ECE-223, Assignment #3

Chapter 3, Digital Design, M. Mano, 3rd Edition

3.3) Simplify the following Boolean functions, using three-variable maps:
   a) $xy + x'y'z' + x'yz'$
   b) $x'y' + yz + x'yz'$
   c) $A'B + BC' + B'C'$

3.5) Simplify the following Boolean functions, using four-variable maps:
   a) $F(w, x, y, z) = \sum (1, 4, 5, 6, 12, 14, 15)$
   b) $F(A, B, C, D) = \sum (0, 1, 2, 4, 5, 7, 11, 15)$
   c) $F(w, x, y, z) = \sum (2, 3, 10, 11, 12, 13, 14, 15)$
   d) $F(A, B, C, D) = \sum (0, 2, 4, 5, 6, 7, 8, 10, 13, 15)$

3.12) Simplify the following Boolean functions in products of sums:
   a) $F(w, x, y, z) = \sum (0, 2, 5, 6, 7, 8, 10)$
   b) $F(A, B, C, D) = \prod (1, 3, 5, 7, 13, 15)$

3.13) Simplify the following expressions in (1) sum of the products and (2) products of sums:
   a) $x'z' + y'z' + yz' + xy$
   b) $AC' + B'D + A'CD + ABCD$
   c) $(A' + B' + D') (A + B' + C') (A'+ B + D')(B+ C' + D')$

3.15) Simplify the following Boolean function F , together with the don't-care conditions d, and then express the simplified function in sum of minterms:
   a) $F(x, y, z) = \sum (0, 1, 2, 4, 5)$, $d(x, y, z) = \sum(3, 6, 7)$
   b) $F(A, B, C, D) = \sum (0, 6, 8, 13, 14)$, $d(A, B, C, D) = \sum (2, 4, 10)$
   c) $F(A, B, C, D) = \sum (1,3,5,7,9,15)$, $d(A, B, C, D) = \sum (4,6,12,13)$

3.16) Simplify the following expressions, and implement them with two-level NAND gate circuits:
   a) $ABZ + ABD + ABD' + A'C'D' + A'BC'$
   b) $BD + BCD' + AB'C'D'$

3.28) Derive the circuits for a three-bit parity generator and four-bit parity checker using odd parity bit.

3.29) Implement the following four Boolean expressions with three half adders
   a) $D = A \oplus B \oplus C$
   b) $E = A'BC + AB'C$
   c) $F = ABC' + (A' +B')C$
   d) $G = ABC$