**CS 742 Computer Communication Networks Exam 2 - Name: _____**
**Fall 2003**

**Part 1: (42 points - 3 points for each problem)**

( C ) 1. Which is a collision-free protocol?
(A) pure ALOHA (B) slotted ALOHA (C) binary countdown (D) none of above

( B ) 2. Which cable does 100Base-TX use?
(A) thick coax (B) twisted pair (C) thin coax (D) fiber optics

( A ) 3. 1000Base-T can support segments of up to
(A) 100 m (B) 200 m (C) 500 m (D) 1000 m

( C ) 4. What is the baud rate of the standard 10-Mbps Ethernet?
(A) 5 Megabaud (B) 10 Megabaud (C) 20 Megabaud (D) None of above

( D ) 5. The standard for wireless MAN is
(A) 802.3 (B) 802.11 (C) 802.15 (D) 802.16

( A ) 6. Which transmission techniques are not specified in 802.11?
(A) QPSK (B) FHSS (C) DSSS (D) OFDM

( B ) 7. 802.11b can operate at up to
(A) 54 Mbps (B) 11 Mbps (C) 10 Mbps (D) 2 Mbps

( C ) 8. The standard for personal area network is
(A) 802.3 (B) 802.11 (C) 802.15 (D) 802.16

( B ) 9. Which 802.16 service is the best choice for large file transfers?
(A) constant bit rate (B) non-real-time variable bit rate service
(C) real-time variable bit rate service (D) best-efforts service

( C ) 10. Which device operates in the network layer?
(A) repeater (B) bridge (C) router (D) gateway

( A ) 11. Which is a static routing algorithm?
(A) flooding (B) distance vector (C) link state (D) none of above

( A ) 12. Based on the QoS, videoconferencing can tolerate low
(A) reliability (B) delay (C) bandwidth (D) none of above

( D ) 13. Which byte order is used in the Internet protocols?
(A) forward-endian (B) reverse-endian (C) little-endian (D) big-endian

( D ) 14. In which function do we specify SOCK_STREAM in C socket programming?
(A) bind (B) connect (C) listen (D) socket

**Part 2: (58 points)**

1. A 1480-byte datagram (20-byte IP header plus 1460 bytes of data) arrives for transmission across a network that has the maximum transmission unit (MTU) of 532 bytes. How long will each of the segments be (including the IP header)? (4 points)
Ans: The largest amount of data that can be transmitted is 532 - 20 = 512 bytes. The last segment will be 1460 - 512 -512 = 436 bytes. The three segments will be 532 bytes, 532 bytes, and 456 bytes.

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

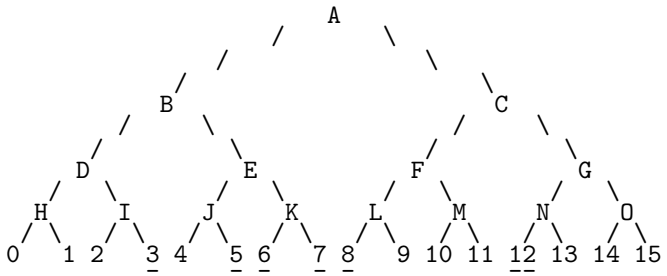
   (a) **MAC layer** The Medium Access Control (MAC) (sub)layer is the bottom part of the data link layer and deals with sharing the physical channel among several stations.

   (b) **Bluetooth** is a specification for the technology that connects different (mobile) devices through short-range radio.

   (c) **MANET** A Mobile Ad hoc NETwork (MANET) is a network where the routers are mobile.

   (d) **AODV** Ad hoc On-demand Distance Vector (AODV) is a routing algorithm used to solve the problem of mobile routers.

3. Sixteen stations, numbered 0, .., 15, are contending for the use of a shared channel using the adaptive tree walk protocol. If only stations 3, 5, 6, 7, 8, and 12 suddenly become busy at once and want to transmit a frame, how many bit slots are needed to resolve the contention? (6 points)
   Ans:




| | |
|---|---|
| Try A → collision | Try B → collision |
| Try D → 3 transmit | Try E → collision |
| Try J → 5 transmit | Try K → collision |
| 6 transmit | 7 transmit |
| Try C → collision | Try F → 8 transmit |
| Try G → 12 transmit | |

   11 slots are needed.

4. The network layer provides both connectionless and connection-oriented services. (8 points)

   (a) What subnet for each service is built respectively?

   (b) Give one advantage for each service respectively?

   (c) Give two applications which fit each service respectively.

   (a) A connectionless subnet is a datagram subnet. A connection-oriented subnet is a virtual-circuit subnet.

   (b)
   - The connectionless service has advantages: more potential for adapting to congestion robustness in the face of router failures, various adaptive routing algorithms are possible, it can be used over subnets that do not use virtual circuits inside.
   - The connection-oriented service has advantages: buffers can be reserved in advance, sequencing can be guaranteed, shorter headers can be used, and troubles caused by delayed duplicate packets can be avoid.

   (c)
   - Applications fit the connectionless service: email, news transfer, and database query.
   - Applications fit the connection-oriented service: file transfer, remote login, bank transactions, and videoconferencing.

5. (a) What does CSMA/CD stand for? Briefly explain CSMA/CD protocol.
   (b) Explain the binary exponential backoff algorithm used in CSMA/CD.
   (c) What problems would happen if a wireless protocol follows exactly CSMA/CD.
   (d) Briefly explain CSMA/CA protocol.

   (14 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) When there is collision, the station wait some time between 0 to $2^n - 1$ slotted time at the n's trial. This is called backoff algorithm.

   (c) 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 recipients.

   (d) 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 transmit until the receiver sends an acknowledge (ACK) frame to the sender.

6. Complete the following Java TCP echo server. (8 points)

```
import java.net.*;
import java.io.*;

public class TCPServer {
  public static void main (String args[]) throws IOException {
    int serverPort = 7896;
    ServerSocket replySocket = new ServerSocket(serverPort);
    while(true) {
      Socket clientSocket = replySocket.accept();
      Connection c = new Connection(clientSocket);
    }
  }
}

class Connection extends Thread {
  DataInputStream in;
  DataOutputStream out;

  public Connection (Socket requestSocket) throws IOException {
      in = new DataInputStream(requestSocket.getInputStream());
      out =new DataOutputStream(requestSocket.getOutputStream());
      this.start();
  }
  public void run() {
    try {
      String data = in.readUTF();
      out.writeUTF(data);
    } catch(IOException e) {System.out.println("IO:"+e.getMessage());}
  }
}
```

7. Describe how the Mobile IP works. (6 points)
   Ans:

   (a) A mobile node has a home agent which is the proxy of the mobile node during its absence from the home network. It acquires a care-of address that identifies its location in the current network from the foreign agent.

   (b) Each time a user moves the device to a different network, it acquires a a care-of address and notify its home agent. The home agent then associates its home address with its care-of address.

   (c) Traffic for the mobile node is sent to the home network and forwarded by the home agent via tunneling mechanisms to the appropriate care-of address.