Digital Electronics
Moule-II-B

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Applications of Multiplexer

- Multiplexer are used in various fields where multiple data need to be transmitted using a single line.

- **Communication system** –Multiplexer allow the process of transmitting different type of data such as audio, video at the same time using a single transmission line.

- **Telephone network** – In telephone network, multiple audio signals are integrated on a single line for transmission with the help of multiplexers.

- **Computer memory** – Multiplexers are used to implement huge amount of memory into the computer.

- **Transmission from the computer system of a satellite** – Multiplexer can be used for the transmission of data signals from the computer system of a satellite or spacecraft to the ground system using the GPS.

Applications of Demultiplexer

Demultiplexer is used to connect a single source to multiple destinations

- **Communication System** –The demultiplexer receive the output signals of the multiplexer and converts them back to the original form of the data at the receiving end.

- **ALU (Arithmetic Logic Unit)** – In an ALU circuit, the output of ALU can be stored in multiple registers or storage units with the help of demultiplexer.

- **Serial to parallel converter –** A serial to parallel converter is used for reconstructing parallel data from incoming serial data stream.

Binary to Gray Code

Let $b_0,\ b_1,\ b_2\ ,\ and\ b_3$ be the bits representing the binary numbers, where b_0 is the LSB and b_3 is the MSB, and

Let $g_0,\ g_1,\ g_2\ ,\ and\ g_3$ be the bits representing the gray code of the binary numbers, where g_0 is the LSB and g_3 is the MSB.

Binary to Gray Code

Binary				Gray Code			
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

Binary to Gray Code

Binary				Gray Code
b_3	b_2	b_1	b_0	g_0
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	0
0	1	0	0	0
0	1	0	1	1
0	1	1	0	1
0	1	1	1	0
1	0	0	0	0
1	0	0	1	1
1	0	1	0	1
1	0	1	1	0
1	1	0	0	0
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0

for g_0

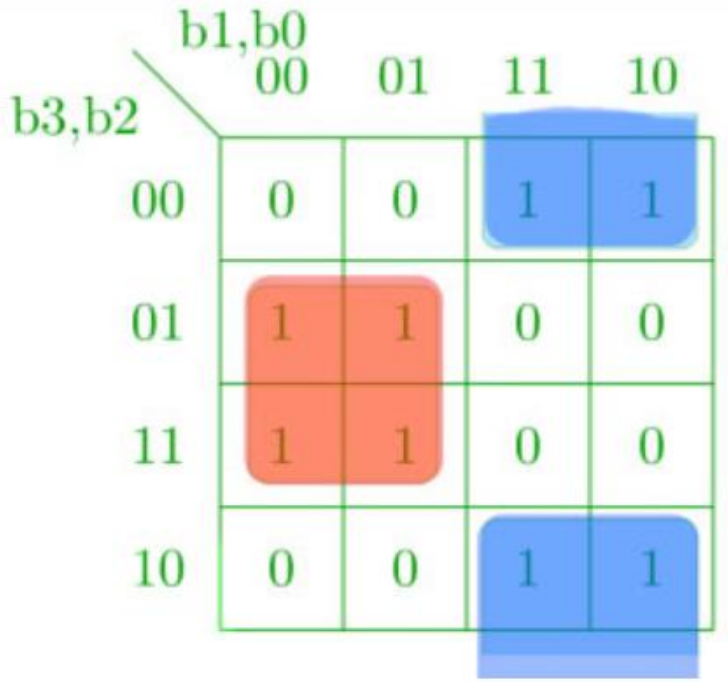
b3,b2 \ b1,b0	00	01	11	10
00	0	1	0	1
01	0	1	0	1
11	0	1	0	1
10	0	1	0	1

$$g_0 = b_0\overline{b_1} + \overline{b_0}b_1 = b_0 \oplus b_1$$

Binary to Gray Code

Binary				Gray Code	
b_3	b_2	b_1	b_0		g_1
0	0	0	0		0
0	0	0	1		0
0	0	1	0		1
0	0	1	1		1
0	1	0	0		1
0	1	0	1		1
0	1	1	0		0
0	1	1	1		0
1	0	0	0		0
1	0	0	1		0
1	0	1	0		1
1	0	1	1		1
1	1	0	0		1
1	1	0	1		1
1	1	1	0		0
1	1	1	1		0

for g_1



$$g_1 = b_1\overline{b_2} + \overline{b_1}b_2 = b_1 \oplus b_2$$

Binary to Gray Code

Binary				Gray Code
b_3	b_2	b_1	b_0	g_2
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	0

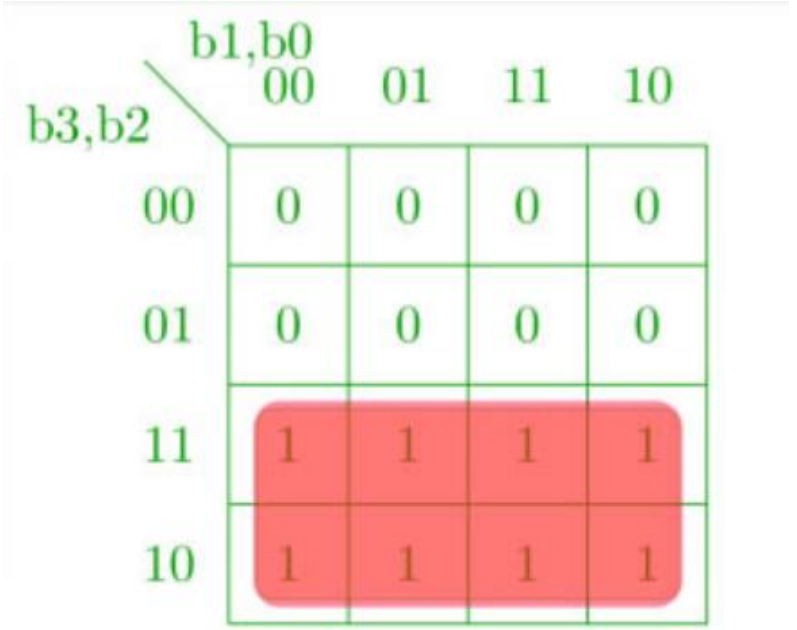
for g_2:

b3,b2 \ b1,b0	00	01	11	10
00	0	0	0	0
01	1	1	1	1
11	0	0	0	0
10	1	1	1	1

$$g_2 = b_2\overline{b_3} + \overline{b_2}b_3 = b_2 \oplus b_3$$

Binary to Gray Code

Binary				Gray Code
b_3	b_2	b_1	b_0	g_3
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	1
1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1



$$g_3 = b_3$$

Binary to Gray Code

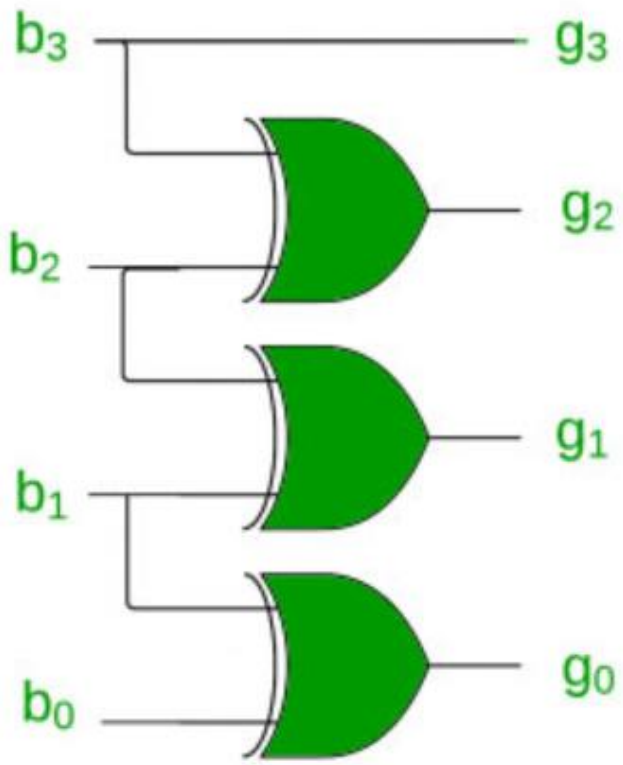
Binary				Gray Code			
b_3	b_2	b_1	b_0	g_3	g_2	g_1	g_0
0	0	0	1	0	0	0	1
0	0	1	0	0	0	1	1
0	0	1	1	0	0	1	0
0	1	0	0	0	1	1	0
0	1	0	1	0	1	1	1
0	1	1	0	0	1	0	1
0	1	1	1	0	1	0	0
1	0	0	0	1	1	0	0
1	0	0	1	1	1	0	1
1	0	1	0	1	1	1	1
1	0	1	1	1	1	1	0
1	1	0	0	1	0	1	0
1	1	0	1	1	0	1	1
1	1	1	0	1	0	0	1
1	1	1	1	1	0	0	0

$$g_3 = b_3$$

$$g_2 = b_2 \oplus b_3$$

$$g_1 = b_1 \oplus b_2$$

$$g_0 = b_0 \oplus b_1$$



Gray to Binary Code

Let $b_0,\ b_1,\ b_2\ ,\ and\ b_3$ be the bits representing the binary numbers, where b_0 is the LSB and b_3 is the MSB, and

Let $g_0,\ g_1,\ g_2\ ,\ and\ g_3$ be the bits representing the gray code of the binary numbers, where g_0 is the LSB and g_3 is the MSB.

Gray to Binary Code

Gray Code				Binary			
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	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

Gray to Binary Code

Gray Code				Binary			
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	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

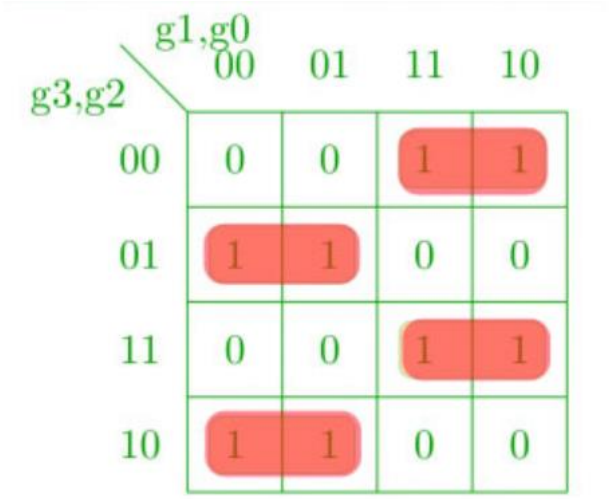
for b_0

g3,g2 \ g1,g0	00	01	11	10
00	0	1	0	1
01	1	0	1	0
11	0	1	0	1
10	1	0	1	0

$$b_0 = g_0 \oplus g_1 \oplus g_2 \oplus g_3$$

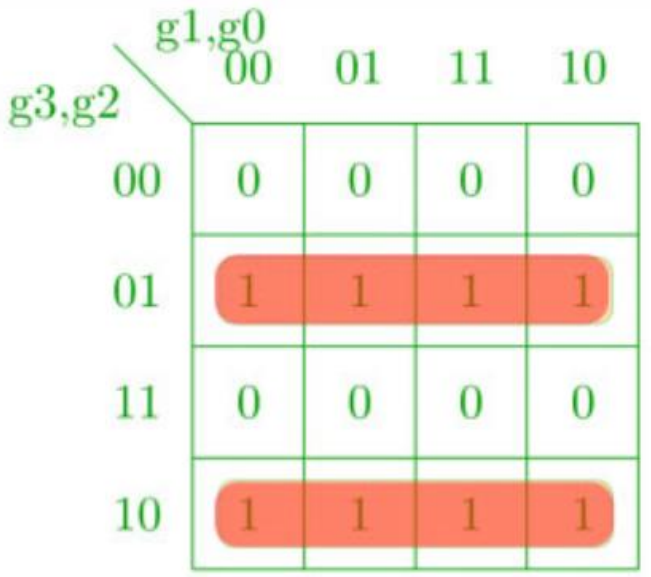
Gray to Binary Code

for b_1



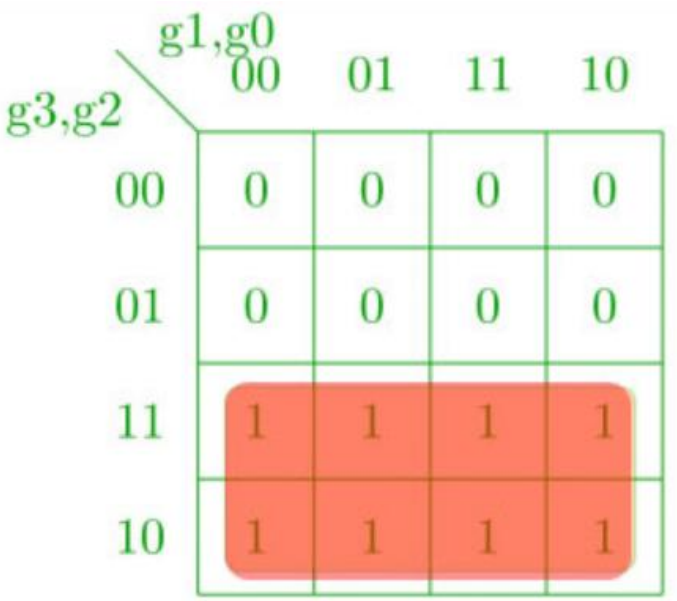
$$b_1 = g_1 \oplus g_2 \oplus g_3$$

for b_2



$$b_2 = g_2 \oplus g_3$$

for b_3



$$b_3 = g_3$$

Gray to Binary Code

$$b_3 = g_3$$

$$b_2 = g_2 \oplus g_3$$

$$b_1 = g_1 \oplus g_2 \oplus g_3$$

$$b_0 = g_0 \oplus g_1 \oplus g_2 \oplus g_3$$