Examples – Circuits and Electronics

Decoders and Multiplexers – Week 2

Example 1

A combinational circuit is defined by the following three output functions:

$$F_1 = \overline{X}\,\overline{Y} + X\,Y\,\overline{Z}$$

$$F_2 = \overline{X} + Y$$

$$F_3 = XY + \overline{X}\,\overline{Y}$$

a) Use two 4-to-1 multiplexers, an OR gate and an inverter in the implementation

b) Design the circuit using a 3-to-8 line decoder and external NAND gates.

Example 2

Implement a full adder circuit which will add two bits, A and B, using two 4-to-1 multiplexers. Use input variables B and Carry-in (C_i) connected to select lines S_1 and S_0, respectively.

Example 3

Consider the function F(A,B,C,D) = Σm(2,3,8,10,13,14) that is F(A,B,C,D)=1 for ABCD=0010, 0011, etc…

Implement the above function using **ONLY the 4-to-1 multiplexer shown below, inverters or any number of 2-input NOR gates.** Note that in the 4:1 multiplexer shown below, **input variables A, B have been connected to select lines S_1, S_0**, respectively.. Assume variables A, B, C and D are **NOT available in their complemented form**. Show your working using the truth table drawn below.

A	B	C	D	F	
0	0	0	0		
0	0	0	1		
0	0	1	0		
0	0	1	1		
0	1	0	0		
0	1	0	1		
0	1	1	0		
0	1	1	1		
1	0	0	0		
1	0	0	1		
1	0	1	0		
1	0	1	1		
1	1	0	0		
1	1	0	1		
1	1	1	0		
1	1	1	1