ECE697AA
Spring ‘08 – Exam I
Prof. Wolf

Name: _____

ID Number: _____

	Maximum	Achieved
Question 1	9	
Question 2	10	
Question 3	14	
Question 4	11	
Question 5	6	
Total	50	

This exam is closed book, closed notes. One single page handwritten notes is allowed. No electronic devices (other than calculators) are allowed. Be concise, but show your work. Write legibly.

Time: 75 minutes.

Question 1 (9 points):
Answer the following general questions regarding computer.

a) Name the five layers of the Internet protocol stack and give an example of protocol for each layer (except for the lowest layer). Do not use abbreviations or acronyms. (4 points)

b) Switch tables can get large for large LANs since each station requires one entry. In order to reduce the number of entries, your colleague suggests using prefix aggregation for Ethernet MAC addresses similar to how it is used in CIDR for IP. What do you think of this suggestion? (2 points)

c) What are the three most common packet sizes in the Internet? Explain why this is the case. (3 points)

Question 2 (10 points):
Answer the following questions regarding transport protocols and their performance. Assume a network uses 100 Mbps links with a 1 ms one-way end-to-end delay between two nodes. Also assume that these nodes use a sliding window transport protocol with a maximum window size of 3 packets and a fixed packet size of 1300 bytes (50 bytes of headers and 1250 bytes of payload). Assume acknowledgement packets are 50 bytes in size. There is no connection setup.

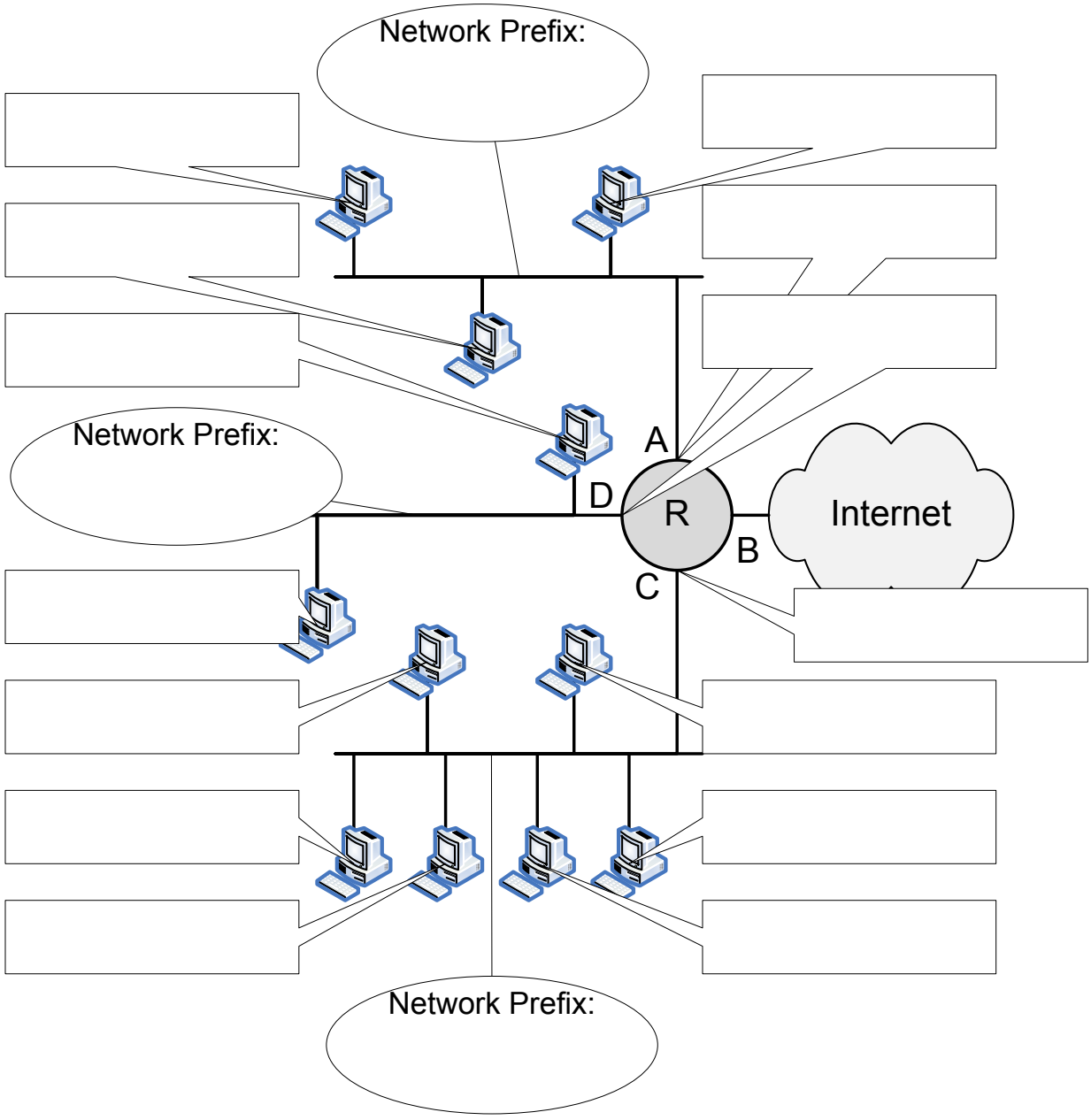
a) What is the throughput of this protocol from the point of view of the end-system application (i.e., how much payload data can the protocol transfer per second)? Assume queuing and processing delays are zero, but consider transmission delays. Please report your results in bits per second, not bytes per second. (5 points)

b) What changes could be made to the transport protocol to increase the throughput? (2 points)

c) What window size would be necessary to achieve 80 Mbps of throughput from the point of view of the end-system application? (3 points)

Question 3 (14 points):
Answer the following questions regarding IP address allocation and routing tables.

a) Consider the network topology shown below. Assume you are given an address block of 128.119.86.128/25. Assign a suitable address to each network interface (enter IP address in white rectangular box). Allocate addresses such that they can be aggregated into prefixes. Note the network prefix in the while oval. (6 points)



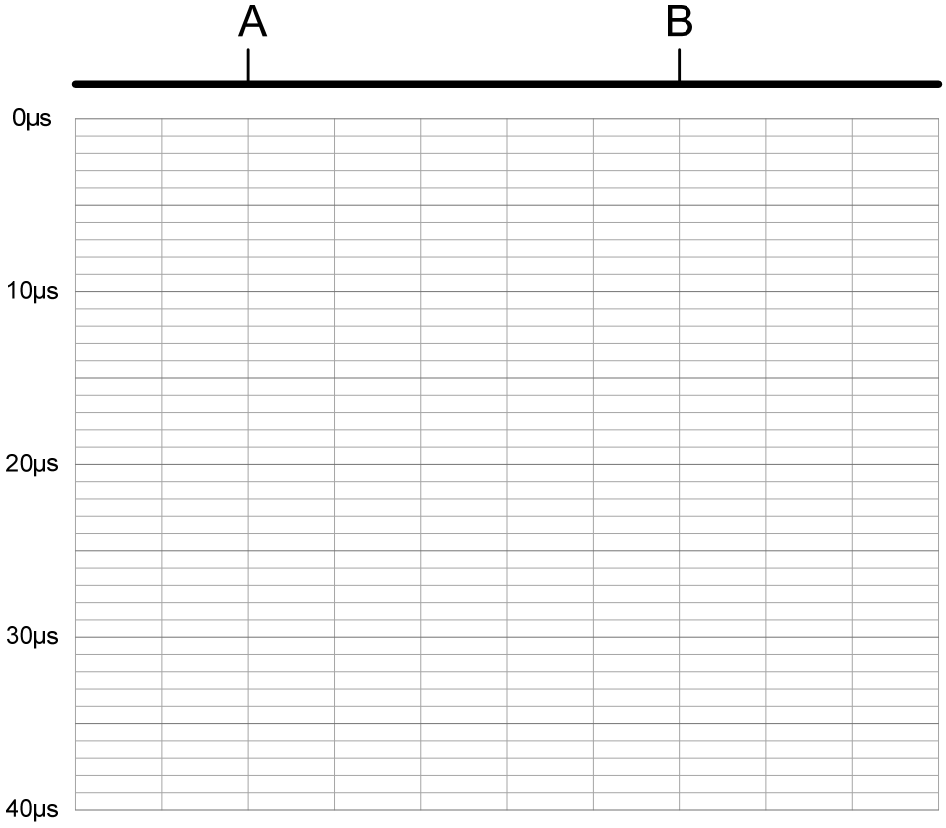
b) Show the routing table for router R that matches your configuration in a). All hosts should be reachable. Assume that the Internet is configured to send all traffic destined for 128.119.86.128/25 to router R. The routing table should have an entry for each network prefix and the port (A-D) through which the packet should be forwarded. (4 points)

Prefix	Port

c) A colleague suggests a new IP protocol ("IPlight"), which uses a header that consist of only a version field and a (sufficiently long) destination address field. Discuss if IPlight would be an effective network protocol. If not, state which header fields you think need to be added and why. (4 points)

Question 4 (11 points):
Answer the following questions regarding CSMA/CD protocols.

a) Consider two stations that are 5 meters apart on a shared 10 meter long wire. The propagation speed of signals in this wire is 1 meter / microsecond (=1000km/s). Assume that station A starts transmitting a very long packet at time 0μs. Station B – after checking that the channel is clear – starts transmitting a very long packet at time 3μs. Determine the times of the events listed below the figure. Assume that in case of a collision a station stops transmitting instantaneously (no jam signal). You may solve the problem graphically or by calculation. (5 points)



Station A detects a collision at time t=_____

Station B detects a collision at time t=_____

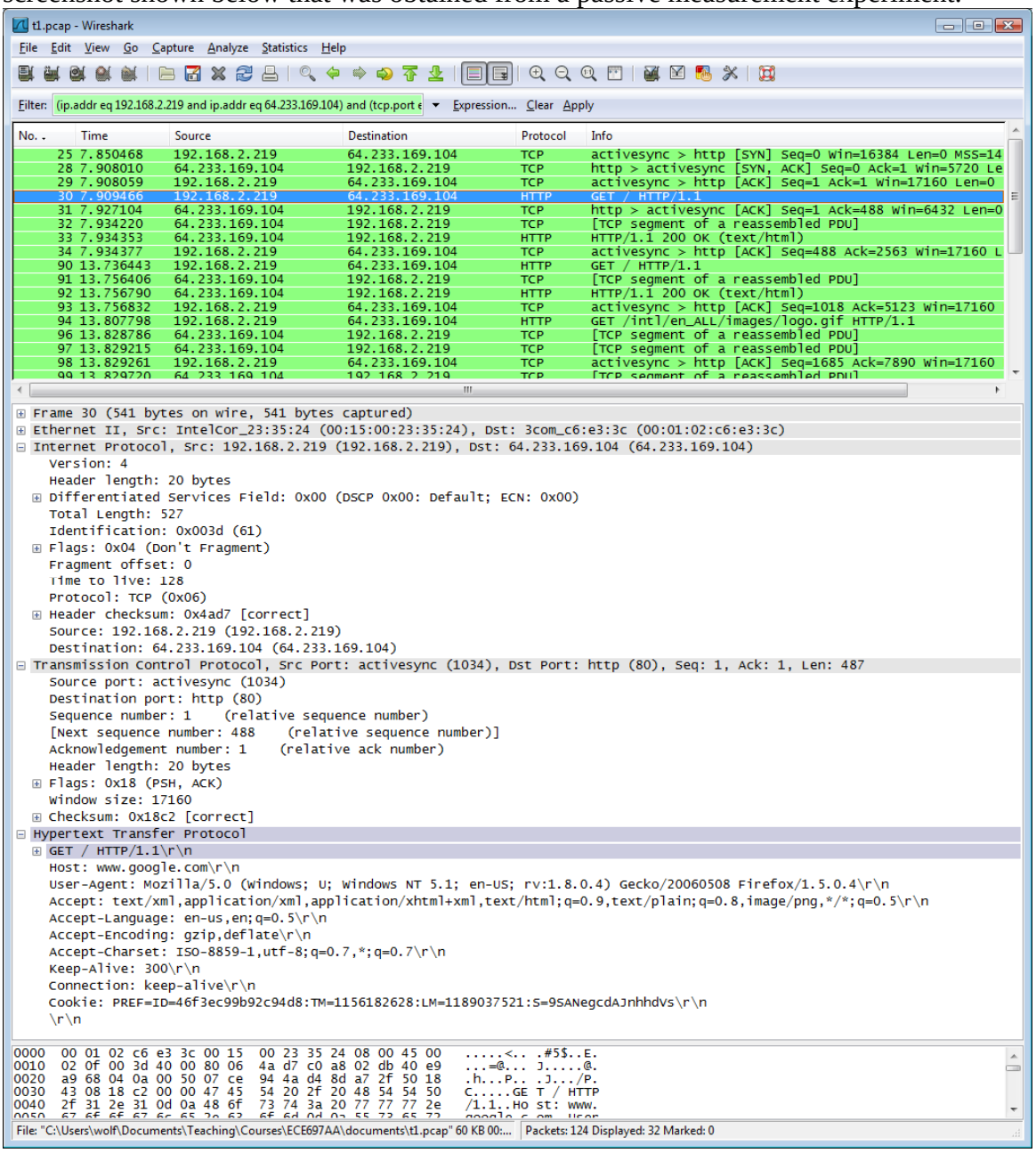
Station A determines channel is clear (after collision) at time t=_____

Station B determines channel is clear (after collision) at time t=_____

Entire wire is free of any transmission (after collision) at time t=_____

b) Assume the network in a) and assume the transmission speed is 10Mbps. If collisions need to be detected reliably, what is the minimum packet size that can be permitted? (6 points)

Question 5 (6 points)
Answer the following questions regarding network measurement. Consider the Wireshark screenshot shown below that was obtained from a passive measurement experiment.



a) Do these packets belong to the same (bi-directional) connection? (2 point)

b) What is the IP address and DNS name of the server? (2 point)

c) What is the round-trip time for this connection (based on TCP handshake)? (2 points)