

CS 3251: Computer Networks I, Final, Fall 2004

- Total Time: 8:00am - 10:50am
- *Closed Book and Notes.*
- *Answers given without adequate explanation of where they come from will not receive any credit.*

Question 1 (25 points) The following is the output of the command “tracert www.cs.utexas.edu” as it was executed on my machine “ibis.cc.gatech.edu”

```
52--ibis> traceroute www.cs.utexas.edu
traceroute to net2.cs.utexas.edu (128.83.120.155), 30 hops max, 40 byte packets
 1 cc-cisco1-comm.cc.gatech.edu (130.207.8.1)  1 ms  1 ms  0 ms
 2 130.207.251.1 (130.207.251.1)  1 ms  1 ms  1 ms
 3 gateway2-rtr.gatech.edu (130.207.254.117)  1 ms  1 ms  1 ms
 4 sox-gw2-rtr.sox.gatech.edu (199.77.194.5)  1 ms  1 ms  1 ms
 5 56marietta-to-gatech-rtr.sox.gatech.edu (199.77.194.42)  1 ms  1 ms  1 ms
 6 atla.abilene.sox.net (199.77.193.10)  2 ms  2 ms  2 ms
 7 hstnng-atlang.abilene.ucaid.edu (198.32.8.33)  21 ms  30 ms  21 ms
 8 192.88.12.21 (192.88.12.21)  25 ms  25 ms  25 ms
 9 192.88.12.90 (192.88.12.90)  25 ms  25 ms  25 ms
10 ser9-v703.gw.utexas.edu (128.83.9.1)  25 ms  25 ms  25 ms
11 128.83.37.42 (128.83.37.42)  25 ms  25 ms  25 ms
12 net2.cs.utexas.edu (128.83.120.155)  25 ms  25 ms  25 ms
```

Answer the following questions:

1. How does Traceroute work? Make sure to explain which protocols and which features Traceroute uses.
2. Why is the name in the final line (line 12) not the same as the argument to traceroute.
3. Lines 1,3-7, 10 and 12 show domain names as well as IP addresses while lines 2, 8, 9, and 11 show IP addresses only. Explain this inconsistency?
4. Which router’s Ethernet address would my machine (ibis) need before it can send an IP packet to www.cs.utexas.edu? which protocol is typically used to obtain this address?

Question 2 (10 points)

1. Explain the concept of “Well-known Port Numbers”.
2. Discuss the alternative to the use of well known port numbers. What if a server (e.g., a web server) chose its own port number every time it started up? Devise a scheme that can be used by the client to determine the server port number and ** Explain the pros and cons of your scheme relative to the use of well known port numbers.

Question 3 (10 points)

1. Describe two approaches by which packet loss is detected in a Go-Back-N ARQ protocol.
2. A Go-Back-N ARQ protocols aims to insure that data is delivered in sequence and the receiver has the option to not accept out of order data. Explain why this was deemed necessary.

Question 4 (10 points)

1. Explain why there is only one standard *Inter-Domain* Routing protocol (BGP4) and several standard *Intra-Domain* Routing protocols (like RIP and OSPF).
2. Comment on this statement

“The advantage of datagram routing in the Internet is that it allows each IP packet to reach its destination over the shortest path available at the time the packet is sent out.”

Is this true or false and *why*?

Question 5 (30 points)

1. Why doesn't TCP rely on the IP Checksum field and instead includes its own checksum in the TCP header?
2. Describe two mechanisms used in TCP that aim to avoid having segments from a previous TCP connection confuse an on-going TCP connection.
3. What are two functions that TCP's congestion control algorithm tries to achieve?
4. For the purposes of RTT estimation what is the definition of an *ambiguous ack*? How does TCP adjust its timeout estimate after receiving an ambiguous ack and *why*?
5. Two of the rules that TCP employs for generating acks are as follows:
 - **Event:** Arrival of in-order segment with expected sequence number. All data up to expected sequence number already acknowledges.
 - **Action:** Delayed ACK. Wait up to 500 msec for arrival of another in-order segment. If next in-order segment does not arrive in this interval send an ACK.

 - **Event:** Arrival of out-of-order segment with higher-than-expected sequence number. Gap detected.
 - **Action:** Immediately send Duplicate ACK, indicating sequence number of next expected byte.

Explain the reasoning behind each action above.

Question 6 (15 points)

1. For how long does the Ethernet CSMA/CD protocol need to listen for collisions while it is transmitting a frame
2. Why does the Ethernet's CSMA/CD protocol use a random backoff after a collision is detected?
3. Suppose that my Ethernet card's collision detection capability is not functioning but its carrier sensing capability (and other functionality) are intact. What would the effect of this malfunction be assuming that my card is connected to an Ethernet Hub?