

Assignment 5

Due Saturday May 17. Show your work. Hand in your assignment using the appropriate dropbox on the course web site. Assignments submitted after the solutions are made available will be given a mark of zero.

Question 1

A router has the following routing table:

network	netmask	interface
10.0.0.0	255.0.0.0	10.0.1.5
192.168.1.0	255.255.255.0	192.168.1.1

and these are the only entries in its ARP table:

IP Address	MAC address
10.0.1.1	12:a4:56:10:12:de
192.168.1.200	12:a4:56:78:9f:12
192.168.1.203	12:a4:56:c4:56:07

- (a) This router receives a packet with a destination address of 192.168.1.203. Over which interface would the packet be sent back out? What destination MAC address would be used for the outgoing packet?
- (b) This router receives ICMP echo request packets (pings) with the IP source and destination addresses and TTL values shown in the table below. For each ping request, determine:
- if the router would send an ICMP packet in response to receiving the packet,
 - the ICMP type and code values in decimal and a brief explanation of why this type and code were used,
 - the destination IP and MAC addresses of the ping response,
 - the source IP address of the ping response, and
 - the interface on which each response would be transmitted.

source	destination	TTL
10.0.1.1	24.83.17.6	2
192.168.1.200	10.0.0.4	10
192.168.1.203	10.0.0.1	1

Question 2

A UDP frame containing the two 16-bit values, 0xf00f and 0x0ff0 is received. The source port is 0x4000 and the destination port is 16 (decimal). The source IP address is 10.0.0.0 and the destination IP address is 20.0.0.0. Compute the values of all the bytes in the UDP header. Give the byte values in hexadecimal. Show your work. *Hint: UDP is IP protocol 17.*

Question 3

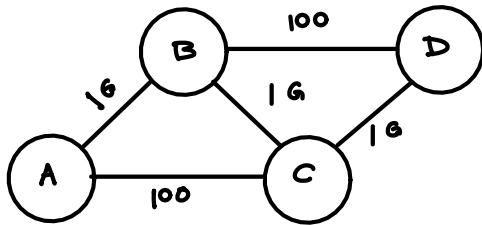
You receive a packet with the ACK bit set, an Acknowledgement field value of 500 and a Window value of 2500. Your most recently transmitted packet had a sequence number of 1000. How many more bytes you can transmit before waiting for an acknowledgement?

Question 4

- (a) What is the value of the ACK field in a SYN packet sent in response to a SYN? Why?
- (b) A router receives a packet with the FIN bit set and replies with a packet with the FIN and ACK bits set and an Acknowledgement field value of 321. How many data (TCP payload) bytes were received by this router in this TCP session? Show the calculation.

Question 5

The following diagram shows an IP network with the bit rates on each of the links shown as 100 Mb/s or 1 Gb/s.



Compute the shortest path first routing table for Router B. Assume the link costs are calculated as $1 \times 10^9 / \text{link bit rate}$. Give your answer as a table with a column showing the destination router and the next-hop router.

Question 6

You make 1000 measurements of the delay between two VoIP devices and find that the minimum delay is 80 ms but 100 packets had a delay of more than 100 ms and 10 had a delay of more than 140 ms. Assuming each speech packet contains 20 ms of speech, how long a jitter buffer should be used to ensure a packet loss rate of 1% or less due to excessive delay? Give the buffer length in ms and packets?

Question 7

You are talking with someone using VoIP. When they start using a speakerphone you notice an annoying echo. What signal processing by *your* VoIP phone could eliminate this echo:

- (a) near-end echo cancellation
- (b) far-end echo cancellation
- (c) (a) and (b)
- (d) (a) or (b)
- (e) neither, nothing can be done about this

Explain.