**CS31006: Computer Networks**

**Spring 2017: Mid-Semester Examination**

**Time: 2 hours Marks: TBA**

**Question 1**

Select the most appropriate option (only one) for the following questions: [1x10 = 10]

1. What is the frequency of the DC component in a signal?
2. 0 (b) Between 400 – 4000 Hz
3. Between 20 Hz – 20 kHz (d) Infinite
4. Which of the following constitutes a node in a computer network?
5. A device where data originates (b) A device which routes data
6. A device where data terminates (d) All of the above
7. In the layer hierarchy as the data packet moves from the upper to the lower layers, headers are:
8. Added (b) Removed
9. Rearranged (d) Modified
10. The number of layers in the OSI model and the TCP/IP model are, respectively:
11. 6, 5 (b) 7, 4
12. 7, 6 (d) 7, 5
13. Communication between a computer and a keyboard involves what type of transmission?
14. Half-duplex (b) Full-duplex
15. Simplex (d) None of the above
16. The role of a “gateway” is to connect:
17. A router to a switch (b) A PC to another PC
18. A router to an end-device (d) A network to another network
19. Which of the following services belong in the “deep” web?
20. Profiles on Twitter (b) Videos of a music channel on Youtube
21. Emails on Gmail (d) None of these
22. Which of the following properties of a typical network makes the role of the data link layer important?
23. Distortions (b) Limited bandwidth
24. High delay (d) All of the above
25. Which of the following guided transmission media allow/s two devices to share the medium?
26. Point-to-point (b) Multi-point
27. Both (a) and (b) (d) None of these
28. The following is a list of potential metrics to measure the quality of a network.
29. Quality of Service (QoS) (2) Quality of Transmission (QoT)
30. Quality of Experience (QoE) (4) Quality of Reception (QoR)

Which of the above metrics are used in practice?

1. (1) and (2) (b) (2) and (4)
2. (2) and (3) (d) (1) and (3)

**Question 2**

Answer the following questions briefly: [2x5 = 10]

1. Explain briefly why both MAC and IP addressing schemes are required in the same network?
2. Is a connectionless service unreliable? Explain briefly with an example or counter-example.
3. In asynchronous transmission, explain framing error with an example.
4. Define the following terms: (i) Absolute bandwidth; (ii) Bit error rate.
5. A receiver is known to have an effective noise temperature of 294K and a bandwidth of 10 MHz. What is the thermal noise level at the receiver output? [Boltzmann constant = 1.38 x 10-23]

**Question 3**

Answer the following questions:

1. Explain briefly, with diagrams, the relation between bit rate and symbol (baud) rate. [2]
2. How does differential Manchester encoding differ from Manchester encoding? State with an example. [2]
3. A typical telephone subscriber loop has a usable audio bandwidth of 0-8000 Hz. Voice samples for digital transmission using a modem are represented in 4 bits. What is the bit rate required for the digital transport of voice? What is the permissible S/N ratio to support this bit-rate? [2+2]
4. Suppose that an 11-Mbps 802.11b LAN is transmitting 64-byte frames back-to-back over a radio channel with a bit error rate of 10−7. How many frames per second will be damaged on average? [2]

**Question 4**

1. Consider a channel with a 1-MHz capacity and an SNR of 63. [1.5x2 = 3]
2. What is the upper limit to the data rate that the channel can carry?
3. The result of part (a) is the upper limit. However, as a practical matter, better error performance will be achieved at a lower data rate. Assume we choose a data rate of 2/3 the maximum theoretical limit. How many signal levels are needed to achieve this data rate?
4. Answer the following questions with respect to video interlacing: [2x2 = 4]
5. State and illustrate the principle of video interlacing scanning.
6. Given that there are 483 lines in a TV screen, assume 60 scans per second, and width to height ratio of the TV screen as 4:3. What is the bandwidth of the video signal needed?
7. Represent the signal 11001011101 using ASK, BFSK, and BPSK. [3]

**Question 5**

1. Neatly draw the waveforms resulting from NRZ, NRZI, Manchester and AMI signaling for transmitting the bit stream "00110110". [1+1+1+1]
2. Suppose we want to transmit the message **1011 0010 0100 1011** and protect it from errors using the CRC-8 polynomial$ x^{8}+x^{2}+x^{1}+1$. [2+ (2+1)]
3. Use polynomial long division to determine the message that should be transmitted.
4. Suppose the leftmost bit of the message is inverted due to noise on the transmission link. What is the result of the receiver’s CRC calculation? How does the receiver know that an error has occurred?
5. State two types of noise encountered in communication. [1]