

Answer on Question #43450, Math, Discrete Mathematics

write the following boolean expressions in an equivalent sum of product canonical form in three variables x_1 , x_2 , and x_3 :

1. $x_1 * x_2$?
2. $x_1 \oplus x_2$?
3. $(x_1 \otimes x_2) * x_3$

Solution.

We will express each function as sum of minterms.

$$1. f(x_1, x_2, x_3) = x_1 x_2 = x_1 x_2 (x_3 + x_3') = x_1 x_2 x_3 + x_1 x_2 x_3'$$

$$2. f(x_1, x_2, x_3) = x_1 \oplus x_2 = x_1' x_2 + x_1 x_2' = x_1' x_2 (x_3 + x_3') + x_1 x_2' (x_3 + x_3') = x_1' x_2 x_3 + x_1' x_2 x_3' + x_1 x_2' x_3 + x_1 x_2' x_3'$$

$$3. f(x_1, x_2, x_3) = (x_1 \oplus x_2)' x_3 = (x_1' x_2 + x_1 x_2')' x_3 = (x_1 + x_2')(x_1' + x_2) x_3 = x_1 x_1' x_3 + x_1 x_2 x_3 + x_1' x_2' x_3 + x_2 x_2' x_3 = x_1 x_2 x_3 + x_1' x_2' x_3$$

Answer:

$$1. f(x_1, x_2, x_3) = x_1 x_2 x_3 + x_1 x_2 x_3'$$

$$2. f(x_1, x_2, x_3) = x_1' x_2 x_3 + x_1' x_2 x_3' + x_1 x_2' x_3 + x_1 x_2' x_3'$$

$$3. f(x_1, x_2, x_3) = x_1 x_2 x_3 + x_1' x_2' x_3$$