CMSC 311 Computer Organization

Boolean Algebra Worksheet

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Reduce and Write with C

Suppose that each of the variables below represents a single bit. Rewrite the expression using either a minimum of C-bitwise operators or a minimum of operands or both. Trust me–solutions exist. Note that logical `OR` operator is indicated by the plus symbol, so that $A+B$ means `A OR B`. The logical `AND` is 'assumed' when two symbols are written together, such as `A AND B` is written as AC. The logical `XOR` function is the $\oplus$, giving $P \oplus Q$ for `P XOR Q`. Finally, the apostrophe represents logical `NOT`. You get to use the symbols `~ \ & | ^`, the bit-wise C operators.

1. $(AB + C)(AB + C') =$
2. $X'W + XW' + XW + X'W' =$
3. $pqr + rp =$
4. $(y' + z')xyz =$
5. $(C + DX)(C + EX) =$
6. $T(L' + V) + TV' =$
7. $fg \oplus 1 =$
8. $(m \oplus n) \oplus (m' \oplus n) =$
9. $(uw \oplus (t + u))'$
10. $(xy + z)'(z(x' + y'))$
11. $[(x + a)(x + b)(x + c)(x + d)]' =$

Prove or Disprove the following expressions

This section is truly overkill for any test we might have. But read the instructions anyway. One way to prove is to demonstrate that truth table match. However, as the problems get larger, the truth table method becomes gnarlier. So, use of any of properties of Boolean variables or, perhaps Boolean Algebra Identies, might be the best way to go. What's the best way to disprove? A counterexample! Quick and dirty, no one can argue.

1. $(X \oplus Y)' = (X' \oplus Y)$
2. $(A' \oplus T') = (A \oplus T)$
3. $[a'(b + c')]' + b'c = a$
4. $wvx' + wv'x + w'vx' + w'v'x = w \oplus v \oplus x$
5. $(A + D)(A + B + D) = (A + B)$
6. $(M'N) \oplus (MN') = M \oplus N$
7. $(x + a)(y + b)(x + c)(y + a)(x + b)(y + c) = (xy + abc)$
8. $(K \oplus L \oplus M \oplus N \oplus P)' = (K' \oplus L' \oplus M' \oplus N' \oplus P')$