ENGIN 341 – Advanced Digital Design

Homework 2

Roth and John 3rd edition – Chapters 3 and 6 (Sections 6.1 & 6.2)

Note: [Equivalent problems from the 2nd edition are specified in brackets.]

1. Problem 3.1 [3.1]

   - **Note:** Give an exact answer including the size of the ROM memory, and specify reasoning for it.
   - **Example 3.1 (a):** 2^{17}x9 because there are 8 input bits for each input to the adder, so 2*8=16 bits, plus an additional input bit for the Cin, for a total of 17 input bits. The adder produces 8 sum output bits and 1 Cout, for a total of 9 output bits. We need a truth table (ROM implementation) with 2^{17} rows, and 9 columns, therefore 2^{17}x9 bits are needed for the ROM realization of a 8-bit full adder with a carry in.

2. Problem 3.10 (Part a) [3.3 (a)]

3. Problem 3.19 [3.12]

4. Problem 3.20 [3.13]

5. Problem 6.5 [6.5]
   - Note: You can cut and paste the images from the following page and use them to draw the appropriate connections (rather than redrawing the figures yourself)

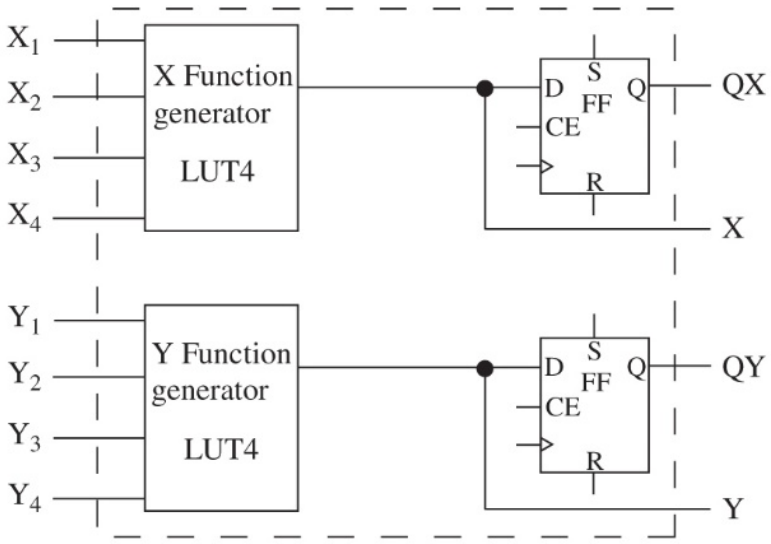
6. Repeat steps a-d of problem 6.5, but design a 2-bit full-adder.
   - Inputs: A1, A0, B1, B0, Cin. Outputs: S1, S0, Cout. Additionally, map the solution using only 5-input look-up tables; show the contents of the tables.

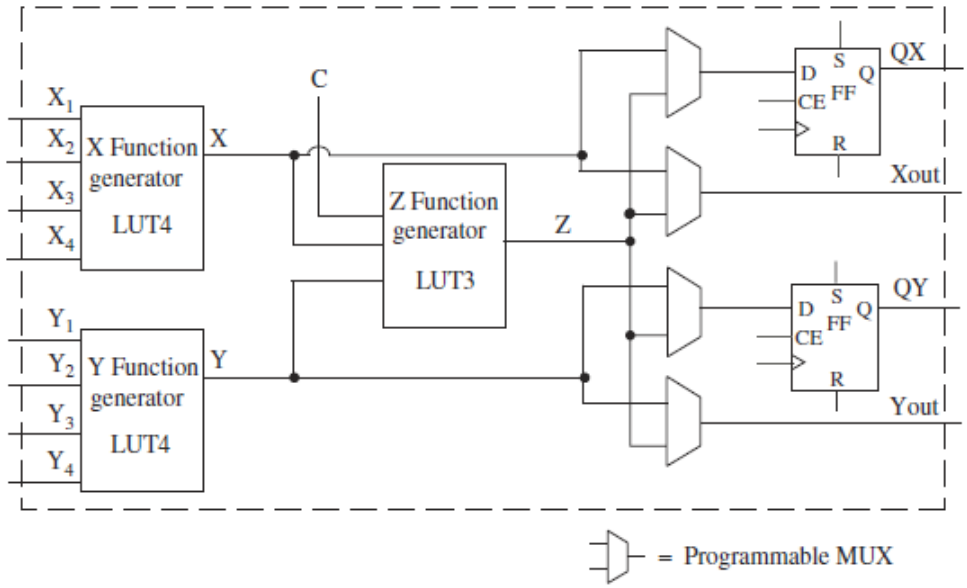
7. Problem 6.10 [No 2nd edition equivalent, problem is specified below]

   a) How may LUT3 are required to create the following function?

   $$F_1 = W + X'Z + WY + WZ' + X'Z'$$

   b) Give the content of the LUTs


X1
X2
X3
X4
X Function generator
LUT4
S
D
Q
FF
CE
R
QX
X
Y1
Y2
Y3
Y4
Y Function generator
LUT4
QY
Y


X1
X2
X3
X4
X Function generator
LUT4
X
C
Z Function generator
LUT3
Z
Y1
Y2
Y3
Y4
Y Function generator
LUT4
Y
QX
Xout
QY
Yout
= Programmable MUX