# Computer Networks (CS30006)
Question Bank 1

1. A periodic signal has a bandwidth of 20 Hz. The highest frequency is 60 Hz. What is the lowest frequency?

2. A digitized voice channel, is made by digitizing a 4-kHz bandwidth analog voice signal. We need to sample the signal at twice the highest frequency (two samples per hertz). We assume that each sample requires 8 bits. What is the required bit rate?

3. The loss in a cable is usually defined in decibels per kilometer (dB/km). If the signal at the beginning of a cable with -0.3 dBlkm has a power of 2 mW, what is the power of the signal at 5 km?

4. 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?

5. A network with bandwidth of 10 Mbps can pass only an average of 12,000 frames per minute with each frame carrying an average of 10,000 bits. What is the throughput of this network?

6. A periodic composite signal with a bandwidth of 2000 Hz is composed of two sine waves. The first one has a frequency of 100 Hz with a maximum amplitude of 20 V; the second one has a maximum amplitude of 5 V. What is the bandwidth?

7. A device is sending out data at the rate of 1000 bps.
   a. How long does it take to send out 10 bits?
   b. How long does it take to send out a single character (8 bits)?
   c. How long does it take to send a file of 100,000 characters?

8. What is the bit rate for the signal in Figure?

16 ns
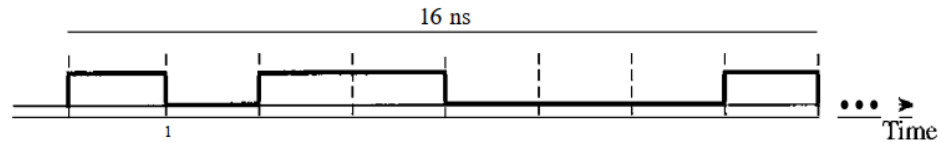
9. The attenuation of a signal is -10 dB. What is the final signal power if it was originally 5 W?

10. A line has a signal-to-noise ratio of 1000 and a bandwidth of 4000 KHz. What is the maximum data rate supported by this line?

11. We measure the performance of a telephone line (4 KHz of bandwidth). When the signal is 10 V, the noise is 5 mV. What is the maximum data rate supported by this telephone line?

12. What is the transmission time of a packet sent by a station if the length of the packet is 1 million bytes and the bandwidth of the channel is 200 Kbps?

13. Draw the graph of the Manchester scheme using each of the following data streams, assuming that the last signal level has been positive.
   a. 00000000
   b. 11111111
   c. 01010101
   d. 0011001

14. Draw the graph of the Differential Manchester scheme using each of the following data streams, assuming that the last signal level has been positive.
   a. 00000000
   b. 11111111
   c. 01010101
   d. 0011001

15. Calculate the baud rate for the given bit rate and type of modulation.
   a. 2000 bps, FSK
   b. 4000 bps, ASK
   c. 6000 bps, QPSK

16. For binary phase-shift keying, E_b/N_0 = 8.4 dB is required for a bit error rate of 10-4 (1 bit error out of every 10,000). If the effective noise temperature is 290 K (room temperature) and the data rate is 2400 bps, what received signal level is required?

17. Given the narrow (usable) audio bandwidth of a telephone transmission facility, a nominal SNR of 56 dB (400,000), and a certain level of distortion
    a. What is the theoretical maximum channel capacity (kbps) of traditional telephone lines?
    b. What can we say about the actual maximum channel capacity?

18. For the 11-bit binary string 01001100011, what are the number of transitions for the encoding scheme: a) Manchester b) Differential Manchester

19. Suppose there is exactly one packet switch between a sending host and a receiving host. The transmission rates between the sending host and the switch and between the switch and the receiving host are $R1$ and $R2$, respectively. Assuming that the switch uses store-and-forward packet switching, what is the total end-to-end delay to send a packet of length L? (Ignore queuing, propagation delay, and processing delay.)

20. How long does it take a packet of length 1,000 bytes to propagate over a link of distance 2,500 km, propagation speed 2.5 · 108 m/s, and transmission rate 2 Mbps? More generally, how long does it take a packet of length L to propagate over a link of distance d, propagation speed s, and transmission rate R bps? Does this delay depend on packet length? Does this delay depend on transmission rate?