Principles of Data Communication [ICT 2156]

Tutorial Questions-1

Date: September 28, 2021

Q1: Represent the following signal in frequency domain. Explain the nature of the graph so formed.

Signal, s(t)=1, -X/2 ≤ t ≤ X/2

Q2: Represent the following signal in time and frequency domains.

	Sine Wave 1	Sine Wave 2	Sine wave 3	Sine Wave 4
Amplitude (volts)	1	10	5	8
Frequency (Hz)	8	2	1	5
Phase (rad)	$\pi/2$	π	0	0

Q3: We have a channel with a 1-MHz bandwidth. The SNR for this channel is 63. What are the appropriate bit rate and signal level?

Q4: Show a sine wave with: (a) frequency = 12Hz (b) period = 0.1667 second.

Q5: A composite signal consists of 3 signals with peak amplitudes of 5V, 3V, and 2V respectively. The frequencies of the signals are 2Hz, 4Hz and 16Hz respectively. Calculate the bandwidth of the composite signal.

Q6: A periodic signal has a bandwidth of 20 Hz. The highest frequency is 60 Hz. What is the lowest frequency? Draw the spectrum if the signal contains all frequencies of the same amplitude.

Q7: Repeat last class's problem (relationship between data rate and bandwidth) with BW= 2MHz.

Q8: A digital signal has eight levels. How many bits are needed per level?

Q9: To download a text document (24 lines per page, 80 characters per line, 8 bits per character) at the rate of 100 pages per minute, what is the required bit rate of the channel?

Q10: Given a receiver with an effective noise temperature of 294 K and a 10-MHz bandwidth, what is the thermal noise level at the receiver's output in decibel-watts? (Boltzmann's constant, k = 1.38 * 10-23 J/K)

Q11: The power of a signal is 10 mW and the power of the noise is 1 µW; what are the values of SNR and SNR_{dB}?

Q12: Suppose that the spectrum of a channel is between 3 MHz and 4 MHz and SNR_{dB} =24dB. Based on Nyquist's formula, how many signaling levels are required?