

ITS 323 – QUIZ 2 (CS) ANSWERS

First name: _____ Last name: _____

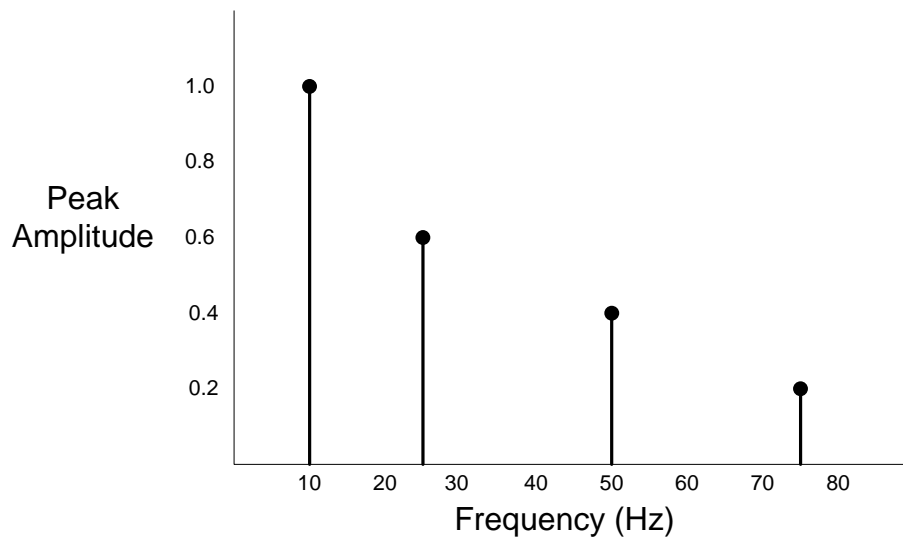
ID: _____

Total Marks: _____

out of 8.5

Question 1 [1 mark]

a) What is the bandwidth of the signal shown in the figure below?



Answer: 65 Hz

b) How long does it take to send out a single character (8 bits), if the device sending rate is 1000 b/s?

Answer: 8 ms

Question 2 [3 marks]

Encoding scheme A maps the following signal levels into sequences of bits:

Signal Level (volts)	Bit sequence
+7	000
+5	001
+3	010
+1	011
-1	100
-3	101
-5	110
-7	111

- a) For the encoding scheme *A*, what is the maximum data rate that can be achieved in a 1MHz noise-free channel?

Answer:

$$\begin{aligned} \text{Nyquist: } C &= 2B \log(M) \\ &= 2 \times 1\text{MHz} \log(8) \\ &= 6\text{Mb/s} \end{aligned}$$

- b) If a second encoding scheme *B* mapped a signal level to a sequence of 5 bits, how many signal levels would be needed?

Answer: 32

- c) What is an advantage of encoding scheme *A*, compared to encoding scheme *B*?

Answer: Less chance of errors

Question 3 [2.5 marks]

Consider a channel with a 1MHz bandwidth and an SNR of 63.

- a) What is the upper limit to the data rate that the channel can carry?
 b) The result of part (a) is the upper limit. However, as a practical matter, better error performance will be achieved at a lower data rate. Assume we choose a data rate of $2/3$ the maximum theoretical limit. How many signal levels are needed to achieve this data rate?

Answer:

a. Shannon: $C = B \log(1 + \text{SNR})$
 $= 1\text{MHz} \log(64)$
 $= 6\text{Mb/s}$

b. Nyquist: $C = 2B \log(M)$

We know $C = 2/3 \times 6\text{Mb/s} = 4\text{Mb/s}$, therefore we can find *M*:

$$\begin{aligned} 2/3 \cdot 6\text{Mb/s} &= 2B \log(M) \\ 2 \times 10^6 &= B \log(M) \\ \text{Log } M &= 2 \\ M &= 4 \end{aligned}$$

Question 4 [2 marks]

True or false (select the most appropriate answer):

- a) The best method for encoding digital data onto a digital signal is to map 1's to a high voltage and map 0's to a low voltage.

T / F

b) According to the free space loss equation, an increase in transmit antenna gain will increase the amount of power lost between transmitter and receiver.

T / F

c) Providing higher quality shielding on copper cables (e.g. Shielded Twisted Pair, as opposed to Unshielded Twister Pair) increases the data rate and cost of the cable.

T / F

d) Satellite microwave transmission has a much larger delay than terrestrial microwave transmission because of the data rate on satellite links is typically less than terrestrial microwave.

T / F

Answers:

F; F; T; F