CS 742 Computer Communication Networks Exam 1 - Name: _____
Fall 2002

Part 1: (24 points - 3 points for each problem)

(b) 1. OSI 7-Layer Reference Model is a
(a) hardware (b) network architecture (c) protocol (d) software

(a) 2. The known port for the SSH service is:
(a) 22 (b) 23 (c) 79 (d) 80

(a) 3. A link is working at 20 MHz. Each bit data is encoded in 4 pulses. What is the data transfer rate for this link?
(a) 5 Mbps (b) 10 Mbps (c) 20 Mbps (d) 80 Mbps.

(c) 4. Which framing approach is used in PPP?
(a) time framing (b) frequency framing (c) character stuffing (d) bit stuffing

(c) 5. Which one is a wireless network standard?
(a) IEEE 802.3 (b) IEEE 802.5 (c) IEEE 802.11 (d) IEEE 802.12

(b) 6. Which command can be used to show the hardware address of a network interface?
(a) `ftp` (b) `ifconfig` (c) `telnet` (d) `ping`

(d) 7. Which is not the approach that a switch can use?
(a) datagram (b) virtual circuit (c) source routing (d) None of above.

(d) 8. Which is not examples of virtual circuit technologies?
(a) X.25 (b) Frame Relay (c) ATM (d) None of above.

Part 2: (76 points)

1. Briefly explain these terminologies. If they are acronyms, also write what they stand for. (12 points)

   (a) SMTP - Simple Mail Transfer Protocol is a protocol used in sending and receiving e-mail.

   (b) Socket - It is an endpoint for communication over a network or an abstraction through which an application can send and receive data.

   (c) ADSL - Asymmetric Digital Subscriber Line is a technology for transmitting digital information at a high bandwidth on existing phone lines to homes and businesses. It is called asymmetric because the upstream bandwidth is lower than downstream.

   (d) Direct Sequence - It is an approach to spread spectrum modulation for digital signal transmission over the airwaves. A data signal at the point of transmission is combined with a higher data-rate bit sequence (also known as a chipping code). The redundant chipping code helps the signal resist interference and also enables the original data to be recovered if data bits are damaged during transmission.

2. Complete the following table listing the seven layers in the OSI 7-Layer Reference Model. Then, identify three of the four layers used in the TCP/IP protocol suite (write TCP/IP beside them). Finally, identify where the following protocols belong: TCP, UDP, IP, PPP, FTP. (10 points)

   - Layer 7: Application Layer - FTP (TCP/IP)
   - Layer 6: Presentation Layer
   - Layer 5: Session Layer
   - Layer 4: Transport Layer - TCP, UDP (TCP/IP)
   - Layer 3: Network Layer - IP (TCP/IP)
   - Layer 2: Data Link Layer - PPP (TCP/IP)
   - Layer 1: Physical Layer

3. What is the main difference between connectionless and connection-oriented protocols? Give two examples for each protocol respectively. (6 points)
Ans:

   (a) A connection-oriented protocol requires that communication parties set up a link before the communication whereas the connectionless protocol does not.

   (b) Connection-oriented protocol: FTP, SMTP, TCP
   Connectionless protocol: TFTP, UDP, IP

4. Using the divisor polynomial $x^3 + 1$ for CRC, what frame will be transmitted for the data M = 10101100? (7 points)
Ans: M(x) = 10101100, C(x) = 1001, r = 3

```
       10111011
     ------------
1001 )10101100000
      1001
      ----
        1111
        1001
        ----
         1100
         1001
         ----
          1010
          1001
          ----
            1100
            1001
            ----
             1010
             1001
             ----
               11
```

   So the transmission frame T(x) is 10101100011.

5. A video signal at a resolution of 640 x 480 pixels, 2 bytes/pixel color encoding, and 30 frames/second.

   (a) Calculate the bandwidth necessary for transmitting in real time.

   (b) Suppose your cable modem is up to 10 Mbps. Without loss of the resolution and color, how many frames per second can it transfer?

   (6 points)
   Ans:

   (a) $640 \times 480 \times 2 \times 8 \times 30 = 147456000$ bps

   (b) $10 \times 10^6/(640 \times 480 \times 2 \times 8) = 2.03$ frames/s

6. Write the functions in sequence which are needed to create a server program using socket API in C. Briefly explain those functions. (8 points)
Ans:

   (a) socket - create an endpoint for communication.

   (b) bind - bind a socket to an address. The address is a pair consisting of an IP-address and a port number.

   (c) listen - specify the maximum number of outstanding connection requests that can be enqueued; that is, the connection request queue length.

   (d) accept - wait to accept an incoming connection request. Use by a server to wait for an incoming request. When a request arrives, a new socket is created and the new socket is used for the connection.

   (e) write, sendto - send data using a connection-oriented (TCP), or connectionless (UDP) protocol, respectively.

   (f) read, recvfrom - read data using a connection-oriented (TCP), or connectionless (UDP) protocol, respectively.

7. (a) What does CSMA/CD stand for? Briefly explain CSMA/CD protocol.
   (b) What problems would happen if a wireless protocol follows exactly CSMA/CD.
   (c) Briefly explain CSMA/CA protocol.
   (16 points)

   Ans:

   (a) Carrier Sense Multiple Access/Collision Detect (CSMA/CD) is the protocol for carrier transmission access in Ethernet networks. On Ethernet, any device can try to send a frame at any time. Each device senses whether the line is idle and therefore available to be used. If it is, the device begins to transmit its first frame. If another device has tried to send at the same time, a collision is said to occur and the frames are discarded. Each device then waits a random amount of time and retries until successful in getting its transmission sent.

   (b) Hidden and exposed nodes are the problems when CSMA/CD is employed in a wireless environment. Hidden nodes are those nodes which cannot be detected by another node. The collision could happen during transmission. Exposed nodes are those nodes which are detected but are not the recipeints.

   (c) Carrier sensing multiple access with collision avoidance (CSMA/CA) is a protocol used in wireless networking. When a node is ready for transmission, it sends a request to send (RTS) frame to the receiver and waits to receive a clear to send (CTS) frame from the receiver. As a result, all nodes within the range will refrain from transmitting a data frame. Once CTS is received, the sender can send packets. Other nodes do not tranmit until the receiver sends an acknowledge (ACK) frame to the sender.

8. How do you know the IP address of your machine on Linux and Windows platforms respectively?
   (6 points)

   Ans:

   (a) On Linux, use the `/sbin/ifconfig` command.
   (b) On Windows, use the `ipconfig` command.

9. Consider the following 6over4 tunnel diagram.

IPv4: 156.26.10.11		IPv4: 156.26.10.125
Dual Stack Host 1	⇐ IPv4 Infrastructure ⇒	Dual Stack Host 2
IPv6: 3ffe:8271:a030:e73::99/127		IPv6:

   What IPv6 address should be assigned to Host 2 to get the tunnel established properly ? (5 points)

   Ans: 3ffe:8271:a030:e73::98/127 should be assigned because the subnet address consists of 127 bits. Because the network address in IPv6 has 127 bits. So the Host 2 has to have the same network address. This gives only the least bit to change. Changing the least bit from 1 to 0 gives the following IPv6 address. This is the only possible address, since the subnet address consists of the 127 most significant bits. The least significant bit is 1 in the address of Host 1, so it must be 0 in the address of Host 2.