March 24, 2002

COMPUTER ENGINEERING DEPARTMENT

COE 342

DATA & COMPUTER COMMUNICATIONS

Major Exam I

Second Semester (012)

Time: 6:30-8:30 PM

Student Name : _____

Student ID. : _____

Question	Max Points	Score
Q1	10	
Q2	45	
Q3	20	
Q4	10	
Q5	15	
Total	100	

Dr. Aiman El-Maleh

[10 Points]

(Q1) Determine in which of the OSI layers, each of the following functions is performed:

- Ordered delivery of data with no loss or duplication
- Node-to-node error-free transmission
- Bit transmission
- Route determination of packets
- Translation between character formats
- Fragmentation and reassembly of messages
- Data compression and encryption
- File transfer program
- Dialogue discipline i.e., half duplex or full-duplex transmission
- Optimizing the use of network services

[45 Points]

(Q2) Indicate whether the following is true or false, and if it is false **correct** it:

(1) (True, False) A CODEC performs the same function of a modem.

(2) (True, False) The Internet protocol architecture has been designed according to the OSI model.

(3) (True, False) As a protocol data unit is passed from layer n+1 to layer n, the header of layer n+1 is modified by the protocol of layer n before passing it to layer n-1.

(4) (True, False) Combining several signals for transmission on a shared medium is called modulation.

(5) (True, False) If the bandwidth of a signal is 5 KHz, and the highest frequency is 52 KHz, the lowest frequency is 5 KHz.

(6) (True, False) When one of the signal components has a frequency of zero, then the average amplitude of the signal is 0.

(7) (True, False) The bit error rate (BER) for digital data is an increasing function of Eb/No.

(8) (True, False) As frequency increases, the period decreases and the wavelength increases.

(9) (True, False) Loss or attenuation is a decreasing function of frequency.

(10) (True, False) Routers and Bridges perform exactly the same function.

(11) (True, False) Nyquist theorem states that given a bandwidth of B, then the highest bit rate that can be carried is 2B.

(12) (True, False) Thermal noise is uniformly distributed over all frequencies.

(13) (True, False) Analog signal can be used to carry digital data and digital signal can be used to carry analog data.

(14) (True, False) The effective bandwidth of a signal is the width of the signal spectrum.

(15) (True, False) If the time for a single bit is 0.001 ms, then the bit rate is 1 Mbps.

(16) (True, False) The sine wave $s(t) = \sin(2\pi ft - \frac{\pi}{2})$ is equal to the sine wave $-\sin(2\pi ft)$.

(17) (True, False) The sine wave $\sin(\pi t)$ has a frequency 4 times larger than the sine wave $\sin(4\pi t)$.

(18) (True, False) The frequency-domain function of a periodic signal is continuous and has nonzero values indefinitely.

(19) (True, False) Suppose that each pixel in an image represents 256 different intensity levels. To download an 800x600 pixel image over a 56 Kbps telephone line takes 68.57s .

(20) (True, False) Much of the energy in speech is concentrated at the lower frequencies, and frequencies beyond 600-700Hz add very little to the intelligibility of speech to the human ear.

(21) (True, False) The bandwidth of the signal $s(t) = 1 + \frac{4}{\pi}\left[\sin(2000\pi t) + \frac{1}{3}\sin(6000\pi t)\right]$ is 2000 Hz.

(22) (True, False) The period of the signal $s(t) = 1 + \frac{4}{\pi}\left[\sin(2000\pi t) + \frac{1}{3}\sin(6000\pi t)\right]$ is 0.5 ms.

(23) (True, False) The use of excessive signal strength causes unwanted coupling between signal paths.

(24) (True, False) Intersymbol interference is caused by attenuation distortion.

(25) (True, False) If the ratio of the power in a signal to the power contained in noise is 100, then the $(SNR)_{dB}$ is equal to 2 dB.

(26) (True, False) If the signal voltage is attenuated during transmission by 2 dB, the signal voltage at the output is almost 0.8 the signal voltage at the input.

(27) (True, False) A signal with power equal to 1 Watt and energy per bit equal to 1uJ has a data rate equal to 1 Kbps.

(28) (True, False) In the TCP/IP protocol suite, it is possible for applications to skip the services of TCP and make use of IP directly.

(29) (True, False) Sending packets using virtual circuits is more efficient and more reliable than using Datagram.

(30) (True, False) Stop-and-wait procedure is an error control procedure in which after each PDU is sent, the transmitter waits for a specified period of time before the next PDU is sent.

[20 Points]

(Q3)

a. Signals suffer from transmission impairments including attenuation, attenuation distortion, and delay distortion. Briefly describe each of these impairments.

b. Noise is one of the major transmission impairments affecting a transmitted signal. Describe the different types of noise that may exist in a transmission system.

c. Amplifiers, repeaters, and equalizers are transmission devices used to correct the effect of various types of transmission impairments. Briefly explain when such devices are used.

d. List four advantages of digital transmission over analog transmission.

[10 Points]

(Q4)

a. Plot the signal $s(t) = 2\left[\sin(\pi t - \frac{\pi}{2})\right]$ in time domain from t=0 to 4 sec.

b. Plot the signal $s(t) = 1 + \frac{4}{\pi}\left[\sin(2000\pi t) + \frac{1}{3}\sin(6000\pi t) + \frac{1}{5}\sin(10000\pi t)\right]$ in frequency domain from f=0 to 6KHZ.

[15 Points]

(Q5)

a. What is the maximum bit rate that can be achieved over a voice-grade telephone line (cut-off frequency of 4KHz) if a 4-level signaling scheme is used?

b. What signal-to-noise ratio in decibels is required in order to achieve a bit rate of 9.6 Kbps over a voice grade telephone line?

c. What is the signal-to-noise ratio in decibels of a channel with a bandwidth of 10 KHz, carrying a signal of 4.5 Watts at 50^{o} C. Note that the Boltzman constant, k, $=1.38 \times 10^{-23}$ Joules/Kelvin.