CODE CONVERTERS

Lecture 7 & 8

Design a code converter using NOR gates only to convert a decimal digit represented in 8 4 2 1 code to a decimal digit represented in 8 4 -2 -1 code.

8 4 2 1				8 4 -2 -1			
A	B	C	D	B_3	B_2	B_1	B_0
0	0	0	0	0	0	0	0
1	0	0	0	1	1	1	1
2	0	0	1	0	1	1	0
3	0	0	1	1	1	0	1
4	0	1	0	0	1	0	0
5	0	1	0	1	1	0	1
6	0	1	1	0	1	0	1
7	0	1	1	1	1	0	0
8	1	0	0	0	1	0	0
9	1	0	0	1	1	1	1
x	1	0	1	0	x	x	x
x	1	0	1	1	x	x	x
x	1	1	0	0	x	x	x
x	1	1	0	1	x	x	x
x	1	1	1	0	x	x	x
x	1	1	1	1	x	x	x

B_3 :-

AB \ CD	00	01	11	10
00	0	0	0	0
01	0	1	1	1
11	x	x	x	x
10	1	1	x	x

$$B_3 = (A+B)(A+C+D)$$

$$= (A+B) + (A+C+D)$$

B_2 :-

AB \ CD	00	01	11	10
00	0	1	1	1
01	1	0	0	0
11	x	x	x	x
10	0	1	x	x

$$B_2 = \left[(B+C+D)(\bar{B}+\bar{D})(\bar{B}+\bar{C})\right]$$

$$= \left[(B+C+D) + (\bar{B}+\bar{D}) + (\bar{B}+\bar{C})\right]$$

B_1 :-

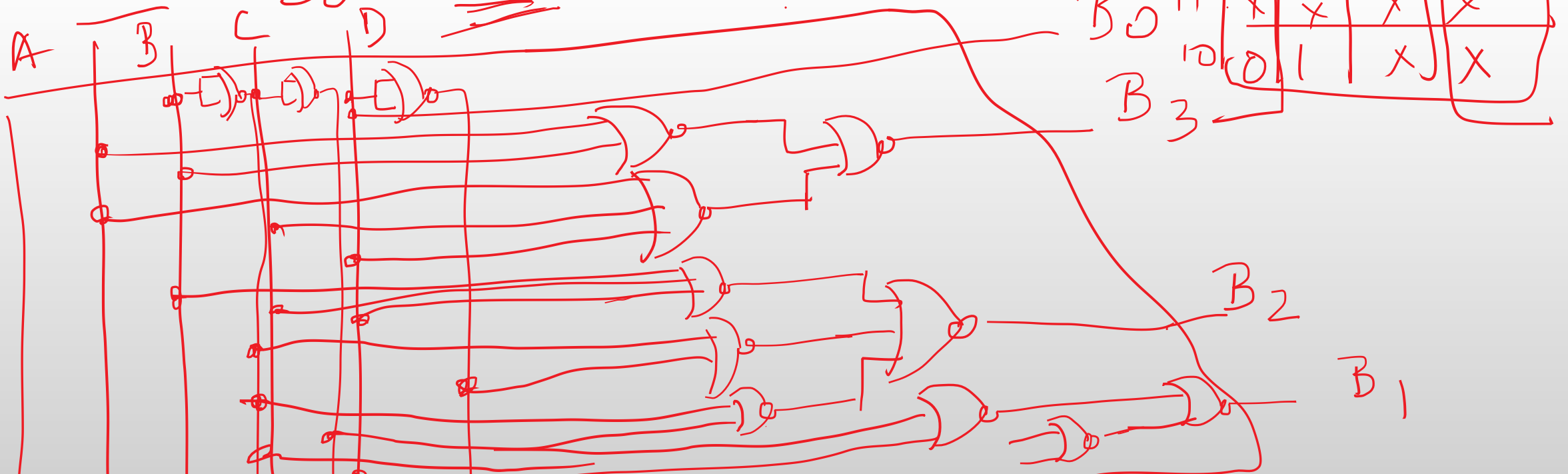
AB \ CD	00	01	11	10
00	0	1	0	1
01	0	1	0	1
11	X	X	X	X
10	0	1	X	X

$$B_1 = \overline{(C+D)\,(\bar{C}+\bar{D})}$$

$$= \overline{(C+D)} + \overline{(\bar{C}+\bar{D})}$$

AB \ CD	00	01	11	10
00	0	1	1	0
01	0	1	1	0
11	X	X	X	X
10	0	1	X	X

B_0 :- $B_0 = D$

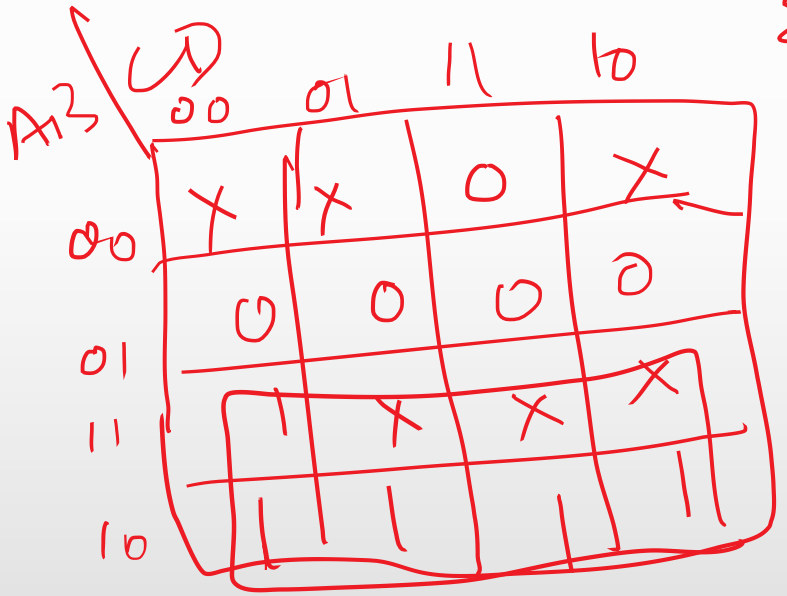


Design a code converter using basic gates to convert a decimal digit represented in Excess 3 code to a decimal digit represented in 8 4 -2 -1 code.

	Excess-3 A B C D	8 4 -2 -1 F_3 F_2 F_1 F_0
X	0 0 0 0	X
X	0 0 0 1	X
X	0 0 1 0	X
0	0 0 1 1	0 0 0 0
1	0 1 0 0	0 1 1 1
2	0 1 0 1	0 1 1 0
3	0 1 1 0	0 1 0 1
4	0 1 1 1	0 1 0 0
5	1 0 0 0	1 0 1 1
6	1 0 0 1	1 0 1 0
7	1 0 1 0	1 0 0 1
8	1 0 1 1	1 0 0 0
9	1 1 0 0	1 1 1 1
X	1 1 0 1	X
X	1 1 1 0	X
X	1 1 1 1	X

F_3 :-

$F_3 = \sum_m(8,9,10,11,12) + \sum_d(0,1,2,[3,14,15])$



$F_3 = A$

$F_2 = \sum(4,5,6,7,[b]) + \sum_d(0,1,2,13,14,15)$

$F_1 = \sum(4,5,8,9,[ ]) + \sum_d(0,1,2,13,14,15)$

$F_0 = \sum(4,6,8,[ ]) + \sum_d([ ])$

$F_2 = B$

$F_1 = \overline{C}$

$F_0 = \overline{D}$

Draw the circuit

Design a code converter to convert a decimal digit represented in 8 4 -2 -1 code to a decimal digit represented in 2 4 2 1 code.

	8 4 -2 -1				2 4 2 1			
	A	B	C	D	F_3	F_2	F_1	F_0
0	0	0	0	0	0	0	0	0
x	0	0	0	1	x			
x	0	0	1	0	x			
x	0	0	1	1	x			
4	0	1	0	0	0	1	0	0
3	0	1	0	1	0	0	1	1
2	0	1	1	0	0	0	1	0
1	0	1	1	1	0	0	0	1
8	1	0	0	0	1	1	1	0
7	1	0	0	1	1	1	0	1
6	1	0	1	0	1	1	0	0
5	1	0	1	1	1	0	1	1
x	1	1	0	0	x			
x	1	1	0	1	x			
x	1	1	1	0	x			
x	1	1	1	1	x			

F_3 :-

AB \ CD	00	01	11	10
00	0	X	X	X
01	0	0	0	0
11	X	X	1	X
10	1	1	1	1

$= A$

$F_1 =$

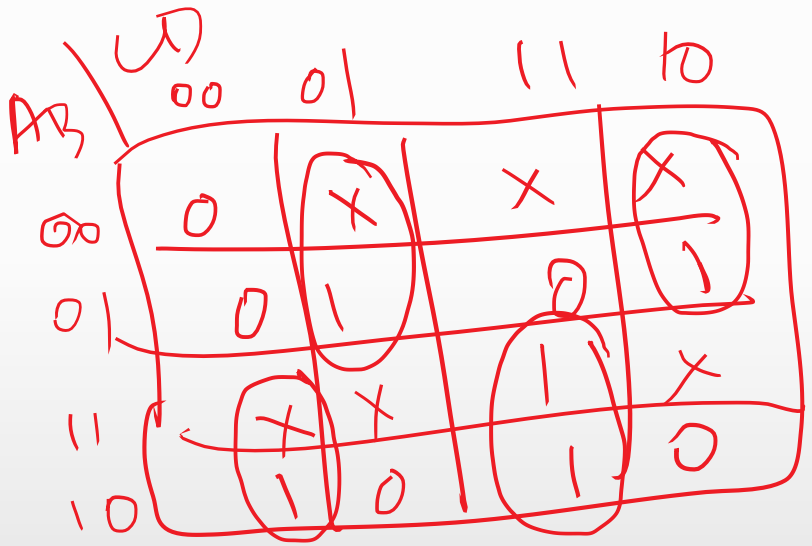
F_2 :

AB \ CD	00	01	11	10
00	0	X	X	X
01	0	0	0	0
11	X	X	1	X
10	1	1	0	1

$F_0 = D$

$F_2 = A\bar{C}$ + $B\bar{C}\bar{D} + A\bar{B}$ + $\bar{A}\bar{D}$

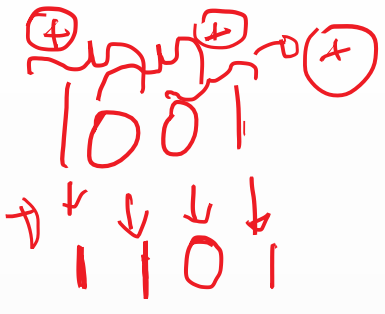
$F_1 =$



$\bar{A}\bar{C}D + \bar{A}C\bar{D} + A\bar{C}\bar{D} + ACD.$

Design a code converter to convert a decimal digit represented in 2 4 2 1 code to a decimal digit represented in gray code.

2 4 2 1 A	B	C	D	G_3	G_2	G_1	G_0
0	0	0	0	0	0	0	0
1	0	0	0	1	0	0	1
2	0	0	1	0	0	1	1
3	0	0	1	1	0	1	0
4	0	1	0	0	0	1	1	0
x	0	1	0	1	x			
x	0	1	1	0	x			
x	0	1	1	1	x			
x	1	0	0	0	x			
x	1	0	0	1	x			
x	1	0	1	0	x			
5	1	0	1	1	0	1	1	1
6	1	1	0	0	0	1	0	1
7	1	1	0	1	0	1	0	0
8	1	1	1	0	1	1	0	0
9	1	1	1	1	1	1	0	1



5 → 0101 → 0111

6 → 0110 → 0101

7 → 0111 → 0100

8 → 1000 → 1100

9 → 1001 → 1101

Obtain the simplified expression & draw the circuit