Department of Computer Science – York University

Assignment 1

COSC 3213 – Communication Networks

Fall 2011

Chapters 1 and 2

1. What are the advantages of designing protocols using a layering approach? What are the disadvantages?

2. What are the similarity(ies) and difference(s) between TCP and UDP?

3. Suppose an application layer entity wants to send an *L*-byte message to its peer process, using an existing TCP connection. The TCP segment consists of the message plus 20 bytes of header. The segment is encapsulated into an IP packet that has an additional 20 bytes of header. The IP packet in turn goes inside an Ethernet frame that has 18 bytes of header and trailer. What percentage of the transmitted bits in the physical layer correspond to message information, if L = 100 bytes, 500 bytes, 1000 bytes?

4. Consider the example "Browsing a Homepage" given in the notes of the first lecture. Sketch the sequences of TCP segments, IP packets and Ethernet and PPP frames that are generated by the three examples of packet transfers:

   (a) from the workstation to the server

   (b) from the server to the PC

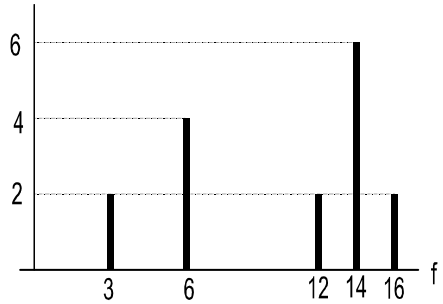
   (c) from the PC to the workstation.

   Include all relevant header information in the sketch.

5. Suppose a computer is moved from one department to another. Does the physical address need to change? Does the IP address need to change? Does it make a difference if the computer is a laptop?

Chapter 3

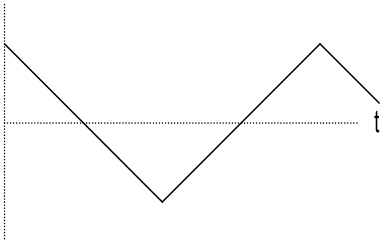
6.



Given the frequency-domain graph above, answer the following:

(a) What is the frequency spectrum?
(b) What is the bandwidth?
(c) Write the series of sine waves that represents this signal. Assume that all sine waves have a phase of 0.

7. A triangle wave has the following shape:



This wave can be generally represented by the Fourier series

$$\sum_{k=0}^{\infty} \frac{1}{(2k+1)^2} \sin(2\pi(2k+1)f_1 t + \frac{\pi}{2})$$

where f_1 is the fundamental frequency of the wave.

(a) What is the bandwidth of this signal? Assume that f_1 = 1MHz.

(b) If the signal can be closely approximated with the first 3 terms of the series, what is the effective bandwidth of this signal?

(c) Sketch the frequency-domain graph of the approximated signal.

8. The Fourier series for a particular signal is represented by the following summation:

$$\sum_{k=1}^{\infty} \frac{1}{k} \sin(2\pi \frac{k-1}{k} f_0 t)$$

where f_0 is a fixed frequency.

a) What is the bandwidth of this signal? Assume that f_0 = 2MHz.

b) Assume that we approximate this signal with the first 3 terms of this series. What is the bandwidth of the approximated signal?

c) Sketch the frequency-domain graph of the approximated signal.

9. "CAT-5" twisted-pair cable has a bandwidth of roughly 100MHz. We would like to transmit information at a bit rate of 500Mbps. Is a signal-to-noise ratio of 30dB enough to reliably transmit this much information? Why or why not?

10. What is the maximum capacity of a medium with a bandwidth of 750 KHz and a signal-to-noise ratio of 30dB?

11. What is the minimum signal-to-noise ratio, in decibels, that must be maintained in order to transmit a 600Kbps signal over a medium with a bandwidth of 20,000Hz?

12. For each of the following sine waves identify the amplitude, frequency and phase-shift:
    a) $3\sin(2\pi 5t + \frac{\pi}{2})$
    b) $\sin(4t + \pi)$
    c) $\sin(t)$

13. We are given a medium that will reliably transmit frequencies between 0 and 25,000Hz. Is it possible to transmit 200Kbps of information along this line? If so, then describe a method and any conditions that must be satisfied. If not, explain why.

Chapter 5

14. Problems 5.6, 5.7, 5.8, 5.9 in the textbook.