College of Computing

Georgia Institute of Technology

CS 6250: Computer Networking: Fall 2010

Practice Quiz

There are XXX questions and 10 pages in this quiz booklet (including this page). Answer each question according to the instructions given. You have **85 minutes** to answer the questions.

If you find a question ambiguous, write down any assumptions you make. **Be neat and legible.** If I can't understand your answer, I can't give you credit! There are three pretty challenging questions (clearly marked); you may want to look through the whole quiz and save those for last.

Use the empty sides of this booklet if you need scratch space. You may also use them for answers, although you shouldn't need to. *If you do use the blank sides for answers, make sure to clearly say so!*

Note well: Write your name in the space below AND your initials at the bottom of each page of this booklet.

THIS IS AN "OPEN NOTES, OPEN PAPERS" QUIZ.
NO OTHER MATERIALS, NO PHONES, NO COMPUTERS, NO LAPTOPS, NO PDAS.
NO ENCRYPTED WIRELESS TRAFFIC.
MAKE SURE YOU'VE READ ALL THE INSTRUCTIONS ABOVE!

Initial here to indicate that (1) you've read the instructions and (2) you agree to abide by the Georgia Tech Honor Code:

The last page has easy bonus questions, which you can answer outside of the allotted time. Rip the last page off of your quiz for five bonus points. Turn it in anonymously if you like.

Do not write in the boxes below

XX-XX (xx/XX)	XX-XX (xx/XX)	11-14 (xx/XX)	Bonus (xx/5)	Total (xx/XX)

Name:

I Warmup

1. [4 points]: Which of the following is true about Address Resolution Protocol (ARP) and learning bridges?

(Circle ALL that apply)

A. A learning bridge maintains state that maps IP addresses to hardware (MAC) addresses.

B. A learning bridge maintains state that maps IP addresses to MAC addresses.

C. A host's ARP table maintains state that maps IP addresses to hardware (MAC) addresses.

D. A host's ARP table maintains state that maps hardware addresses to IP addresses.

Answer 1 The answer is: (A), (C). ■

2. [4 points]: Which of the following is true about DNS?

(Circle ALL that apply)

A. A query for an `A` record may return multiple IP addresses in the response.

B. A query for an `NS` record may return multiple IP addresses in the response.

C. A query for a `MX` record may return multiple IP addresses in the response.

D. A short TTL on an `A` record reply may run the risk of increasing traffic at the root nameserver.

E. None of the above.

Answer 2 The answer is: (A), (C). ■

3. [2 points]: Which of the following most accurately describes the *most common* uses for eBGP, iBGP, and IGP?

(Circle the BEST answer)

A. eBGP is used between ASes for external destinations, iBGP is used within an AS for external destinations, and IGP is used within an AS for destinations within an AS.

B. eBGP is used within an AS for external destinations, iBGP is used between ASes for external destinations, and IGP is used within an AS for internal destinations.

C. eBGP is used between ASes for external destinations, iBGP is used within an AS for internal destinations, and IGP is used within an AS for external destinations.

D. None of the above

Answer 3 The answer is (A). ■

4. [4 points]: Which of the following might the operator of an AS use for *inbound* traffic engineering (i.e., to control how traffic reaches the destinations in its network)?

(Circle the BEST answer)

A. AS path prepending

B. Selectively advertising prefixes on some BGP sessions but not others

C. Adjusting local preference settings for routes learned from neighboring ASes

D. None of the above

Answer 4 The answer is (A), (B). ■

5. [4 points]: Suppose that a link is being monitored with both packet flow monitoring and a full packet trace.

Assume that routes do not change, the interface and packet filters do not drop any packets, that the packet trace contains full payloads, and that the flow records are based on *all* packets that traverse the link (*i.e.*, that there is no sampling).

Which of the follow statements are true about each of the traces?

(Circle ALL that apply)

A. The packet trace can be used to calculate the exact duration of every flow that crosses the link.

B. The trace of flow records can always be used to calculate the exact duration of every flow that crosses the link.

C. Both the packet trace and the trace of flow records can be used to determine the number of bytes in each flow.

Initials:

D. The size of a flow record will always be smaller than the combined size of the packets in the corresponding flow.

Answer 5 The answer is (A) and (C). (B) is false because a single flow may be split across multiple flow records, so it may be tough to distinguish when a flow begins and ends if it is idle for a long time. (D) is false; recall the example in class where we discussed that a single flow could consist of a SYN packet, while a typical flow record is 1500 bytes. ■

II Potpourri

6. [4 points]: Recall that in class we discussed that the Georgia Tech network has hundreds of virtual LANs. State *two advantages* for dividing a single network into multiple VLANs.

(Answer legibly in the space below.)

Answer 6 Multiple VLANs divide the network into smaller broadcast domains, which can provide various improvements for, say, security (it's much harder to "snoop" traffic on a different LAN) and scaling (reducing the size of each broadcast domain allows the network to scale better). ■

7. [2 points]: Recall from Hands-On Assignment 1, the Click `FromHost` module for your Ethernet switch had to be set in promiscuous mode. Explain why the switch would not forward Ethernet frames if this was not the case.

(Answer legibly in the space below.)

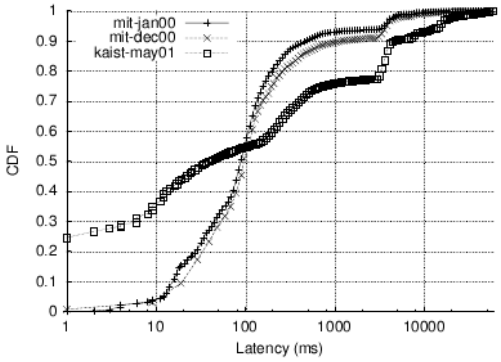
Answer 7 In this assignment, the `EtherSwitch` needed to be set in promiscuous mode because ethernet frames from a nost connected to the switch would have a destination MAC address for the host to which the frame was destined. However, the `EtherSwitch` in the Emulab testbed is simply another host with interfaces: if the interface on that nodes is not set to promiscuous mode, it will not accept a frame that does not have a MAC address that corresponds to the MAC address of its own interface. ■

8. [4 points]: Consider the graph below, which shows a cumulative distribution function (CDF) of the DNS response times for DNS lookup latencies for three data traces: (1) two different traces at a resolver at MIT in Cambridge, MA; (2) one trace at a resolver in Korea (`kaist`). [1]

A. Which resolver has more queries that take more than a second to resolve?

B. Why might the two traces have different latency distributions? (In other words, why might one resolver take longer to resolve queries than another?) There are several possible reasons; give one. (*Hint:* Think about geography.)

(Answer legibly in the space below.)



Answer 8 Korea (kaist) has more queries that take more than a second to resolve. The two traces likely have different latency distributions because the local resolvers are located in different geographic regions, but the lookup distributions themselves may also vary. For example, it is likely that a local resolver in Korea will have more DNS queries for authoritative domains that are within Korea than one in the US, but also a local resolver in Korea will likely have a significantly larger number of queries that are for domains that are very far away (i.e., in the US). ■

[1] In case you don't know, the way to read a CDF is as follows: a point (x, y) means that for that distribution, the fraction y of the points in that distribution have value x or smaller. For example, slightly more than 30% of the queries in the `kaist` trace had a lookup latency of 10ms or less.

Initials:

III Design Question: Scaling Ethernet

Recall the Ethernet switch topology from Hands-On Assignment 1, shown below. You installed learning bridges on a dumbbell topology. Learning bridges can control some flooding of data traffic, but 1other broadcast traffic (e.g., ARP queries, DHCP) will still be flooded across the entire LAN.

9. [2 points]: Explain why flooding ARP queries across the entire network could impose scaling problems.

(Answer legibly in the space below.)

Answer 9 Flooding ARP queries across the entire network could impose scaling problems by introducing a substantial amount of broadcast network traffic, unnecessarily wasting network capacity. ■

George Burdell has an idea about how to make Ethernet scale by cutting down ARP traffic: "Instead of flooding ARP queries to all nodes on the LAN, why not simply have an ARP directory server?" He suggests that a single machine on a LAN could maintain a table of IP-to-MAC address mappings.

10. [4 points]: Explain the advantages of making the ARP directory server state "soft".

(Answer legibly in the space below.)

Answer 10 In this case, soft state provides benefits for both host mobility and for resilience. If the ARP directory server state is soft, then the directory server can maintain mappings between IP address and MAC address, even as hosts move or even if the directory server crashes. ■

Initials:

Georgia Tech takes George's suggestion and deploys the ARP directory server, but the operators noticed that the server is sustaining heavy query loads during peak hours. They decide that they would like to *distribute* the ARP directory and see two possibilities for distributing the service:

A. Each directory server maintains a complete copy of the ARP table. Any server can answer an ARP query for any IP address on the LAN.

B. Each directory server maintains only a *subset* of the ARP table. In other words, each directory server can resolve queries for some MAC addresses. *The ARP query must be "routed" to the correct directory server.*

11. [4 points]: Give one advantage and one disadvantage of each approach. (Hint: Think about issues such as how well each approach scales, traffic load, potential consistency issues, how the table(s) will be populated, etc.)

(Answer legibly in the space below.)

Answer 11 If each directory maintains a copy of the ARP table, then any server can answer any ARP query. This simplifies routing of the queries (i.e., determining which server can answer which query), and it also makes the system robust if any one of the ARP directory servers crashes. However, it potentially makes the system less scalable (since each server must store all of these mappings), and it makes maintaining consistency more complicated: when an ARP entry becomes stale or changes (e.g., due to host mobility), *all* of the directory servers must be updated. ■

After some consideration, the Georgia Tech operators decide to implement the second option.

12. [6 points]: Explain how you might (1) decide to divide the ARP table among the directory servers; (2) establish connectivity between the ARP directory servers to properly "route" the query to the right server, without flooding. *No single "right" answer! Be creative. Partial credit will be given for sensible approaches.*

(Answer legibly in the space below.)

Initials:

IV Bonus: Anonymous Course Feedback

This page is anonymous. Rip this off from your exam, and turn it in separately if you like. You'll get five points for simply ripping off the last page of the exam, but I'd prefer if you fill it out and hand it in in a separate stack.

What are the things you like most about the course so far? Anything is fair game here (topics, course structure, board technique, etc.).

What are the things you like least about the course so far? Again, anything is fair game.

What topics would you like to see covered?

Initials: