SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A++' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

19ECB202 – LINEAR AND DIGITAL CIRCUITS

II YEAR/ III SEMESTER

UNIT 4 – COMBINATIONAL and SEQUENTIAL CIRCUITS

TOPIC 4 - Code Converters (Binary to Grey and Grey to Binary)

What is a code converter?

- A converter is needed to convert the information in to the code which we need.
- These are basically encoders and decoders which converts the data in to an encoded form.
- Coding is the process of translating the input information which can be understandable by the machine or a particular device.
- Coding can be used for security purpose to protect the information from steeling or interrupting.

Applications of Code Converters

Computers

Digital electronics

Microprocessors

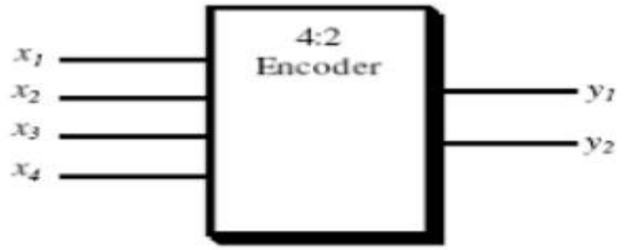
Types of Code Converters

- There are numerous codes like
  - binary,
  - octal,
  - hexadecimal,
  - Binary Coded Decimal (BCD),
  - Excess-3,
  - Gray code,
  - Error Correcting Codes (ECCs) and
  - ASCII code

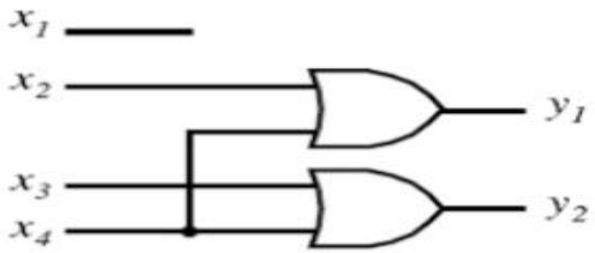
CODE CONVERTER

Truth Table	*Block Diagram*

x_4	x_3	x_2	x_1	y_2	y_1
0	0	0	1	0	0
0	0	1	0	0	1
0	1	0	0	1	0
1	0	0	0	1	1



Logic Circuit Implementation



Binary to Grey Code

Binary

Binary code

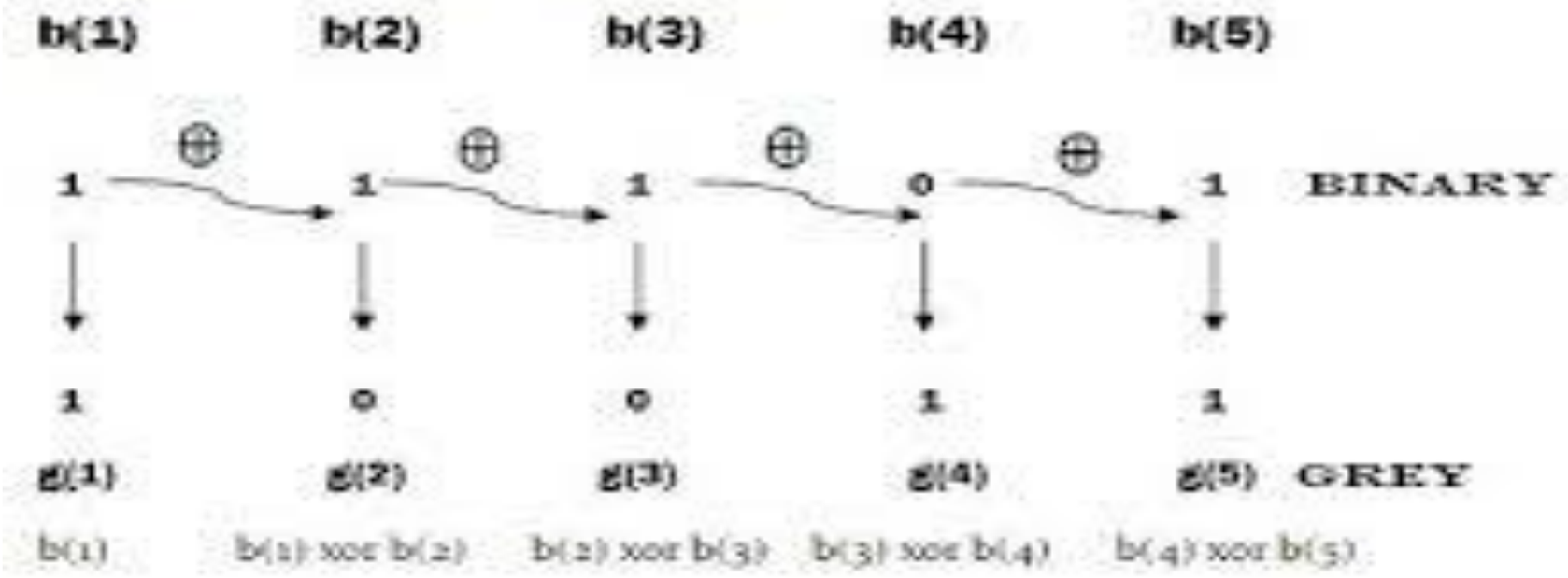
Gray code

Grey

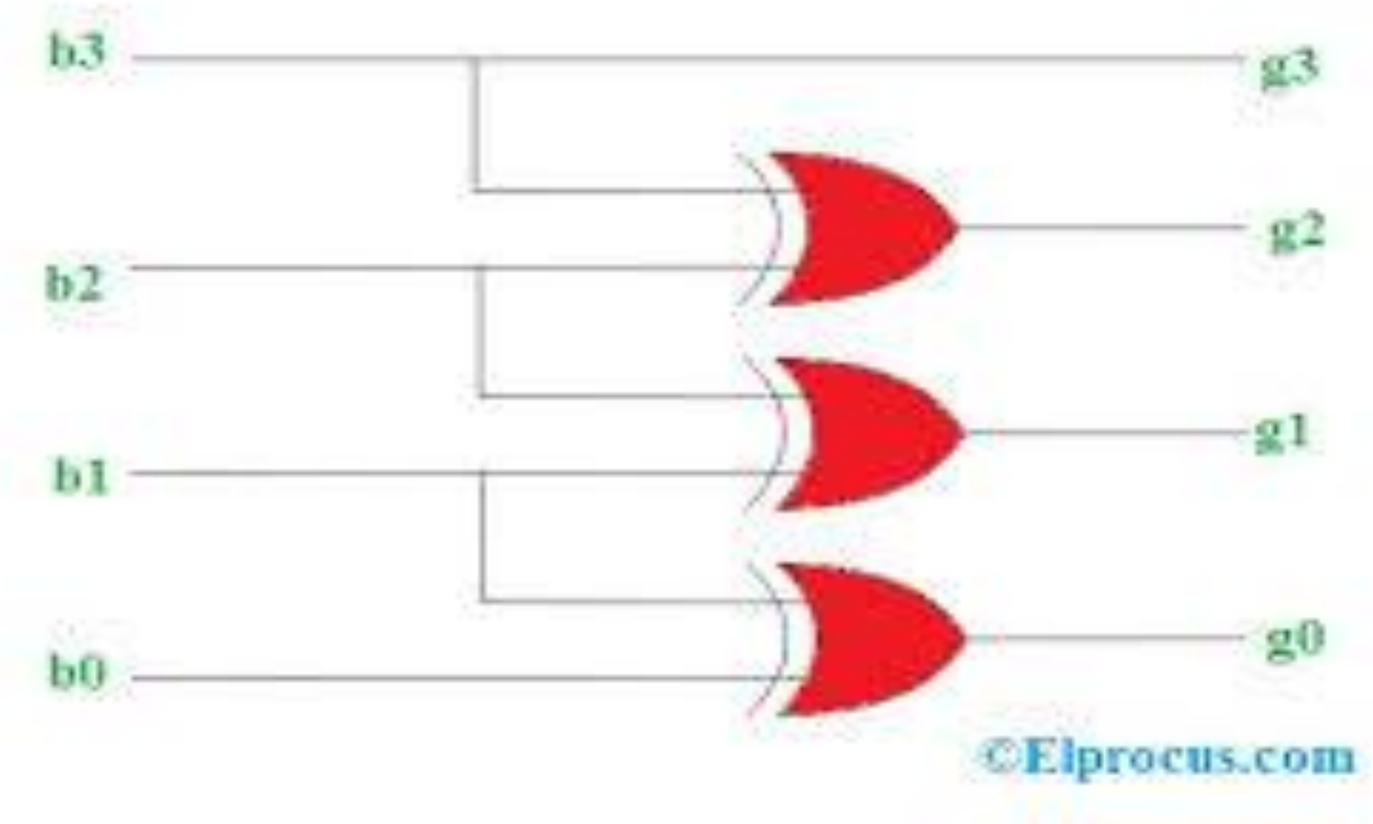
Binary to Grey Code

Binary to Grey Code Conversion

Convert the binary 11101_2 to its equivalent Grey code



Binary to Grey Code - Circuit



Binary to Grey Code – K map

- Looking at grey-code (G3G2G1G0), we find that any two subsequent numbers differ in only one bit-change.
- B3 B2 B1 B0 - inputs
- G3 G2 G1 G0 - outputs

K-map for G_0

B_3B_2 \ B_1B_0	00	01	11	10
00	0	1	0	1
01	0	1	0	1
11	0	1	0	1
10	0	1	0	1

$$G_0 = B_1'B_0 + B_1B_0'$$

$$G_0 = B_0 \oplus B_1$$

K-map for G_1

B_3B_2 \ B_1B_0	00	01	11	10
00	0	0	1	1
01	1	1	0	0
11	1	1	0	0
10	0	0	1	1

$$G_1 = B_1'B_2 + B_1B_2'$$

$$G_2 = B_1 \oplus B_2$$

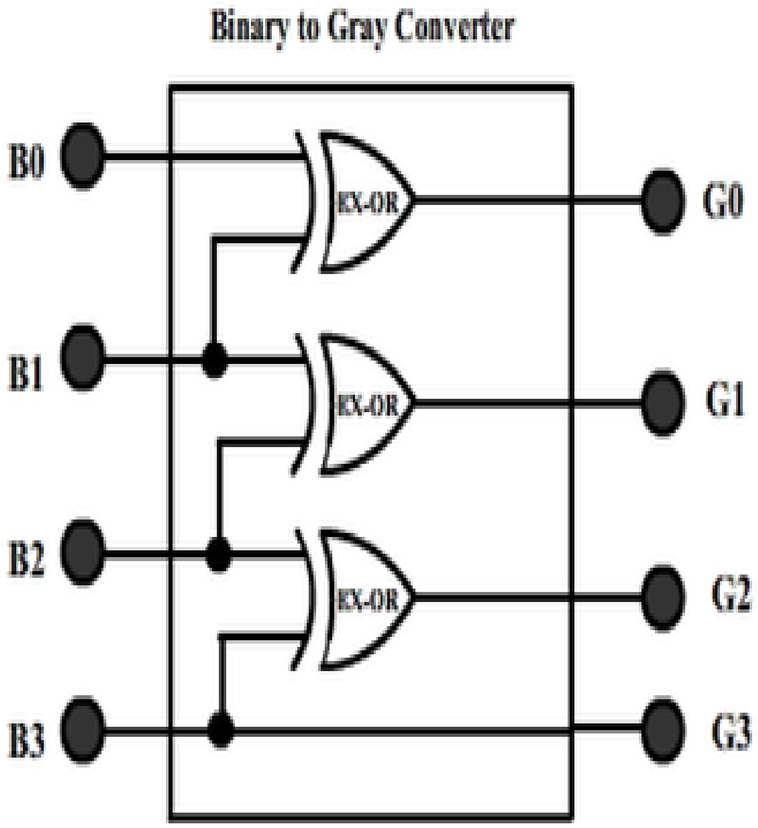
K-map for G_2

B_3B_2 \ B_1B_0	00	01	11	10
00	0	0	0	0
01	1	1	1	1
11	0	0	0	0
10	1	1	1	1

$$G_2 = B_3'B_2 + B_3B_2'$$

$$G_2 = B_2 \oplus B_3$$

Binary to Grey Code – Truth Table



Natural-binary code				Gray code			
B3	B2	B1	B0	G3	G2	G1	G0
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

ACTIVITY

Gray to Binary Code

- Once the converted code (now in Gray form) is processed, we want the processed data back in binary representation.

- Since we need a converter that would perform reverse operation to that of earlier converter called as Gray-to-Binary converter

Gray to Binary Code – K map

K-map for B_0

G_1G_0 \ G_3G_2	00	01	11	10
00	0	1	0	1
01	1	0	1	0
11	1	0	1	0
10	0	1	0	1

$$B_0 = G_2G_1'G_0' + G_2'G_1G_0' + G_2'G_1'G_0 + G_2G_1G_0$$

$$= G_0'(G_1'G_2 + G_1G_2') + G_0(G_1G_2 + G_1'G_2')$$

$$= G_0'(G \oplus G_2) + G_0(G_1 \oplus G_2)' = G_0 \oplus G_1 \oplus G_2$$

K-map for B_1

G_1G_0 \ G_3G_2	00	01	11	10
00	0	0	1	1
01	1	1	0	0
11	0	0	1	1
10	1	1	0	0

$$B_1 = G_3'G_2'G_1 + G_3'G_2G_1' + G_3G_2G_1 + G_3G_2'G_1'$$

$$= G_3'(G_2 \oplus G_1) + G_3(G_2 \oplus G_1)'$$

$$= G_1 \oplus G_2 \oplus G_3$$

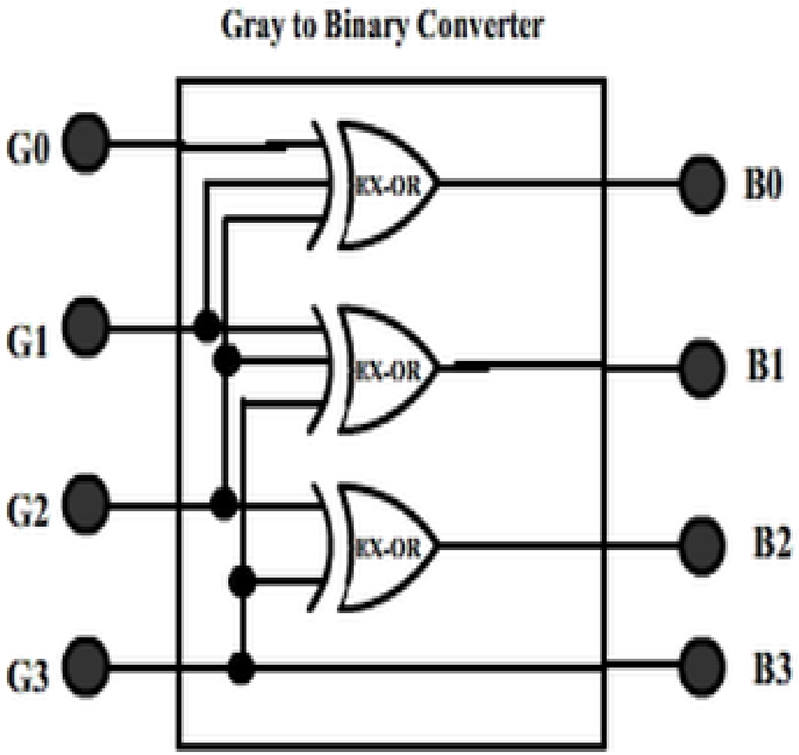
K-map for B_2

G_1G_0 \ G_3G_2	00	01	11	10
00	0	0	0	0
01	1	1	1	1
11	0	0	0	0
10	1	1	1	1

$$B_2 = G_3'G_2 + G_3G_2'$$

$$= G_3 \oplus G_2$$

Gray to Binary Code



Gray code				Natural-binary code			
G3	G2	G1	G0	B3	B2	B1	B0
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	1
0	1	0	1	0	1	1	0
0	1	1	0	0	1	0	0
0	1	1	1	0	1	0	1
1	0	0	0	1	1	1	1
1	0	0	1	1	1	1	0
1	0	1	0	1	1	0	0
1	0	1	1	1	1	0	1
1	1	0	0	1	0	0	0
1	1	0	1	1	0	0	1
1	1	1	0	1	0	1	1
1	1	1	1	1	0	1	0

ASSESMNETS

1). Binary coded decimal is a combination of_____ (OUFR YARBNI SDGIITS)

2). When numbers, letters or words are represented by a special group of symbols, the process is called as _____(NGEIDNOC)

3). A(A+B) =?

4). The logical sum of two or more logical product terms is called _____(PSO)

5). An input that is known never to occur is called _____ (AREC NODT PTUNI)

THANK YOU