CSE316
Assignment 4 Solutions

Chapter - 3

Problems: Q3-2, Q3-4, Q3-5, Q3-7, Q3-10, P3-3, P3-5, P3-9, P3-27, P3-29

Q3-2.

a. The *amplitude* of a signal measures the value of the signal at any point.

b. The *frequency* of a signal measures how may times the signal repeats itself in a second.

c. The *phase* of a signal represents the position of the signal with respect to time 0.

Q3-4. *Attenuation* and *noise* are two out of three causes of transmission impairment; distortion is the third one.

Q3-5. *Baseband transmission* means sending a digital or an analog signal without modulation using a low-pass channel. *Broadband transmission* means to modulate signal using a band-pass channel.

Q3-7. The *Nyquist theorem* defines the maximum bit rate of a noiseless channel.

Q3-10. A signal is *periodic* if its frequency domain plot is discrete; a signal is *nonperiodic* if its frequency domain plot is continuous.

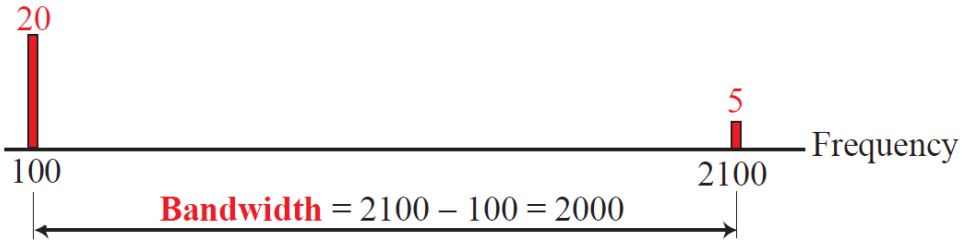
P3-3.

a. 90 degrees ($\pi/2$ radians)

b. 0 degrees (0 radians)

c. 90 degrees ($\pi/2$ radians) (Note that it is the same wave as in part *a*.)

P3-5. We know the bandwidth is 2000. The highest frequency must be 100 + 2000 = 2100 Hz. See below:



P3-9. There are 8 bits in 16 ns. Bit rate is $8 / (16 \times 10^{-9}) = 0.5 \times 10^{9} = 500$ Mbps

P3-27. We can approximately calculate the capacity as

a. $C = B \times (SNR_{dB} / 3) = 20 \text{ KHz} \times (40 / 3) = 267$ Kbps

b. $C = B \times (SNR_{dB} / 3) = 200 \text{ KHz} \times (4 / 3) = 267$ Kbps

c. $C = B \times (SNR_{dB} / 3) = 1 \text{ MHz} \times (20 / 3) = 6.67$ Mbps

P3-29. We can use the approximate formula

$$C = B \times (SNR_{dB} / 3) \text{ or } SNR_{dB} = (3 \times C) / B$$

We can say that the minimum of SNR_{dB} is

$$SNR_{dB} = 3 \times 100 \text{ Kbps} / 4 \text{ KHz} = 75$$

This means that the minimum

$$SNR = 10 \, SNR_{dB}/10 = 107.5 \approx 31{,}622{,}776$$