Analog and Digital Systems (UEE505)

Lecture # 16
Code Converters

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Code Converters

- A conversion circuit must be inserted between the two systems if each uses different codes for the same information.

- Logic circuit whose inputs are bit patterns representing numbers(or characters) in one code and whose outputs are the corresponding representations in different code.

- Changes data presented in one type of binary code to another code of binary code

- These are usually multiple output circuits.

Code Converters

- The following are some of the most commonly used code converters:

i. Binary-to-BCD

ii. BCD-to-Excess-3

iii. Excess-3-to-BCD

iv. Binary-to-Gray code

v. Gray-to-Binary code

vi. BCD-to-binary

Note: Be careful to determine the input combinations if any, those will never occur and consider that as don't cares.

4 bit Binary to BCD Code Converter

Truth Table:

Decimal	Binary Code				BCD Code				
	D	C	B	A	B_4	B_3	B_2	B_1	B_0
0	0	0	0	0	0	0	0	0	0
1	0	0	0	1	0	0	0	0	1
2	0	0	1	0	0	0	0	1	0
3	0	0	1	1	0	0	0	1	1
4	0	1	0	0	0	0	1	0	0
5	0	1	0	1	0	0	1	0	1
6	0	1	1	0	0	0	1	1	0
7	0	1	1	1	0	0	1	1	1
8	1	0	0	0	0	1	0	0	0
9	1	0	0	1	0	1	0	0	1
10	1	0	1	0	1	0	0	0	0
11	1	0	1	1	1	0	0	0	1
12	1	1	0	0	1	0	0	1	0
13	1	1	0	1	1	0	0	1	1
14	1	1	1	0	1	0	1	0	0
15	1	1	1	1	1	0	1	0	1

- $B_0 = \sum m (1, 3, 5, 7, 9, 11, 13, 15)$
- $B_1 = \sum m (2, 3, 6, 7, 12, 13)$
- $B_2 = \sum m (4, 5, 6, 7, 14, 15)$
- $B_3 = \sum m (8, 9)$
- $B_4 = \sum m (10, 11, 12, 13, 14, 15)$

For B_0

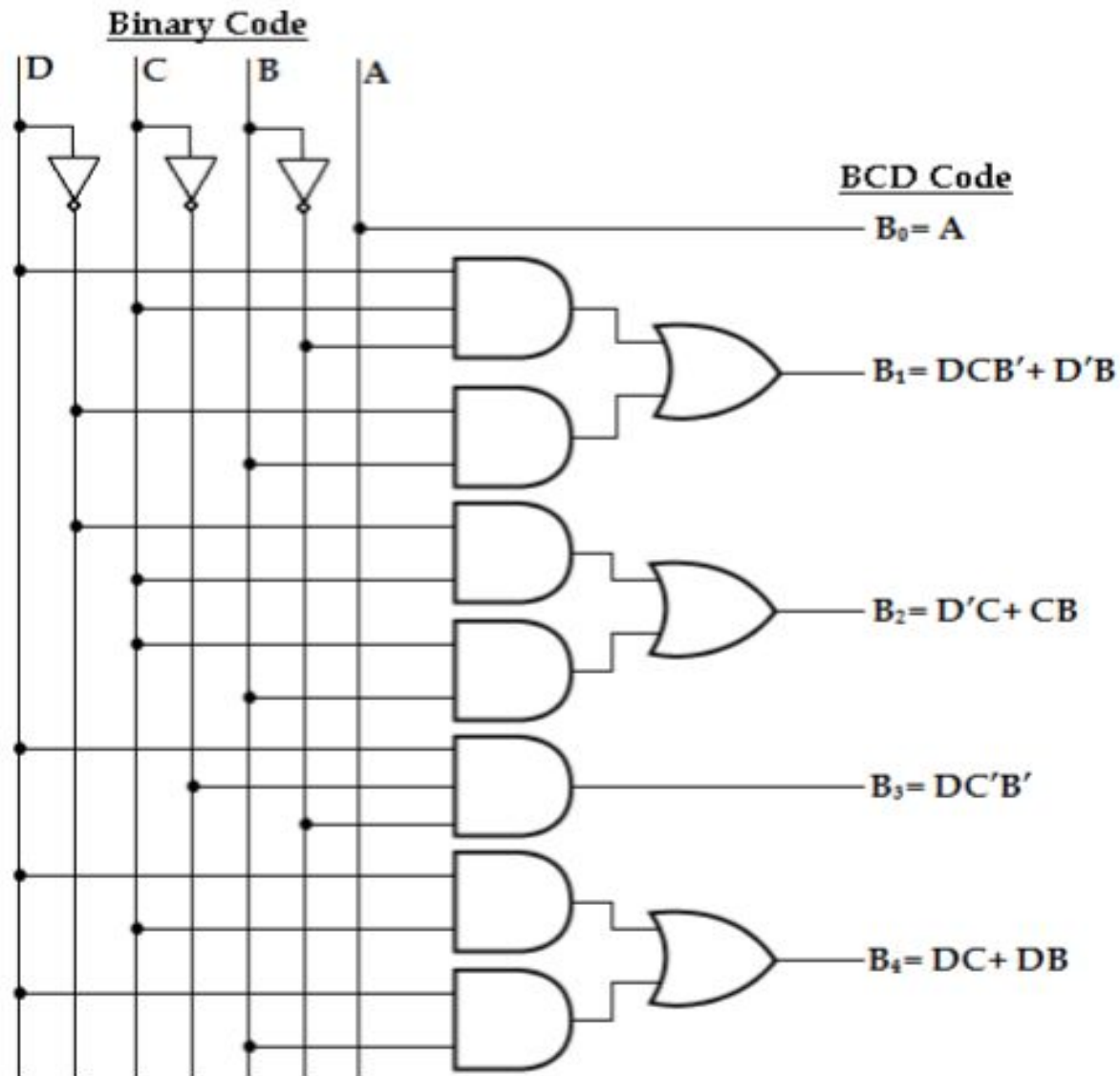| DC \ BA	00	01	11	10
00	0	1	1	0
01	0	1	1	0
11	0	1	1	0
10	0	1	1	0

$B_0 = A$

4 bit Binary to BCD Code Converter

❖ Using K-map, the logical expression can be obtained as:

- $B_0 = A$
- $B_1 = DCB' + D'B$
- $B_2 = D'C + CB$
- $B_3 = DC'B'$
- $B_4 = DC + DB$

Logic Diagram

Design 4 bit BCD to Excess 3 code converter.

References

❖ *Floyd, T.L. and Jain, R. P., Digital Fundamentals, Pearson Education.*

❖ *Tocci, R. and Widmer, N., Digital Systems: Principles and Applications, Pearson Education.*

❖ *Mano, M. M. and Ciletti, M., Digital Design, Pearson Education.*

❖ *Kumar, A., Fundamentals of Digital Circuits, Prentice Hall.*