**PRINT FAMILY NAME:**_____

# Examination 2

CEN 4500C Computer Network Fundamentals
December 7, 1999

**Instructions**

1. This is a closed-book, 50-minute examination.
2. You may use one 8.5" by 11" sheet of notes for reference.
3. Answer any TWO (2) questions, and no more.
4. Each question is worth fifteen (15) points.
5. Start the answer to each question on a new page (i.e., do **not** put the answer to more than one question on the same page).
6. Show your work. No work, no credit.
7. Assemble your answers in numerical order of the questions when you submit them.
8. **Do not turn the page and start until the proctor tells you to start.**
9. **Leave a 1" square in the upper left corner for a staple.**
10. **Read and sign the following statement.** You may write this on your exam and sign it there if you wish to take the exam questions home with you today. Do not discuss this exam with anyone in this course who has not yet taken this exam.

On my honor, I have neither given nor received unauthorized aid on this examination, and I will not discuss the contents of this examination with any student who has not yet taken this examination.

Signed:
Printed name:

1. (a) (7) Characterize the following network nodes in terms of the layer(s) at which they operate and their properties of buffering, delay, error handling, and other capabilites: bridge, repeater, router, amplifier.

   (b) (8) Many of the functions of the transport layer are similar to those of the link layer. In what ways do protocols at these layers usually differ significantly, and why?

2. (a) (3) In your homework, given simplified models of circuit-switching (CS), internal datagram (DG) packet-switching (PS) and internal virtual circuit (VC) packet-switching, it appeared that VCs were always worse than either CS or DGs, except in trivial, boundary cases. Recall that the models had you assume that CS required only some setup time S seconds, and then transmission time (L/R, where L=data length in bits, R=data rate in bps) and propagation delay (kT, where k=number of hops and T=propagation delay per hop). The PS models had you break the data into packets of length P bits, including a header of length H bits, with VCs suffering an extra S seconds setup time. In what ways were these models unrealistic, and how would you change the models to reflect reality better?

   (b) (4) Given your modifications, when do VCs perform better than DGs?

   (c) (3) Now consider CS versus VCs; when are VCs better than CS (hint: consider PS in general rather than giving an inequality).

   (d) (3) How do approaches to routing differ in CS networks and PS networks? Why?

   (e) (2) Why is the Bellman-Ford algorithm always used with distance vector (DV) routing protocols?

3. (a) (5) What are the main ways in which Frame Relay (FR) differs from X.25? Why?

   (b) (6) FR uses both Traffic Rate Management and Explicit Signaling to manage congestion. Compare these two main approaches. Describe the mechanisms used to implement each.

   (c) (4) Compare ATM congestion control mechanisms with FR congestion control mechanisms.

4. (a) (6) Describe and compare Token Ring and FDDI technologies.

   (b) (6) Compare CSMA/CD and Ring-based LAN technologies. When would one be preferred over the other?

   (c) (3) Compare the Token Ring and Token Bus technologies and performance.

5. (a) (4) Why is there a need for an internetworking layer or sublayer between the network layer and the transport layer in OSI terminology?

   (b) (2) What is the maximum header length in an IP version 4 packet? Why?

   (c) (3) What limitations exist on how a gateway fragments a packet too large for the MTU of a transit network? Give all limitations and relate them to header fields.

   (d) (3) One of ICMP's functions is to provide for error handling in IP networks. How does ICMP provide for error management? Why should ICMP not send an error message if the IP checksum is found to be in error?

   (e) (3) In what way do TCP and UDP violate strict layering principles? Why?