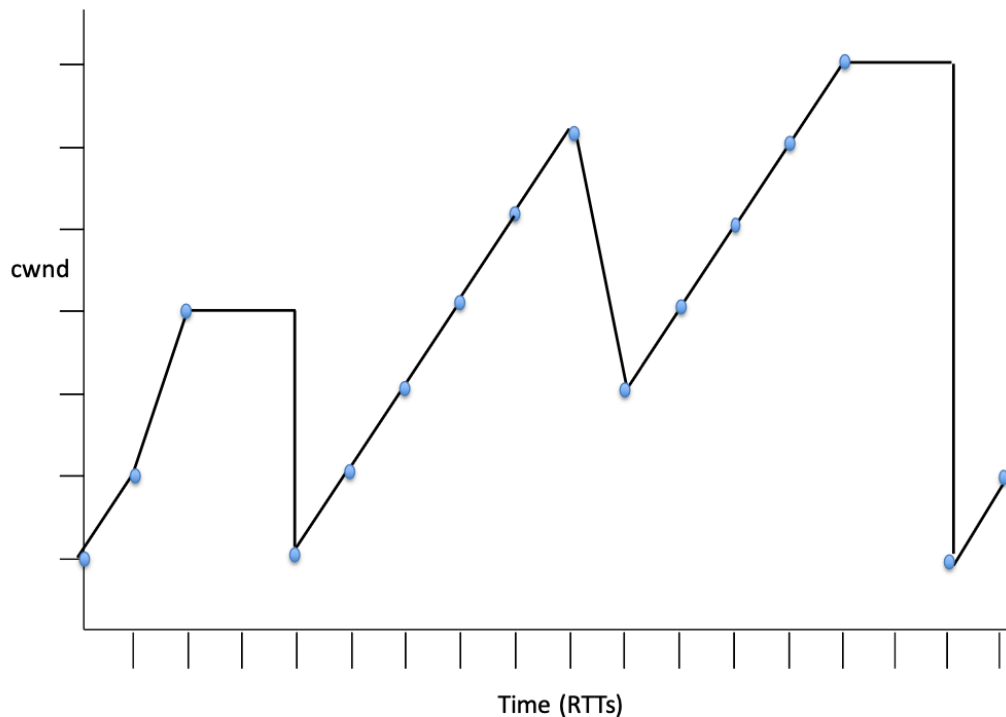


CSE 123 Fall 2026

Due 10am Wednesday 10/21

Submit by uploading a PDF to Canvas. Homework will be graded for completion only.

1. 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.



a) Label the x-axis showing RTT regions where the sender is operating in slowstart and AIMD congestion avoidance.

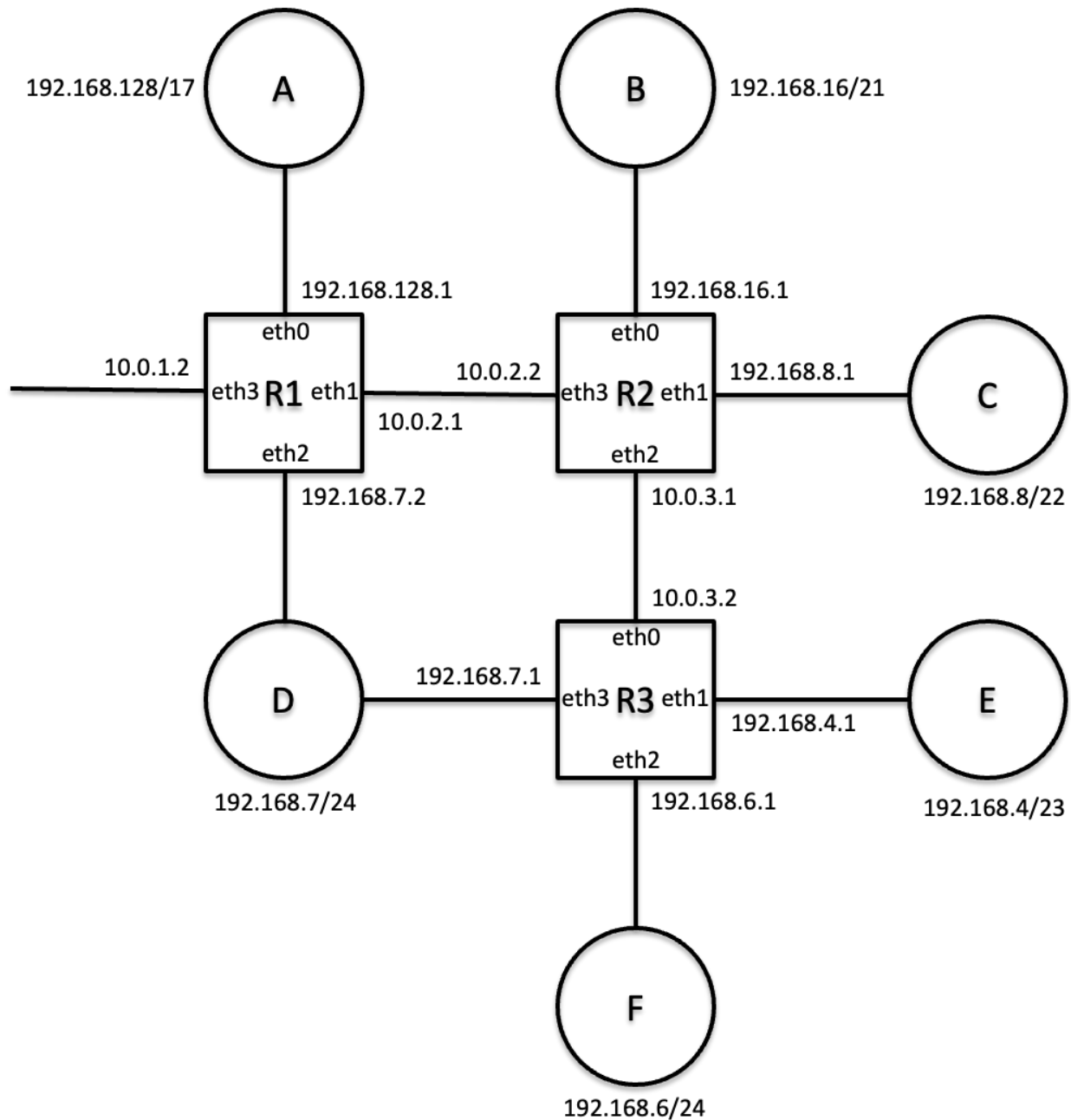
b) Annotate points on the graph where the following events occur:

1. Packet loss
2. Timeout
3. Fast retransmit/fast recovery

c) What is the value of ssthresh at each of the following points in time (measured in RTTs, counting from 0)?

1. RTT 5
2. RTT 14

2. Consider the following network, where A-F are LANs assigned the indicated address, and R1-R3 are L3 switches. Each switch is connected to four networks using Ethernet NICs (named eth0-eth3) which are assigned IP addresses as shown in the diagram. You can assume the rest of the Internet is accessible via R1's eth3 interface.



a) Below is a partial copy of R2's FIB. Fill in the rest using the fewest entries possible.

Destination	Next Hop	Interface
127.0.0.1/32	127.0.0.1	lo0
default	10.0.2.1	eth3
192.168.16/21		eth0
10.0.2/8		eth3

b) Suppose I am using a host with IP address 192.168.5.17. To which network is my host connected?

c) Imagine a host on network A wanted to send a packet to a host on network F. What is the shortest path it could possibly take? Specifically, which routers would need to forward the packet?

3. IP Addressing. Consider the IP address 132.239.15.87.

a) Suppose that we were still using class-based addressing. What type of network would this IP address be a part of?

b) If the network administrator had decided to break the network in part a) into 64 different subnets, what would the subnet mask of the subnet to which this IP address belongs be?

c) What is the subnet number (address) of the subnet to which this IP address would be attached?

d) Now suppose that we are using CIDR addressing instead of class-based addressing and subnets. What would the length of the CIDR prefix be for the physical network in part c) to which the host is attached?

e) What would the broadcast address for this network (i.e., the network from parts c) and d)) be?

4. Suppose 8 flows share a 1-Mbps link. Assume these flows achieve throughputs of 4 Kbps, 12 Kbps, 16 Kbps, 32Kbps, 64 Kbps, 128 Kbps, 256 Kbps, 512Kbps.

a) What is Jain's Fairness index for this set of flows?

b) What would the throughput of each flow need to be to achieve a fairness index of 1?

c) Suppose a new flow arrived that caused congestion and led each of the senders to halve their sending rate according to AIMD. Assuming this new flow has a throughput of 64 Kbps (after halving), what is the Fairness Index of the new set of rates?