Cairo University
Faculty of Engineering
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ELC325b-3
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Sheet 7
Passband Transmission

Consider an M-ary Amplitude Shift Keying (M-ary ASK) where the input symbol modulates the amplitude of the carrier as follows

$$S_i(t) = a_i\sqrt{E_o} \times \sqrt{\frac{2}{T}}\cos(2\pi f_c t) \quad , 0 \le t \le T,$$
$$i = 1,2, \dots M, \qquad a_i = \pm 1, \pm 3, \pm 5, \dots$$

The Modulation- Demodulation of an M-ary ASK is shown in Figure 1

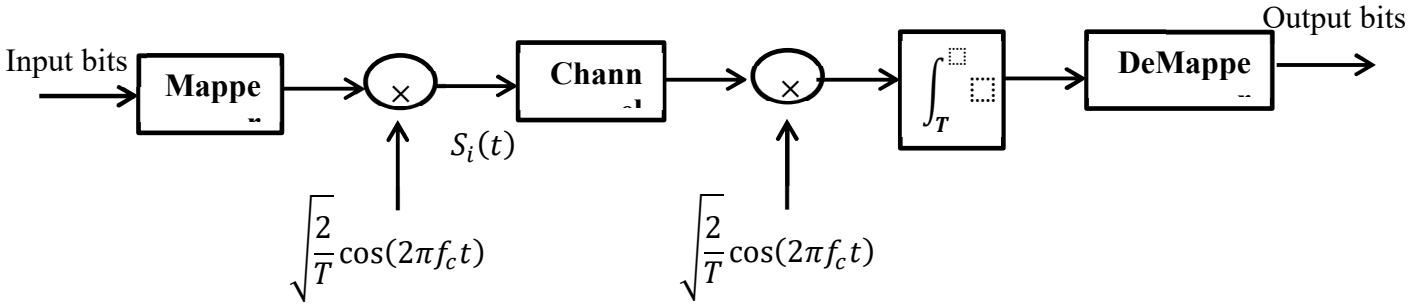


Figure 1: Modulation/Demodulation

The modulation under consideration is the 8-ASK. Figure 2 shows the signal constellation of the modulation schemes

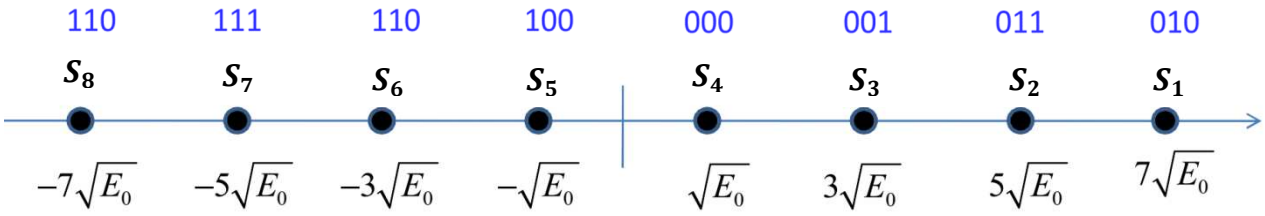


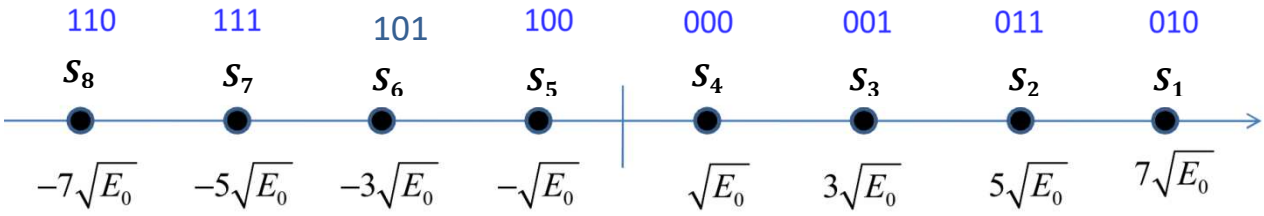
Figure 2: 8-ASK Modulation

1- Sketch the constellation of the 8-ASK in Figure 2 with the decision regions of each symbol marked.

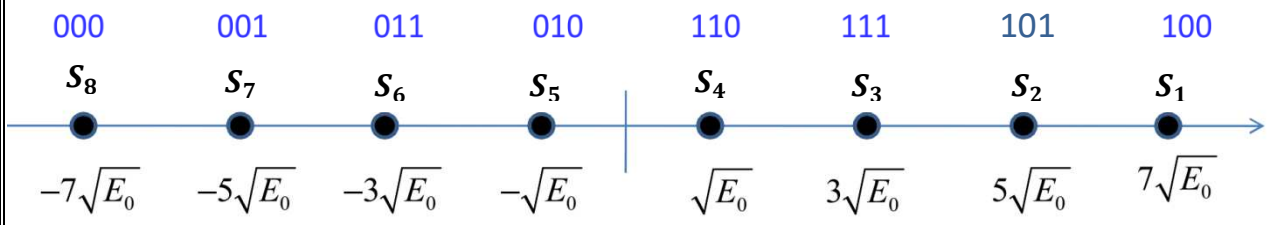
2- Derive the theoretical Bit Error Rate

3- You are designing a system that uses M-ary ASK. The required bit rate is 1Mbps and the available BW is 0.5 MHz centered at a carrier frequency 5 MHz. Knowing that the bandwidth of a passband modulation is twice the symbol rate (i.e. $2R_s$), Can you use a 8-ary ASK? Why? What is the minimum M (in M-ary ASK) that satisfies the bit rate and bandwidth requirement?

4- Which of the following bit to symbol assignment satisfies the Gray Encoding criterion? And Why?



Bit to symbol assignment 1



Bit to symbol assignment 2