

CS413: Computer Networks

2005 Fall Term

Midterm Exam **Solution**

Student ID: _____

Name: _____

Problem No.	Marks	Your Marks
1	16	
2	5	
3	5	
4	7	
5	4	
6	7	
7	3	
8	3	
Total	50	

[Marking schemes are given in blue color and the answers are given in red color.]

1. Answer True or False for the following statements. [16 marks]

[T] (a) In general, the higher the frequency used, the higher the potential bandwidth and therefore the higher the potential data rate.

[T] (b) The higher the data rate, the more cost-effective is the transmission facility.

[F] (c) If the data rate of a digital signal is N bps, then a very good representation can be achieved with the bandwidth of $N/2$ Hz.

[F] (d) When the bit length of the link is greater than the frame length, multiple frames cannot be in transit at one time.

[F] (e) An Internet router connecting N subnetworks requires $N-1$ IP addresses.

[T] (f) Ethernet is a LAN so it is placed in the second layer of the OSI reference model.

[T] (g) UDP provides connectionless service and delivers packets quickly. In case of packet loss, UDP does not provide retransmission.

[F] (h) DNS is used to translate a host name to its MAC address.

[T] (i) UDP is the preferred over TCP for transferring a real-time voice over IP networks.

[F] (j) If a digital transmission system has a bit rate of 45 megabits/second, then it can carry 1500 PCM voice channels by the system.

[T] (k) Circuit switching networks require signaling and control for establishing circuits.

[F] (l) Framing is required in frequency division multiplexing.

[T] (m) T-1 carrier carries Digital Signal 1 (DS-1) that combines 24 voice channels into a digital stream.

[T] (n) One of the ways to reduce transmission delay is to use a higher-speed transmission system.

[F] (o) Jitter is one of the modern sampling techniques for producing high-quality voice.

[T] (p) Bit Error Rate (BER) increases with decreasing signal-to-noise ratio.

2. Name the seven layers defined in the ISO OSI Reference Model and state the functions of the lowest three layers. [5 marks]

[ANSWER: 0.5 mark for listing each layer and 0.5 mark for each layer description]

Layer 1: Physical – concerned with transmission of data (bits) over physical medium

Layer 2: Data Link – concerned with the reliable transfer of information across the physical link; sends blocks of data (frames) with the necessary synchronization, error control and flow control

Layer 3: Network – concerned with reliable transmission of packets from a source to destination node across networks.

Layer 4: Transport

Layer 5: Session

Layer 6: Presentation

Layer 7: Application

3. Suppose you are using a PC at home, which is connected to the Internet using a modem over a telephone communication link. The modem can transfer data at a maximum rate of 28,800 bits/sec.

(a) How long would it take to download a file (which is 1000000 bytes long) from a server your PC is connected to? [3 marks]

[-2 mark for incorrect answer and -1 for each additional mistake]

Time = Amount of Data/Transfer Rate = (1000000 * 8 bits) / 28800 bps = 278 seconds = 4.63 minutes

(b) Suppose that the answer to (a) is X seconds and you transferred the same sized files numerous times. You find that the actual time to transfer always takes longer than X seconds. Give a plausible explanation for this. [2 marks]

[1 mark for bit errors and 1 mark for retransmissions]

- Bit errors can occur on communication links
- Retransmission of damaged frames must occur and thus it takes longer than the theoretical transmission time.

4. The following questions deal with CRC error detecting code. [7 marks]

(a) Given a message $M = 1010001101$, determine the CRC using the polynomial $P = x^5 + x^4 + x^2 + 1$.

Show your work. [4 marks]

[-2 for wrong answer and additional -1 for each mistake. Give 1 mark for a good effort.]

$$\begin{array}{r}
 \mathbf{1101010110} \\
 \text{-----} \\
 \mathbf{110101} \mid \mathbf{101000110100000} \\
 \mathbf{110101} \\
 \text{-----} \\
 \mathbf{111011} \\
 \mathbf{110101} \\
 \text{-----} \\
 \mathbf{111010} \\
 \mathbf{110101} \\
 \text{-----} \\
 \mathbf{111110} \\
 \mathbf{110101} \\
 \text{-----} \\
 \mathbf{101100} \\
 \mathbf{110101} \\
 \text{-----} \\
 \mathbf{110010} \\
 \mathbf{110101} \\
 \text{-----} \\
 \mathbf{01110} \quad \text{Thus, CRC} = \mathbf{01110}
 \end{array}$$

(b) What is the transmitted message T? [1 mark]

$$T = 101000110101110$$

(c) How does the receiver check whether the message T was transmitted without any errors?

[2 marks]

[Note that students can show the division as part of the answer. Full marks should be given if they state the answer without the division. This will allow students to answer and get full marks even if they did not get the first two parts.]

The received message T is divided by P and if the remainder is zero then T is error-free otherwise it contains errors.

5. Name and describe two types of frame errors that occur in the transmission of frames. [4 marks]
[2 marks for each error.]

(1) Lost Frame -- A frame fails to arrive at the receiver. A noise burst may damage a frame to the extent that the receiver is not aware that a frame has been transmitted.

(2) Damaged Frame -- A recognizable frame does arrive but some of the bits are in error.

6. You used Internet sockets for programming the assignment #3. [7 marks]

(a) Describe the difference between stream and datagram sockets as far as what they provide to their users are concerned. [2 marks]

[1 mark for each]

- **Stream socket - provides sequenced, reliable, two-way connection-based byte streams.**
- **Datagram socket – connectionless, unreliable transfer of small, fixed sized messages**

(b) Could you have used UNIX domain sockets for the programming assignment #3? Describe why or why not. [2 marks]

[The answer of YES or NO only is not sufficient for a mark. Must give the reason for full 2 marks]

- **No, it cannot be used for communication between remote machines.**
- **UNIX domain sockets use UNIX files as the communication medium**

(c) Describe the component(s) of the address used to identify the remote process. [3 marks]

[3 full marks for identifying and describing the components. 1 mark for describing either component]

- **the server's address is specified as (host, port)**
- **host identifies the machine on which the server process is running**
- **port identifies the specific endpoint through which the server process transmits and receives data**

7. Suppose a user has two browser applications active at the same time, and suppose that the two applications are accessing the same server to retrieve HTTP documents at the same time. How does the server tell the difference between the two applications? [3 marks]

[3 full marks for identifying the use of different client transport port numbers]

A client application generates an ephemeral port number for every TCP connection it sets up. An HTTP request connection is uniquely specified by the five parameters: (TCP, client IP address, ephemeral port #, server IP address, 80). The two applications in the above situations will have different ephemeral port #s and will thus be distinguishable to the server.

8. Suppose a computer is moved from one building to another within a campus. 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? [3 marks]

[1 mark for each] part. IP address may or may not need to change depending on how the network is configured]

- **The physical address does not change. It is globally unique to the computer's NIC card.**
- **The IP address may need to be changed to reflect a new subnetwork id and host id.**
- **The situation is the same for laptops.**