College of Computing

Georgia Institute of Technology

Online CS 6250: Computer Networking: Fall 2014

Final Exam

There are 15 questions and 7 pages in this quiz booklet (including this page). Answer each question according to the instructions given. You have **85 minutes**.

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! You may want to look through the whole quiz to identify which questions you can complete most quickly for the most points.

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 "CLOSED BOOK" QUIZ.
YOU ARE PERMITTED ONE DOUBLE-SIDED SHEET OF PAPER FOR NOTES.
ABSOLUTELY NO EMAIL OR MESSAGING OF ANY KIND!
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

1-5 (xx/20)	6-12 (xx/49)	13-15 (xx/16)	Bonus (xx/5)	Total (xx/85)

Name:

1. [4 points]: From the Dave Clark paper, *Design Principles of the DARPA Internet Protocols*, which was the first and foremost fundamental design goal of the Internet?

(Circle the BEST answer)

A. Security of end hosts and traffic.

B. Multiplexed utilization of existing interconnected networks.

C. Cost-effectiveness.

D. East of management

E. None of the above.

2. [4 points]: Which of the following are characteristics of packet switching?

(Circle ALL that apply)

A. Variable delay.

B. "Busy signals"

C. Sharing of network resources among multiple recipients.

D. Dedicated resources between each pair of sender and receiver.

E. None of the above.

3. [4 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 within an AS for external destinations, iBGP is used between ASes for external destinations, and IGP is used within an AS for internal destinations.

B. 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.

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

Name:

4. [4 points]: Which of the following is true about required router buffer sizing if TCP senders are *not* synchronized?

(Circle ALL that apply)

- **A.** The amount of buffering to sustain complete utilization is more than the bandwidth-delay product.
- **B.** The amount of buffering required to sustain complete utilization is less than the bandwidth-delay product.
- **C.** Packets from different TCP flows will experience packet drops at different times.
- **D.** The total amount of packets in the bottleneck buffer at any time will be a normal random variable whose standard deviation is inversely proportional to the square root of the number active flows.
- **E.** None of the above

5. [4 points]: Which of the following are characteristics of interdomain routing policies that are commonly applied?

(Circle ALL that apply)

- **A.** Given multiple routes to the same IP prefix, an AS will prefer a route through a provider over a route through its customer.
- **B.** Given multiple routes to the same IP prefix, an AS will prefer a route through a customer over a route through its peer.
- **C.** An AS will not advertise a route that it learns via a provider to a peer.
- **D.** An AS will not advertise a route that it learns via a provider to another provider.
- **E.** All of the above

6. [4 points]: What are some of the possible causes of congestion collapse?

(Circle ALL that apply)

- **A.** Faulty router software
- **B.** Spurious retransmissions in flight
- **C.** Packets traveling distances that are too far in between routers
- **D.** Undelivered packets
- **E.** None of the above.

7. [4 points]: Which of the following are true about additive increase multiplicative decrease (AIMD) and fairness?

(Circle ALL that apply)

- **A.** Additive increase improves efficiency.

Name:

B. Additive increase improves fairness.

C. Multiplicative decrease improves efficiency.

D. Multiplicative increase improves fairness.

E. All of the above.

8. [4 points]: Which of the following pathologies can streaming audio and video tolerate by adding more buffering at the receiver?

(Circle ALL that apply)

A. Packet loss

B. Delay variation or jitter

C. Low throughput

D. Out of order packets

E. All of the above

Name:

9. [4 points]: Which of the following statistics are possible to gather from information such as flow sampling (*e.g.*, NetFlow)?

(Circle ALL that apply)

A. The time in between each packet transmission

B. Packet headers

C. The number of bytes that each flow sends

D. The number of packets that each flow sends

E. None of the above

10. [4 points]: Which of the following are true about a leaky bucket traffic shaper?

(Circle the BEST answer)

A. A link that is shaped with a leaky bucket traffic shaper will never send traffic on the outgoing link at a rate that is higher than the average drain rate of the bucket.

B. On a link that is shaped by a leaky bucket, a sender can never send traffic faster than the average drain rate of the bucket; the link will simply drop any traffic that is sent at a higher rate.

C. Comcast's PowerBoost is likely implemented with a leaky bucket traffic shaper.

D. None of the above

11. [4 points]: What are some advantages of separating the data and control planes, as in a software defined network (SDN)?

(Circle ALL that apply)

A. Independent evolution of data and control plane.

B. Less likelihood of failure.

C. Network-wide view of the state of forwarding elements.

D. Ability to control a network from a single, centralized software program.

E. None of the above.

12. [4 points]: What is the meaning of "parallel composition", in terms of Pyretic policies?

(Circle ALL that apply)

A. Apply each policy to the same copy of the packet concurrently.

B. Apply multiple policies to packets in sequence.

C. Make a copy of the original packet, then apply each policy to an independent copy of the packet.

D. Apply exactly one of the parallel policies to a copy of the packet, depending on which policy matches.

Name:

E. All of the above.

13. [4 points]: What does the Pyretic policy `match(srcip=A) >> fwd(2)` do?
(Circle ALL that apply)

A. For all packets that will be forwarded via output port 2, rewrite the source IP address to A.

B. Forward packets matching source IP address A via output port 2.

C. Rewrite packets matching source IP address A so that the virtual packet header for `outport` has the value 2.

D. Drop packets whose source IP address is not A.

E. All of the above

14. [4 points]: Which of the following are true about BGP routing security?
(Circle ALL that apply)

A. An AS can defend against route hijack attacks by filtering route advertisements for IP prefixes that neighbors do not own.

B. An AS can defend against AS path shortening attacks by filtering route advertisements for AS paths that it does not own.

C. In Secure BGP (S-BGP), an AS that advertises a route signs a version of the AS path that includes the next AS along the path (i.e., the AS to whom it is advertising the route).

D. Attackers can use short-lived BGP routing announcements to make it more difficult to trace certain types of attacks (e.g., spam, DoS).

E. None of the above

15. [4 points]: What are some mechanisms that can be used to implement censorship?
(Circle ALL that apply)

A. Blocking DNS requests.

B. Blocking TCP connections.

C. Redirecting URLs to a block page.

D. Withdrawing BGP routes.

E. None of the above.

Name: