

① Determine the BCC

$$G(x) = x^8 + x^5 + x^2 + x^0$$

$$P(x) = x^5 + x^4 + x^1 + x^0$$

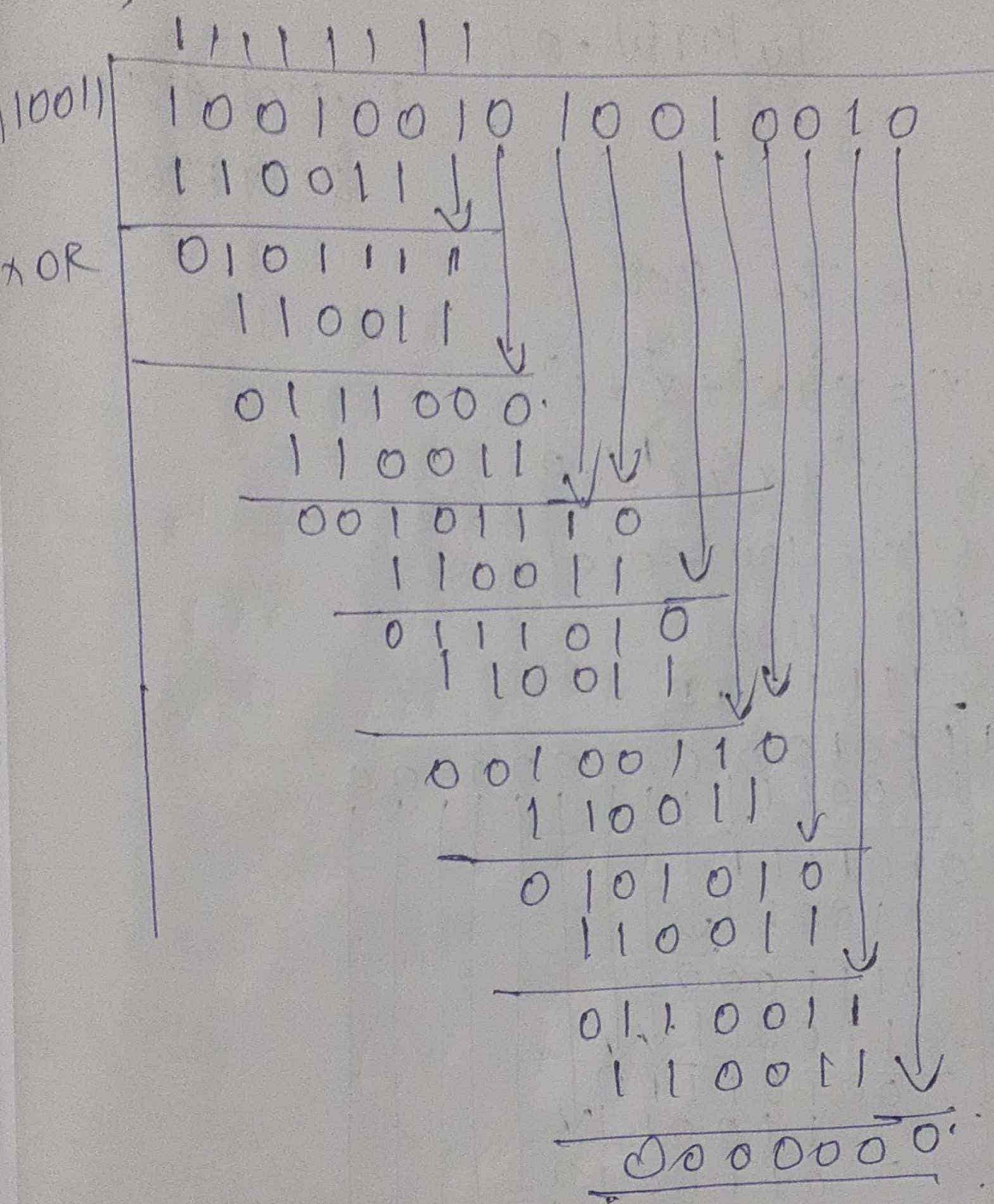
$$G(x) = 100100101$$

$$P(x) = 110011$$

$$11111111$$

110011	1001001010000000
	110011 ↓
XOR	0101111
	110011 ↓
	0111000
	110011 ↓
	00101110
	110011 ↓
	0111010
	110011 ↓
	00100100
	110011 ↓
	0101110
	110011 ↓
	0111010
	110011 ↓
	0010010

$$BCC = 1001001010010010$$



3.

~~B = 2 kHz~~ $B = 8 \text{ KHz}$

$$f_m = 104 \text{ KHz}$$

$$f_s = 106 \text{ KHz}$$

$$\Delta f = \left| \frac{f_m - f_s}{2} \right|$$

$$= \left| \frac{104 - 106}{2} \right|$$

$$= \left| \frac{-2}{2} \right|$$

$$= \frac{2}{2}$$

$$\boxed{\Delta f = 1 \text{ KHz}}$$

$$B = 2 (1 \text{ KHz} + f_b)$$

$$8 \text{ KHz} = 2 (2 \text{ KHz} + f_b)$$

$$4 \text{ KHz} = 2 \text{ KHz} + f_b$$

$$f_b = 4 \text{ KHz} - 2 \text{ KHz}$$

$$\boxed{f_b = 2 \text{ Kbps}}$$

$$2) \quad \text{Baud rate} = \frac{f_b}{N}$$

For PSK

$$N = 1 \quad = \frac{10}{3}$$

$$\boxed{\text{Baudrate} = 3.33 \text{ Mbps}}$$

$$\boxed{\text{Bandwidth} = 3.33 \text{ KHz}}$$

$$\text{Bandwidth efficiency} = \frac{\text{bit rate}}{\text{Bandwidth}}$$

$$= \frac{10}{3.33}$$

$$\frac{10}{3.33}$$

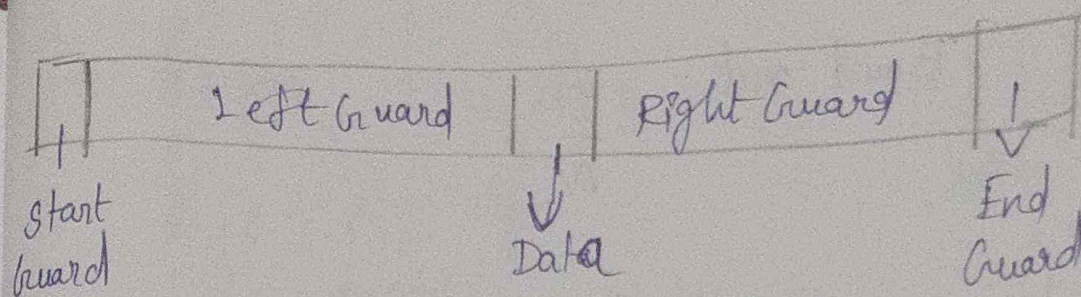
$$\frac{10}{3.33}$$

$$\boxed{\text{Bandwidth efficiency} = 3.003 \text{ bps}}$$

4) Barcode frame structure :

The barcode frame structure typically consists of several elements that encode information in a standardized format.

Here's an example of a barcode frame structure using the popular UPC-A barcode format.



- i) Start Guard: This is a specific pattern of bars and spaces that indicates the beginning of the barcode. It helps barcode scanner identify and synchronize with the barcode data.
- ii) Left Guard: This is another pattern of bars and spaces that serves as a reference point for the scanner. It separates the start guard from the data section.
- iii) Data: The data section of the barcode. Contains the encoded information itself. In the case of UPC-A, it consists of 12-digits that represent the manufacturer identification number, the product code and a check digit of error detection.
- iv) Right Guard: Similar to the left guard, the right guard is a pattern of bars and spaces that marks the end of the data section.
- v) End Guard: This is the final pattern of bars and spaces that signifies the end of the barcode. It helps scanners know when they have completed reading the barcode.