EC 2.101 - Digital Systems and Microcontrollers

Practice Sheet 2 (Lec 1 – Lec 12)

Q1. Three Variable Maps

a. $F(x, y, z) = \sum(0, 2, 4, 5, 6)$
b. $F(x, y, z) = \sum(3, 4, 5, 6, 7)$
c. $F(x, y, z) = x'yz + xy'z' + xyz'$

Q2. Four Variable Maps

a. $F(w, x, y, z) = \sum(1, 3, 4, 5, 6, 7, 9, 11, 13, 15)$
b. $F(A, B, C, D) = \sum(3, 7, 11, 13, 14, 15)$
c. $F(w, x, y, z) = x'z + w'xy' + w(x'y + xy')$
d. $F(A, B, C, D) = AD' + B'C'D + BCD' + BC'D$. Do this as a product of max terms.

Q3. Multi-Level Circuits

a. $CD(B + C)A + (BC' + DE')$ using only NAND gates
b. $CD(B + C)A + (BC' + DE')$ using only NOR gates
c. $w(x + y + z) + xyz$ using only NAND gates

Q4. Implement the following Boolean function F, together with the don't-care conditions d, using no more than two NOR gates:

$$F(A, B, C, D) = \sum(2, 4, 10, 12, 14)$$

$$d(A, B, C, D) = \sum(0,1,5,8)$$

Q5. Design a half subtractor with 2 input variables, X(minuend) and Y(subtrahend) and 2 output variables, D(Difference) and B(Borrow)