

CSE 123: Computer Networks
Fall Quarter 2024
MIDTERM EXAM

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Name _____
Student ID _____

Question	Score	Points
1	10	
2	30	
3	25	
4	25	
5	10	
Total	100	

This exam is **closed book**. You are allowed one 8.5x11-inch (or smaller), double-sided sheet of paper containing whatever you would like (a “crib sheet”). **YOU MUST PUT YOUR NAME ON IT AND TURN THE CRIB SHEET IN WITH THE EXAM.**

The exam contains questions of differing point values. Each question is clearly labeled with its value. Please answer all questions in the space provided. You have 50 minutes to complete this exam. As with any exam, I suggest you read through all the questions first before answering any of them.

You will receive full credit for the final question regardless of your answers, but we would appreciate you taking the time to provide feedback. In order to preserve the anonymity of your responses, please **tear off the last page of the exam**. You may submit it separately at the end of the exam, or bring it to class with you on Wednesday.

GOOD LUCK!

1. (10 pts) True/False. Determine whether each of the following statements is true or false. No explanation is necessary; partial credit will not be awarded.

a) Bridges send ICMP messages when they do not know the destination address of a frame.

b) The IP network layer ensures in-order delivery.

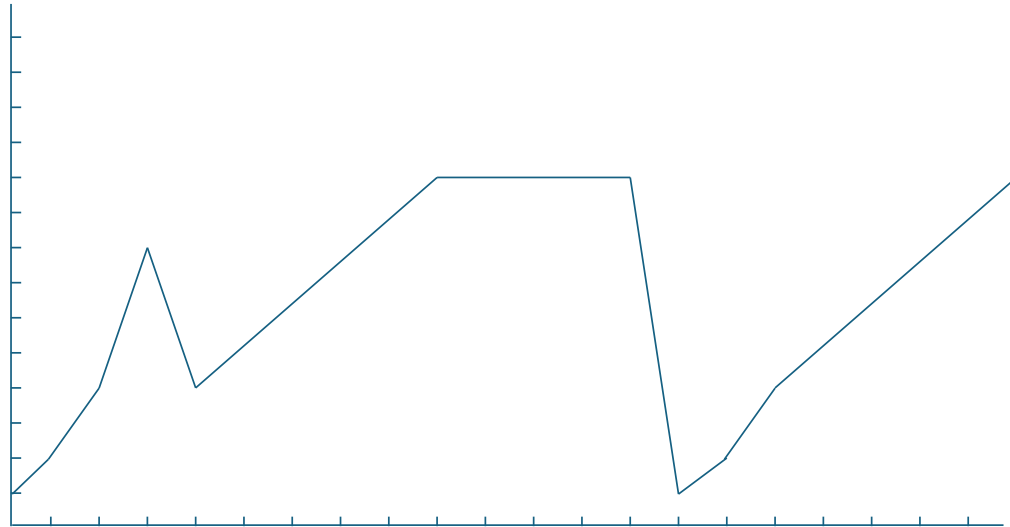
c) Hosts use byte stuffing to ensure all frames are exactly an MTU in length.

d) IPv6 extension headers appear after the transport header in the packet.

e) DHCP request/response packets are forwarded by routers.

2. (30 pts) Short Answer. Concisely answer the following questions.

- a) (10 pts) Consider the following TCP congestion window graph, where the x axis is in terms of round trips (RTTs), and the y axis is in terms of segments. Label the x axis showing RTT regions where the sender is operating in slowstart and AIMD congestion avoidance. Annotate points on the graph where packet loss, timeouts, and Fast retransmit/Fast recovery occur.



- a) (9 pts) Consider the bitstream below received by an HDLC receiver:

```
0010 1101 1111 1000 1010 1011 1111 1111 0110 0101 1010
0110 1111 1011 1011 1111 0110 1000 0000 1111 0010 0101
0111 1110 1010 1110 1011 1111 1001 1010 1001 1101 1111
1001 1010 1101 1110 0110 1110 1110 1101 1110 0101 0000
```

Sketch a rectangle enclosing each unique frame in the bitstream above, and draw vertical boundaries to separate start-of-frame marker, payload, and end-of-frame marker.

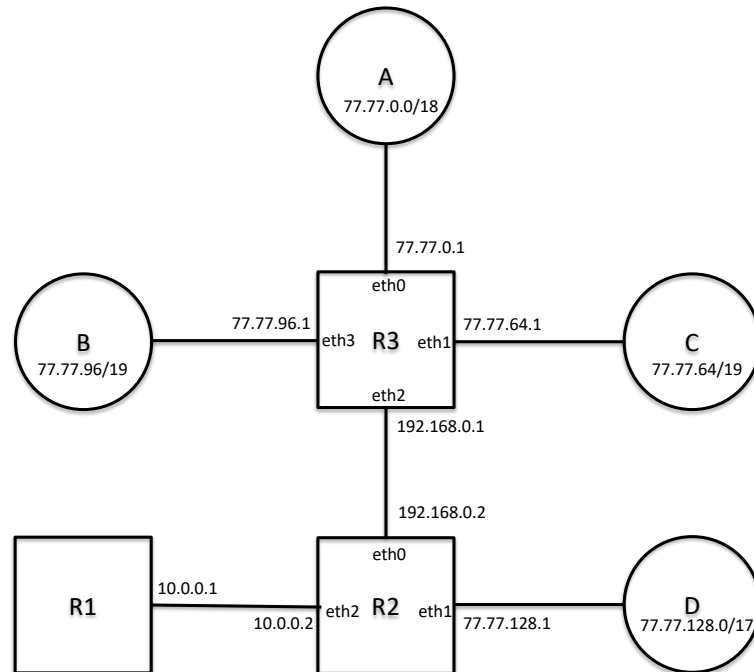
In the payload of each frame above, circle the stuffed bits. If there are any errors, underline the entire sequence of bits that indicate the presence of the error.

- c) (5 pts) Suppose a code consists of three codewords, 01010, 10100 and 11111. What is its Hamming Distance? Is it efficient? Can it correct all possible 2-bit errors?

- d) (6 pts) Suppose a router receives a 500-byte packet with IP ID 17, MF=0, DF = 0, TTL = 27, and Offset = 960 (stored as 120 in the header). It decides to forward the packet out a port where the MTU is only 100 bytes. What are the contents of the following header fields for the last fragment sent?

IPID: MF: DF: TTL: Len: Offset:

3. (25 pts) Consider the IP network shown below; LANs are depicted as circles labeled with their network addresses. Routers are shown as boxes, and each port's IP address is shown right next to the interface. Assume the rest of the Internet is reachable through router $R1$.

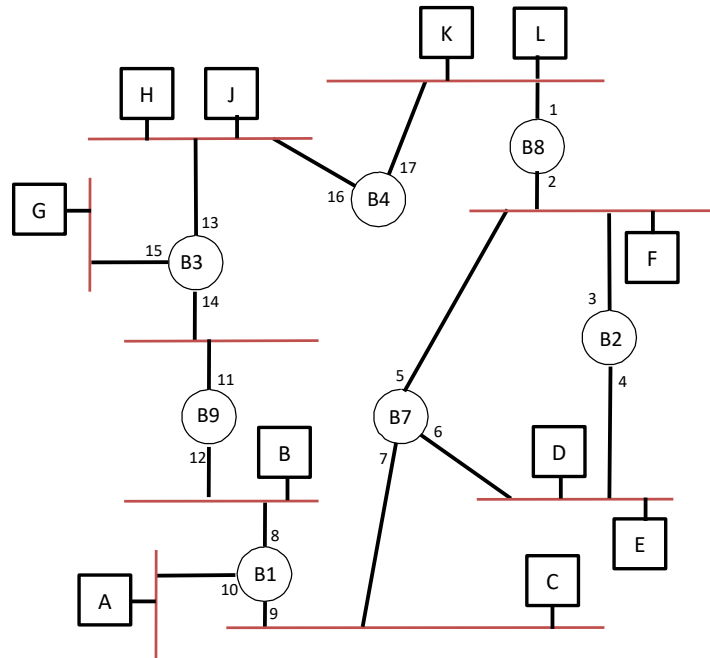


- a) (10 pts) A portion of $R3$'s forwarding table is shown below. Fill in the missing entries.

Destination	Next Hop
127.0.0.0/8	loopback
default	192.168.0.2
192.168.0.0/30	eth2

- b) (5 pts) What is the most concise way $R2$ can describe the networks reachable through the next hop 192.168.0.1?
- c) (5 pts) What is the netmask a host on network C would use?
- d) (5 pts) What is the IP broadcast address for network B ?

4. (25 pts) Consider the extended LAN shown below; LANs are horizontal red bars, hosts are squares, and bridges are depicted as circles with the indicated IDs. Each bridge port is numbered. Bridge IDs follow the natural order, i.e., $B1 < B2 < B3 \dots$. Assume the spanning tree algorithm has already converged.



- a) (5 pts). What ports are disabled after convergence?
- b) (5 pts). In the resulting configuration, what message is being sent by $B2$ and which bridges receive it?
- c) (15 pts). Suppose the following frames (and only these frames) are sent over the converged topology in the order indicated. For each frame, say which hosts and bridges will receive it.

Frame	Recipients
B sends a message to F	
D sends a message to B	
G sends a message to F	