

# CMPSCI 453

## Fall 2009 - Midterm

### 04/01/2009

**Read before starting:**

1. Put down you name on the first page NOW. Put down you initials on the top right corner of each page
2. This answer book has 10 pages.
3. Assign and use variable names before plugging in actual numbers. This way, you are likely to get more partial credit if your final answer is incorrect.
4. In all answers, clearly state the units. Use standard units such as bps, Kbps, or Mbps, not KB/msec and such. Bps means bytes per second and bps means bits per second.
5. Be precise for “explain”-type questions. Giving long-winded vague answers is unlikely to get you much partial credit. You will also lose time.
6. Be a smart exam-taker. Answer questions you are confident of first. The points roughly reflect the most number of minutes you should spend on the question.
7. The space provided roughly reflects how long your answer should be. Feel free to ask the TA for rough sheets. Attach any rough sheets used.
8. Different parts of a question are mostly independent. So, if you can not do one part, don't let it bother you. Just move on to the next part.
9. If you feel a question does not provide some information necessary to solve a problem, make the most reasonable assumption. Or ask.
10. You have 80 minutes to score 100 points.

Name: \_\_\_\_\_

Problem 1	out of 18
Problem 2	out of 10
Problem 3	out of 12
Problem 4	out of 32
Problem 5	out of 28
<b>Total</b>	<b>out of 100</b>

**Problem 1 (Quickies, 18 points):**

- A. (True or false) In a circuit switched network, all data belonging to a connection traverses the same route, whereas in a packet switched network, different packets belonging to the same connection may take different routes.
  
- B. (True or false) An IP header contains a source port and a destination port number that are each 2 bytes long.
  
- C. (True or false) The Go-Back-N and Selective Repeat protocols in the slides can tolerate reordering of packets by the network.
  
- D. (True or false) Sequence numbers are necessary to tolerate losses, but are not needed to tolerate bit errors alone.
  
- E. How many bits must be flipped in an Internet packet for it to still pass the checksum test?
  
- F. Give three differences between an IPv4 header and an IPv6 header.
  
- G. CIDR prefixes make routing scalable. Explain.

End of Problem 1.

**Problem 2 (Longest prefix matching, 10 points):** Consider a datagram network using 8-bit host addresses. Suppose a router uses longest prefix matching and has the following forwarding table:

<b>Prefix match</b>	<b>Interface</b>
<b>1</b>	<b>0</b>
<b>11</b>	<b>1</b>
<b>111</b>	<b>2</b>
<b>Otherwise</b>	<b>3</b>

For each of the four interfaces, give the associated range of destination host addresses and the number of addresses in the range.

End of Problem 2.

**Problem 3 (NAT, 12 points):** Consider a home network with 3 hosts behind a NAT. Suppose that the ISP assigns the router the address 126.13.89.67 and that the network address of the home network is 192.168/16.

A. Assign addresses to the three hosts. (3)

B. Suppose each host has two ongoing TCP connections, one to port 80 at host 128.119.40.86 and another to port 25 at 128.119.10.24. Provide the six corresponding entries in the NAT translation table. (9)

End of Problem 3.

**Problem 4 (TCP, 32 points):** Consider a TCP connection from host A to host B along a route with  $RTT=60ms$ . Assume that the slow start threshold is initially 64 MSS. Assume that  $MSS=1500B$ .

A. After how much time does TCP switch from slow start to AIMD assuming that no loss occurs during the (first) slow start phase?

B. How many segments are sent during this first slow start phase?

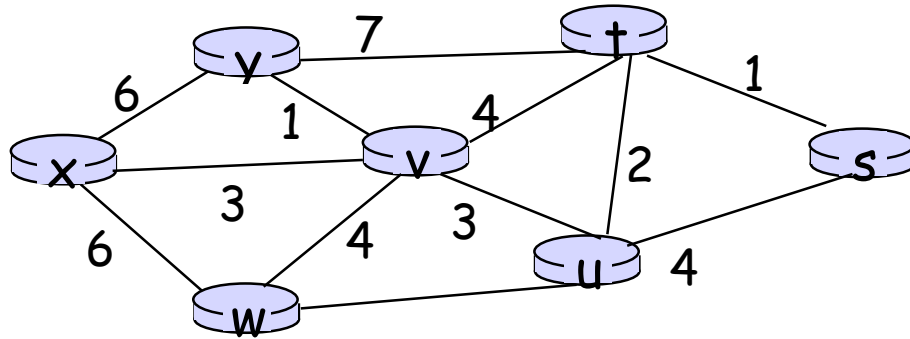
C. Suppose the window size at some point is  $W=12MSS$ . After one RTT, the window size changes to  $18MSS$ . Give two different reasons that could explain this observation.

D. Suppose the window size at some point is  $W=2MSS$ . After one RTT, the window size changes to  $W=1MSS$ . Give two different reasons that could explain this observation.

- E.** Suppose the window size is currently 1MSS and the most recent segment gets lost. How does TCP respond?
- F.** If the current window size is  $W=20\text{MSS}$ , what is the throughput?
- G.** If the current estimate of the round trip time is  $E=64\text{ms}$  and the acknowledgment corresponding to the next segment reports a round trip time of  $S=58\text{ms}$ . What is the updated estimate of the round trip time?
- H.** Suppose the current deviation is  $D=10\text{ms}$  and the next segment reports a round trip time of  $S=58\text{ms}$  as above. What is the updated value of the timeout?

End of Problem 3.

**Problem 5 (Link state routing, 28 points):** Consider the network below. Assume that the cost of the link u-w missing in the figure is 2.



A. Compute the shortest path cost from node x to all other nodes using Dijkstra's link state routing algorithm. (16)

B. Write down the forwarding table at node x. (7)

- C. In link state routing, if the shortest cost path computed by A to a destination C goes through a node B, is the shortest cost path computed by B to C necessarily a suffix of the shortest cost path from A to C? Why or why not? (5)

End of Problem 4.