UNIVERSITY OF CALIFORNIA, LOS ANGELES

*CS M117*

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**Home Work # 1** (Due 01/16/13)

(HW and solutions must be typed)

**Section A**

**(T, Chapter 1; pg. 1-54)**

**Communication Networks**

**1.** (2) What are two reasons for using layered protocols?

When we are separating different layers, each layer will implement its functionality and will not affect the rest of the system if there is a failure in it. Therefore, modularization will be easier for (1) maintenance and (2) updating of the system without affecting the rest of the system.

2. (2) What is the principal difference between connectionless communication and connection-oriented communication?

Connectionless communication do not need to setup a connection before date gets sent, while connection-oriented communication needs acknowledgement between two hosts in order to exchange data in between. So, connectionless is rather unsafe but faster than the other because the host does not need the time to setup the connection between but it is difficult to manage between two peers.

3. Which of the OSI layers handles each of the following?

(a) (1) Dividing the transmitted bit stream into frames.

(b) (1) Determining which route through the subnet to use.

(a) Link layer

(b) Network layer

4. (2) A system has an n-layer protocol hierarchy. Applications generate messages of length M bytes. At each of the layers, an h-byte header is added. What fraction of the network bandwidth is filled with headers?

Initial size = M bytes

Header for n Layers= h\*n bytes

Total size = M + nh

Fraction of the bandwidth= nh/ M+nh

5. (2) List two ways in which the OSI reference model and the TCP/IP reference model are the same, now list two ways in which they differ.

**Section B**

**Difference:** OSI reference model has added two more layers within application, presentation and session into the original TCP/IP reference model. Presentation allows applications to interpret meaning of data for different purposes. Session has higher level of security and checks for recovery of data.

**Similarity:** They both utilize the same layers for the architecture, i.e. Application, Transport, Network, Link and Physical layer. They both encrypt data before it passes onto the other layer.

Amplitude Modulation and Frequency Modulation

A rectangular waveform signal has a value of +*A* for some continuous interval during the period (the “mark”), and has a value of ‑*A* for the remainder of the period (the “space”). The “duty cycle” *d* of the rectangular wave is defined as the length of the positive interval divided by the period.

**1)** The effective amplitude spectrum of a signal is built from the RMS voltages of each frequency represented in the Fourier series for that signal.

**(a)** (1) If the amplitude of square wave signal is *Amax* = 4V, and frequency is *f* ; draw the effective amplitude spectra (through the 8th harmonic) for functions.

**(b)** (1) If the amplitude of sinusoidal wave signal is *Amax* = 4V and frequency is *f*; draw the effective amplitude spectra.



2). (2) The carrier signal *Sc*(*t*) = *Ac*cos( 2*fct* ) is amplitude modulated by a baseband square wave signal *Sm*(*t*) with amplitude *Am* = *Ac* (varies between +*Ac* and ‑*Ac*) and frequency *fm*. Write the Fourier series for the modulated signals *S*(*t*), for DSBTC AM (where the baseband DC offset is equal to +*Ac*) and DSBSC AM. Include the AM constructional coefficient KAM.



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| DSBTC: |
| DSBSC: |

3) (1) Write the formula (using Bessel functions) for the frequency modulated signal when the baseband signal is *Sm*(*t*) = *Am*sin( 2*fmt* ) and the carrier modulated signal is:





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4) (2) Write the formula for the frequency modulation index *kf* with baseband signal *Sm*(*t*) = *Am*cos( 2*fmt* ), and calculate *kf* when *Am* = 4V, *fm* = 1000 Hz and KFM = 2 x 340.



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5) (2) Using the formula obtained in question (3) above and the Bessel function table given in the course reader, calculate and plot the power spectrum (amplitudes and frequencies) for the frequency modulated signal with a sinusoidal carrier signal (*Ac* = 4V and *fc* = 25 kHz) and a sinusoidal baseband signal (*Am* = 3V and *fm* = 1000 Hz). Assume the generator has FM constructional coefficient KFM = 2 x 340. Use these figures as the theoretical prediction in Part D of the experiment.





6) (1) What is a useful approximation for the bandwidth of an FM signal in terms of *kf* and the bandwidth of the baseband signal?

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