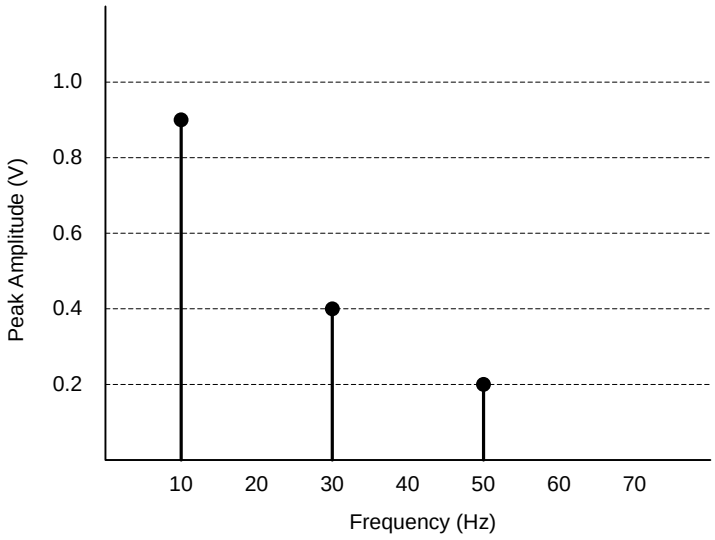
ITS 323 – QUIZ 2 ANSWERS

First name: _____ Last name: _____

ID: _____ Total Marks: _____
out of 10

Question 1 [3 marks]

Below is a frequency domain plot of a communications signal *s(t)*.



a) What is the bandwidth of the signal *s(t)*? (½ mark) _____

b) What is the frequency of the signal *s(t)*? (½ mark) _____

c) Write a time domain equation for the signal *s(t)*? (1 mark)

s(t) = _____

d) If using signal *s(t)*, two bits of information can be sent in one period, what is the maximum data rate? (1 mark)

Answers:

a. 40Hz

b. 10Hz

c. s(t) = 0.9 sin (2πt x 10) + 0.4 sin (2πt x 30) + 0.2 sin (2πt x 50)

d. T (period) = 0.1sec, therefore data rate = 20 bits per second

Question 2 [1 mark]

Consider a communications link with a signal-to-noise ratio of 31. What bandwidth would be required to transmit at the maximum theoretical data rate of 1Mb/s?

Answer

Using Shannon's theorem we know: $C = B \log (1 + SNR)$

Hence, $1Mb/s = B \log (1 + 31)$, therefore $B = 200kHz$.

Question 3 [2 marks]

Assume you are using the free space loss equation to design a wireless link from one building to another (separated by 1km). The wireless receiver has a fixed receiver power threshold.

$$\frac{P_t}{P_r} = \frac{(4\pi d)^2}{G_t G_r \lambda^2} \text{ where } G = \frac{4\pi A}{\lambda^2}$$

After initial testing, although you have line-of-sight, you determine the received signal is two weak to communicate between buildings. List two approaches you can use to improve your design to a stronger link between buildings.

Answer

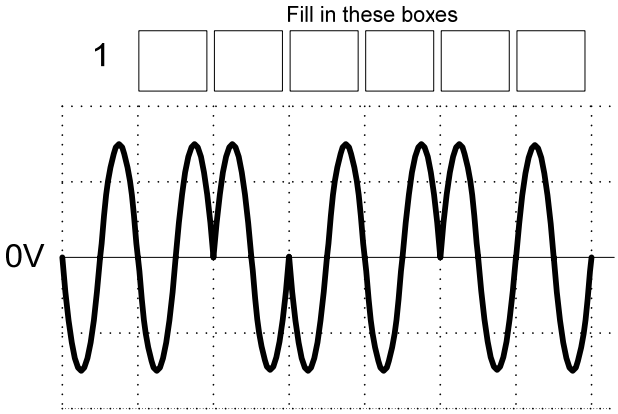
Increase the transmit power.

Increase the antenna gains, by increasing the size of the antennas.

Decrease the wavelength of the signal, by using a higher frequency transmission system.

Question 4 [1.5 marks]

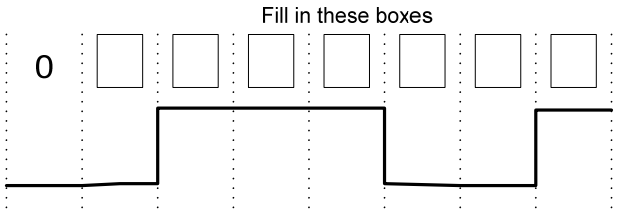
The following diagram shows part of a signal which modulates data using Binary Phase Shift Keying. The vertical dashed lines show the transitions between each bit. Complete the boxes to show the data transmitted.



Answer: 101100

Question 5 [1.5 marks]

If the Non-Return-to-Zero Invert on ones (NRZI) encoding scheme is used, complete the bit pattern that the following signal represents. (That is, fill in the boxes).



Answer: 0100101

Question 6 [1 mark]

a) A signal element takes 10μs to transmit. Each signal element encodes 3 bits of data. What is the data rate?

Answer: _____

b) True or false: 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. True / False

Answer:

a. 300kb/s

b. False. The delay in satellite transmission is typically due to propagation time (distance). The data rate in satellite links is often similar to or higher than terrestrial microwave.