

ECE111: Digital Circuits

Practice Problem IV

1. Minimise the following logic functions and show the prime implicants and essential prime implicants.
 - a. $F(A, B, C, D) = \sum m(0, 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15)$
 - b. $F(A, B, C, D) = \sum m(1, 4, 5, 6, 7, 9, 10, 11)$
 - c. $Z(A, B, C, D) = \sum m(0, 1, 4, 5, 7, 10, 11)$
 - d. $S(A, B, C, D) = \sum m(4, 5, 11, 12, 13, 14) + d(7, 15)$
 - e. $P(W, X, Y, Z) = \sum m(1, 4, 5, 6, 7, 9, 10, 11)$
2. Figure 1 shows the truth table for a two bit multiplier. Design the logic circuit for the two bit multiplier.

A1	A0	B1	B0	C3	C2	C1	C0
0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0
0	0	1	0	0	0	0	0
0	0	1	1	0	0	0	0
0	1	0	0	0	0	0	0
0	1	0	1	0	0	0	1
0	1	1	0	0	0	1	0
0	1	1	1	0	0	1	1
1	0	0	0	0	0	0	0
1	0	0	1	0	0	1	0
1	0	1	0	0	1	0	0
1	0	1	1	0	1	1	0
1	1	0	0	0	0	0	0
1	1	0	1	0	0	1	1
1	1	1	0	0	1	1	0
1	1	1	1	1	0	0	1

Figure 1

3. Evaluate the outputs D1, D0, J1, K1, J0 and K0 for the truth table shown in Figure 2 and give the logic realisations.

INPUTS				OUTPUT 1		OUTPUT 2			
Q1	Q0	A	B	D1	D0	J1	K1	J0	K0
0	0	0	0	0	0	0	X	0	X
0	0	0	1	0	0	0	X	0	X
0	0	1	0	1	0	1	X	0	X
0	0	1	1	X	X	X	X	X	X
0	1	0	0	0	0	0	X	X	1
0	1	0	1	0	1	0	X	X	0
0	1	1	0	0	0	0	X	X	1
0	1	1	1	X	X	X	X	X	X
1	0	0	0	1	1	X	0	1	X
1	0	0	1	0	0	X	1	0	X
1	0	1	0	1	0	X	0	0	X
1	0	1	1	X	X	X	X	X	X
1	1	0	0	1	1	X	0	X	0
1	1	0	1	0	1	X	1	X	0
1	1	1	0	0	0	X	1	X	1
1	1	1	1	X	X	X	X	X	X

Figure 2