CS 742 Computer Communication Networks Exam 1 - Name: _____
Fall 2003

Part 1: (27 points - 3 points for each problem)

(B) 1. TCP/IP protocol suite is a
(A) hardware (B) network architecture (C) protocol (D) software

(A) 2. The known port for the FTP service is:
(A) 21 (B) 22 (C) 23 (D) 80

(C) 3. Which one is a wireless network standard?
(A) IEEE 802.3 (B) IEEE 802.5 (C) IEEE 802.11 (D) IEEE 802.12

(A) 4. The maximum number of independent samples in V.90 is 8000. V.90 runs at 56 Kbps. How many data bits are there per sample ?
(A) 7 (B) 8 (C) 14 (D) 16

(D) 5. Which is not the modulation method?
(A) amplitude (B) frequency (C) phase (D) time

(B) 6. An oil pipeline is
(A) a simplex system (B) a half-duplex system (C) a full-duplex system (D) none of the above

(D) 7. Which statement about ADSL is true?
(A) ADSL is always faster than Cable. (B) More users will reduce the performance for existing users.
(C) ADSL is less secure than cable. (D) Most ADSL providers offer a choice of ISPs.

(C) 8. Which is not issues to be concerned with in the data link layer?
(A) framing (B) error control (C) routing (D) flow control

(D) 9. Which framing approach is used in HDLC?
(A) time framing (B) frequency framing (C) character stuffing (D) bit stuffing

Part 2: (73 points)

1. Briefly explain these terminologies. If they are acronyms, also write what they stand for. (12 points)
   (a) **ATM** Asynchronous Transfer Mode is a dedicated-connection switching technology that organizes digital data into 53-byte cell units and transmits them over a physical medium using digital signal technology.
   (b) **Socket** A socket is an endpoint for communication over a network or an abstraction through which an application can send and receive data.
   (c) **WiFi** Wi-Fi (Wireless-Fidelity) is the popular term for the wireless local area network (WLAN) standard, IEEE 802.11.
   (d) **QAM** Quadrature Amplitude Modulation is a method of combining amplitude and phase modulation to transmit more bits per symbol.
2. What is direct sequence spread spectrum? Give two reasons why it is gaining popularity. (5 points)
   Ans:
   (a) Direct sequence spread spectrum spreads the transmission signal over an allowed band. A data signal at the point of transmission is modulated with a higher data-rate bit sequence (chipping code) and is mapped back into the original data at the destination.
   (b) It has good spectral efficiency and noise immunity.

3. 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, HDLC, HTTP. (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 - HDLC (TCP/IP)
   - Layer 1: Physical Layer

4. (a) What is the main difference between connectionless and connection-oriented protocols?
   (b) Give an example for each protocol respectively.
   (c) In which cases unreliable communication is used?

   (8 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: TCP, Connectionless protocol: UDP
   (c) i. Reliable communication is not available.
   ii. The delay in a reliable service might not be acceptable such as real-time applications.

5. An 8-bit byte with binary value 10101111 is to be encoded using an even-parity Hamming code. How many check bits are needed to ensure that the receiver can detect and correct single bit errors? What is the binary value after encoding? (7 points)

   Ans:

   (a) $m \leq 2^r - r - 1, m = 8 \Rightarrow r = 4$
   (b) _ _ 1 _ 0 1 0 _ 1 1 1 1
   Bit 1 = (1 + 0 + 0 + 1 + 1) mod 2 = 1
   Bit 2 = (1 + 1 + 0 + 1 + 1) mod 2 = 0
   Bit 3 = (0 + 1 + 0 + 1) mod 2 = 0
   Bit 4 = (1 + 1 + 1 + 1) mod 2 = 0
   The encoded value is 101001001111.

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

   Ans: M(x) = 10101101, C(x) = 10011, r = 4

```
          10110001
        -------------
10011 )101011000000
       10011
       -----
         11010
         10011
         -----
          10010
          10011
          -----
              10000
              10011
              -----
                 11
```

   So the transmission frame T(x) is 101011000011.

7. A video signal at a resolution of 640 x 480 pixels, 2 bytes/pixel color encoding, and 24 frames/second.

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

   (b) Suppose your cable modem is up to 24 Mbps. Without loss of the resolution and color, how many frames per second can it transfer?

   (6 points)

   Ans:

   (a) $640 \times 480 \times 2 \times 8 \times 24 = 117964800$ bps

   (b) $24 \times 10^6/(640 \times 480 \times 2 \times 8) = 4.88$ frames/s

8. Briefly describe circuit switching, message switching, and packet switching. What is the main advantage of packet switching over message switching? (8 points)

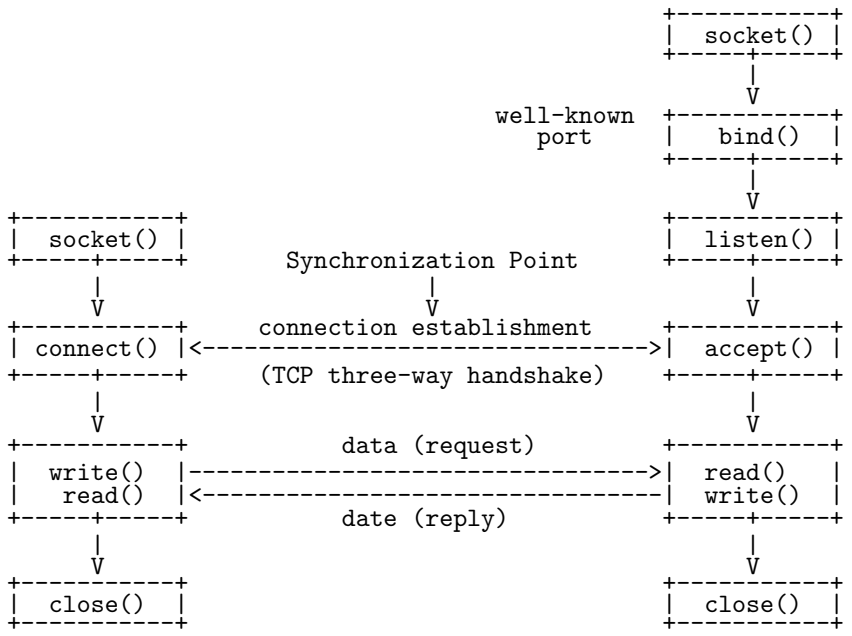
   Ans:

   (a) Switching is a technology to connect two end-points.
   - In circuit switching a physical path is set up between two end-points duration of the connection.
   - In message switching no physical path is established. The message is stored and forwarded to the destination.
   - In packet switching no physical path is established. The message is divided into packets, stored and forwarded to the destination.

   (b) Packet switching can reduce delay and improve throughput.

9. Draw a diagram to illustrate the general pattern followed by a client and server for connection-oriented communication using socket API in C. Briefly explain those functions used in the client and server. (10 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 - send data using a connection-oriented (TCP).

(f) read - read data using a connection-oriented (TCP).

(g) close - close a connection.