Paper 7, TDC Part-3
Chapter– 4, Combinational Logic Design
Lecture - 21

By:

Mayank Mausam

Assistant Professor (Guest Faculty)

Department of Electronics

L.S. College, BRA Bihar University,

Muzaffarpur, Bihar

Combinational Logic Design

Example:→ Design a Binary-to-Gray code converter.

Solution:→ As we know that in a Gray code the binary representation of 2 ~~concept~~ consecutive decimal numbers differ by in only one bit. The truth table of ~~binar~~ gray code for 4-variable binary number is give below,

B_3	B_2	B_1	B_0	G_3	G_2	G_1	G_0
0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	1
0	0	1	0	0	0	1	1

Combinational Logic Design

B_3	B_2	B_1	B_0	G_3	G_2	G_1	G_0
0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	1
0	0	1	0	0	0	1	1
0	0	1	1	0	0	1	0
0	1	0	0	0	1	1	0
0	1	0	1	0	1	1	1
0	1	1	0	0	1	0	1
0	1	1	1	0	1	0	0
1	0	0	0	1	1	0	0
1	0	0	1	1	1	0	1
1	0	1	0	1	1	1	1
1	0	1	1	1	1	1	0
1	1	0	0	1	0	1	0
1	1	0	1	1	0	1	1
1	1	1	0	1	0	0	1
1	1	1	1	1	0	0	0

each of the 4 outputs G_3, G_2, G_1 &

Combinational Logic Design

K-maps are prepared and simplified.

B_3B_2 \ B_1B_0	00	01	11	10
00				
01				
11	1	1	1	1
10	1	1	1	1

K-Map for G_3

There is only one group of 1's possible for G_3 and the group contains group of 8 ones. So expression of

$$G_3 = B_3 \quad \text{—(i)}$$

Combinational Logic Design

B_3B_2 \ B_1B_0	00	01	11	10
00				
01	1	1	1	1
11				
10	1	1	1	1

offset

K-Map for G_2

These are 2 groups of ones and each group have 4 ones, ~~which~~ ~~Each of~~ The 2 groups are in offset adjacencies and so the expression for G_2 can be expressed as EX-OR / EX-NOR operations

$$G_2 = B_3\bar{B}_2 + \bar{B}_3 B_2 = B_3 \oplus B_2$$

B_3B_2 \ B_1B_0	00	01	11	10
00			1	1
01	1	1		
11	1	1		
10			1	1

Diagonal

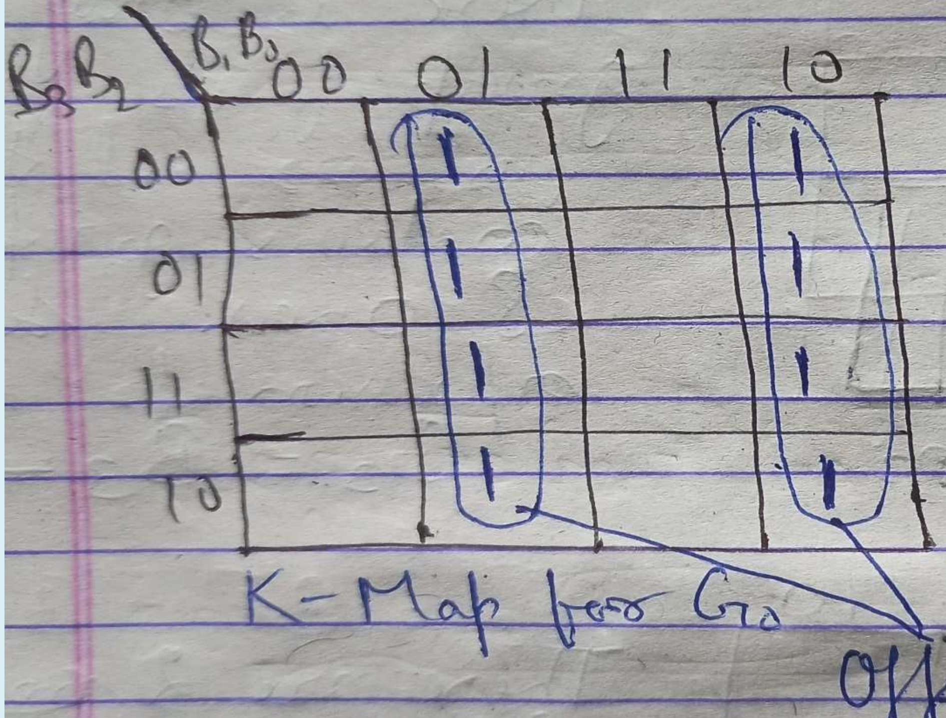
K-Map for G_1

Again there are 2 groups of ones and each group have 4 ones. The 2 groups are in diagonal adjacencies and so the expression for G_1 can be

Combinational Logic Design

expressed as EX-OR / EX-NOR operations.

$G_1 = B_2\bar{B}_1 + \bar{B}_2 B_1 = B_2 \oplus B_1$

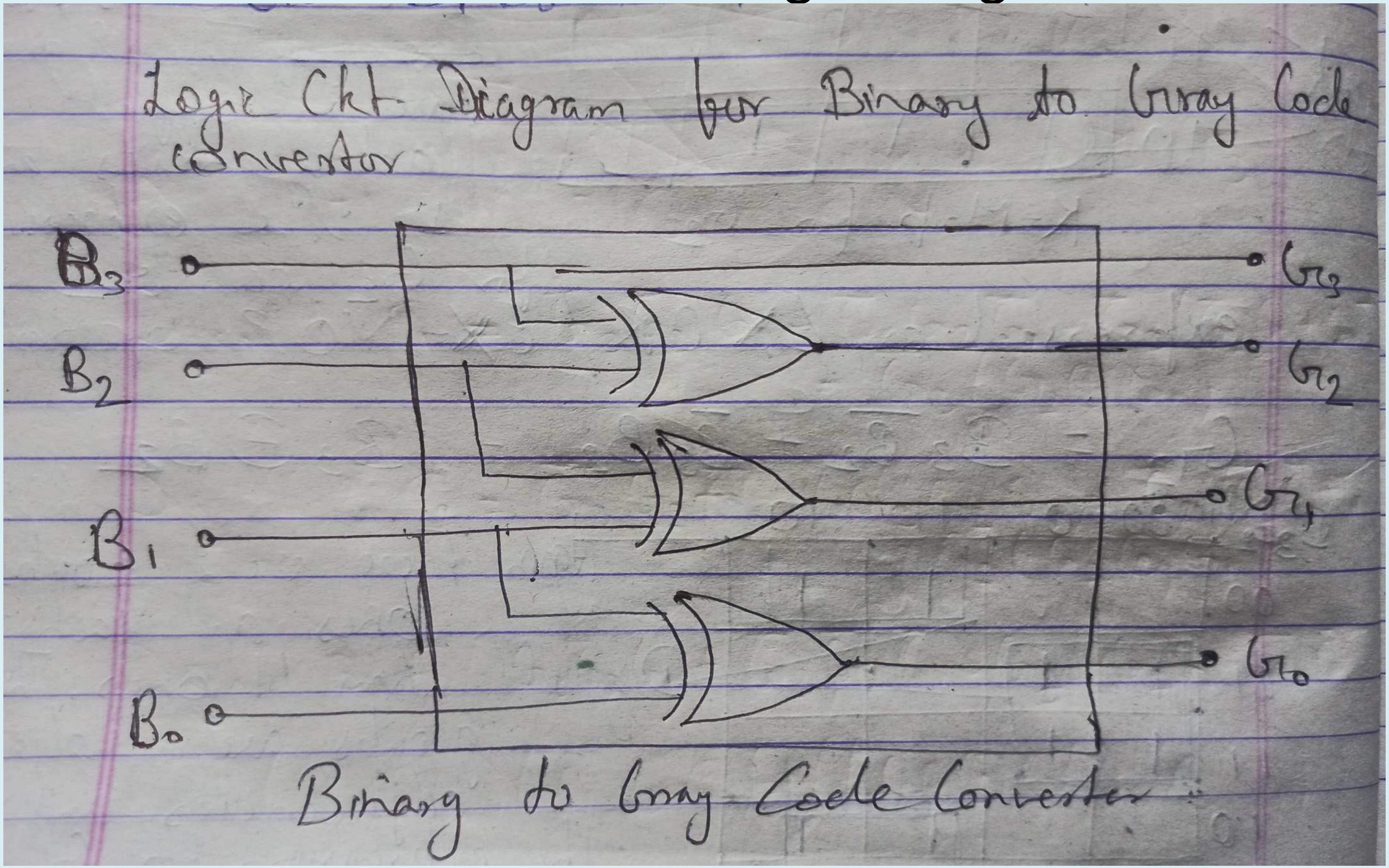


K-Map for G0

Again in K-Map for G0 there is offset adjacency for 2 groups of 4 ones. So the expression for G0 can be given as-

$G_0 = \bar{B}_1 B_0 + B_1 \bar{B}_0 = B_1 \oplus B_0$

Combinational Logic Design



Combinational Logic Design

Example 2) Design a Gray-to-Binary code converter

Solution:- To design the Gray to Binary code converter we first write the truth table then plot the K-Map each Binary Output bits

Decimal	G_3	G_2	G_1	G_0	B_3	B_2	B_1	B_0
0	0	0	0	0	0	0	0	0
1	0	0	0	1	0	0	0	1
2	0	0	1	1	0	0	1	0
3	0	0	1	0	0	0	1	1
4	0	1	1	0	0	1	0	0
5	0	1	1	1	0	1	0	1
6	0	1	0	1	0	1	1	0
7	0	1	0	0	0	1	1	1

Combinational Logic Design

5	0	1	1	1	0	1	0	1
6	0	1	0	1	0	1	1	0
7	0	1	0	0	0	1	1	1
8	1	1	0	0	1	0	0	0
9	1	1	0	1	1	0	0	1
10	1	1	1	1	1	0	1	0
11	1	1	1	0	1	0	1	1
12	1	0	1	0	1	1	0	0
13	1	0	1	1	1	1	0	1
14	1	0	0	1	1	1	1	0
15	1	0	0	0	1	1	1	1

G_3G_2 \ G_1G_0	00	01	11	10
00				
01				
11	1	1	1	1
10	1	1	1	1

K-Map for B_3

There is only one group of ones with 8 ones, so,

$B_3 = G_3$

Combinational Logic Design

Students need to try to find the expression for B_2, B_1 & B_0

Refer book- Modern Digital Electronics by RP Jain.

Thank You