

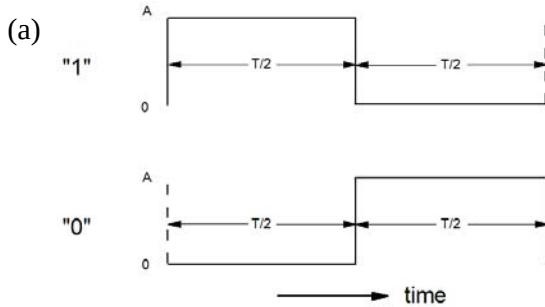
Name: _____

Student Number: _____

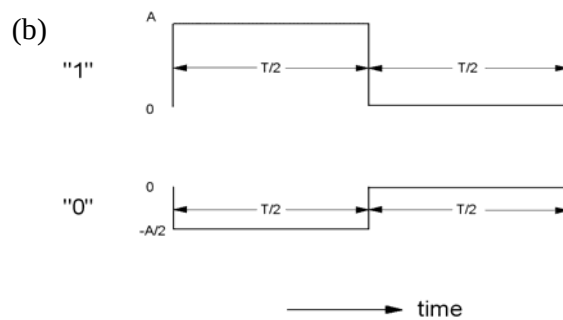
EE3101 Communication Engineering

Quiz 1a [16 marks]

- (1) Consider to use the following waveforms to represent binary "1" and binary "0". Assume that T is the bit duration. In translating the binary data into impulses for power spectral density calculation, can we use single discrete impulse with amplitudes A and $-A$ to represent "1" and "0" respectively? Why? If your answer is negative, suggest suitable and simple impulses to represent "1" and "0".



[4 marks]



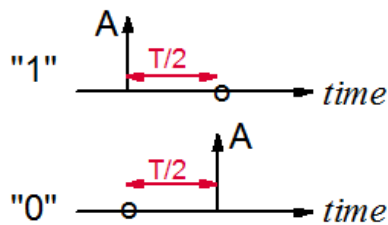
[3 marks]

- (a) No

1 mark

If the pulse response for the +ve impulse is correct, then it is not correct for the -ve impulse; and vice versa.

1 mark



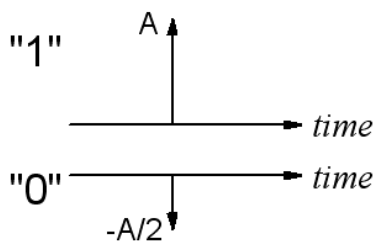
2 marks

- (b) No

1 mark

If the pulse response for the +ve impulse is correct, then it is not correct for the -ve impulse; and vice versa.

1 mark



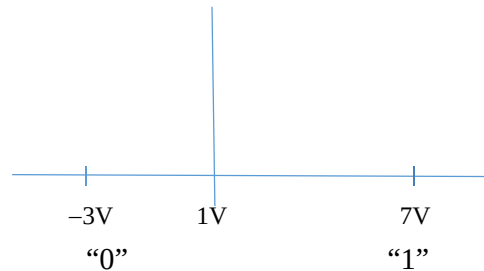
1 mark

- (2) Consider a receiver of a binary system. The mean signal levels at the threshold comparator input are -3V and $+7\text{V}$ for “0” and “1” signals respectively. The threshold is set at 1V and the rms of the AWGN (i.e. σ) at the threshold comparator input is 3V . Assume that the probability of “0” and “1” are 0.4 and 0.6 respectively. The probability of bit error is:

$$P_B = 0.4Q(a) + bQ(c)$$

where $Q(x)$ is the Q function. Determine the values of a , b , and c .

[6 marks]



$$P_B = Q\left(\frac{d_1}{\sigma}\right) 0.4 + Q\left(\frac{d_2}{\sigma}\right) \text{Prob}(1)$$

$$d_1 = 1 - (-3) = 4$$

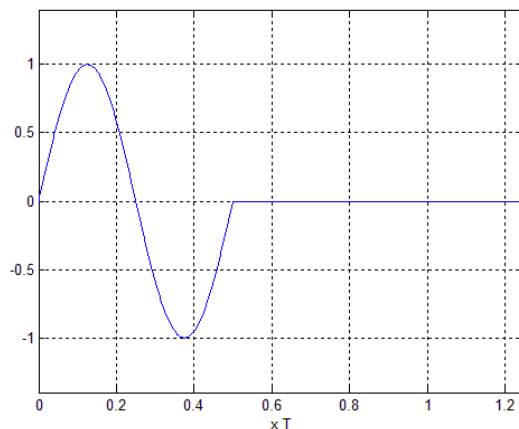
$$d_2 = 7 - 1 = 6$$

$$\text{i.e. } P_B = Q\left(\frac{4}{3}\right) 0.4 + Q\left(\frac{6}{3}\right) 0.6$$

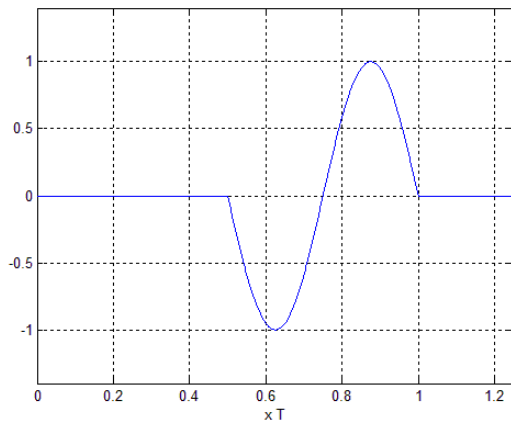
$$a = \frac{4}{3}, b = 0.6, c = 2$$

2 marks each, 6 marks total

- (3) Sketch the impulse response of an ideal matched filter which samples at T for the following received signal. Mark down the time axis of the impulse response clearly. [3 marks]



Impulse response $h(t)$



Correct shape

Mark X-axis correctly on $\sim T/2$ & T

Note that the amplitude in Y-axis is not important

2 marks

1 mark

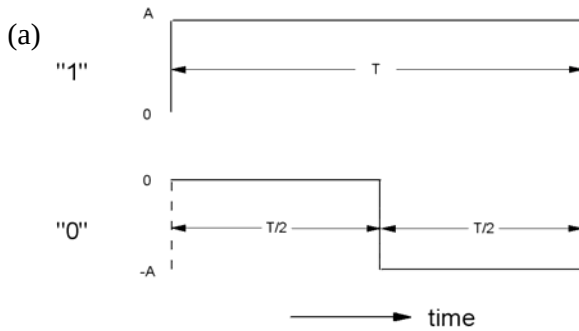
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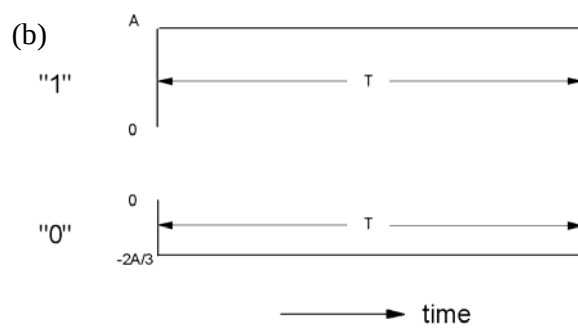
EE3101 Communication Engineering

Quiz 1b [16 marks]

- (1) Consider to use the following waveforms to represent binary "1" and binary "0". Assume that T is the bit duration. In translating the binary data into impulses for power spectral density calculation, can we use single discrete impulse with amplitudes A and $-A$ to represent "1" and "0" respectively? Why? If your answer is negative, suggest suitable and simple impulses to represent "1" and "0".



[4 marks]



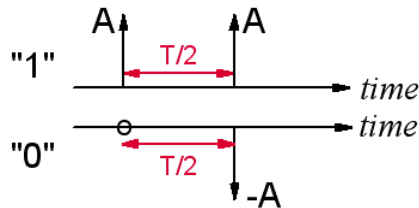
[3 marks]

- (a) No

1 mark

If the pulse response for the +ve impulse is correct, then it won't be correct for the -ve impulse; and vice versa.

1 mark



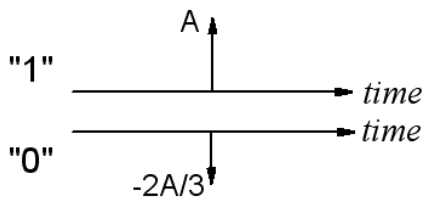
2 marks

- (b) No

1 mark

If the pulse response for the +ve impulse is correct, then it won't be correct for the -ve impulse; and vice versa.

1 mark



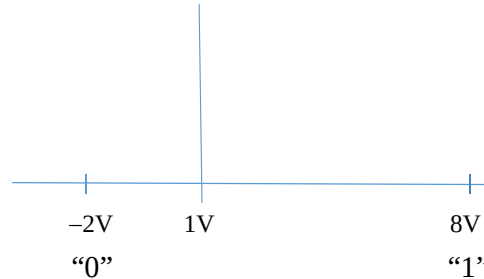
1 mark

- (2) Consider a receiver of a binary system. The mean signal levels at the threshold comparator input are -2V and $+8\text{V}$ for “0” and “1” signals respectively. The threshold is set at 1V and the rms of the AWGN (i.e. σ) at the threshold comparator input is 2V . Assume that the probability of “0” and “1” are 0.3 and 0.7 respectively. The probability of bit error is:

$$P_B = 0.3Q(a) + bQ(c)$$

where $Q(x)$ is the Q function. Determine the values of a , b , and c .

[6 marks]



$$P_B = Q\left(\frac{d_1}{\sigma}\right) 0.3 + Q\left(\frac{d_2}{\sigma}\right) \text{Prob}(1)$$

$$d_1 = 1 - (-2) = 3$$

$$d_2 = 8 - 1 = 7$$

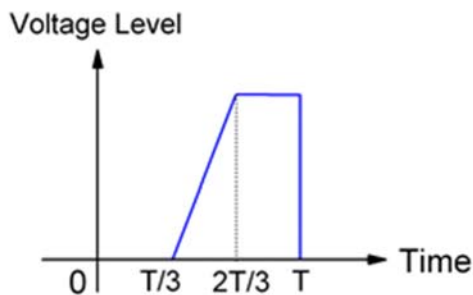
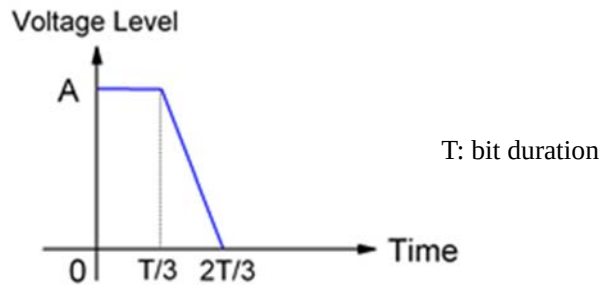
$$\text{i.e. } P_B = Q\left(\frac{3}{2}\right) 0.3 + Q\left(\frac{7}{2}\right) 0.7$$

$$a = \frac{3}{2}, b = 0.7, c = \frac{7}{2}$$

2 marks each, 6 marks total

- (3) Sketch the impulse response of an ideal matched filter which samples at T for the following received signal. Mark down the time axis of the impulse response clearly.

[3 marks]



Correct shape

Mark X-axis correctly on $T/3$ & T

Note that the amplitude in Y-axis is not important

2 marks

1 mark