancel{m_7}$
1 0 0 0	1	001	$X'Y'Z = \cancel{m_8}$
1 0 0 1	2	010	$X'YZ' = \cancel{m_9}$
1 0 1 0	2	010	$X'YZ' = \cancel{m_{10}}$
1 0 1 1	3	011	$X'YZ = \cancel{m_{11}}$
1 1 0 0	2	010	$X'YZ' = \cancel{m_{12}}$
1 1 0 1	3	011	$X'YZ = \cancel{m_{13}}$
1 1 1 0	3	011	$X'YZ = \cancel{m_{14}}$
1 1 1 1	4	100	$XY'Z' = \cancel{m_{15}}$

(5) HALF-ADDER



AB	Sum	Carry
00	0	0
01	1	0
10	1	0
11	0	1

Sum = $A'B + AB' = A \oplus B$
Carry = AB



- design a circuit which finds the negative number of a 4-bit positive input number in 2s complement format