

ECE3076, Internetwork Programming, QUIZ 1

Fall 2009

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RULES.

- i This quiz is **not** open book. One original sheet of hand-written notes may be used. Calculators are ok.
- ii Answer all questions and show all work to receive full credit. Use back of sheets only if necessary.
- iii All sub-questions have the same weight (4 %). Put answers in right-side blank areas.
- iv Please do not ask the proctors any questions during the exam about exam questions. Part of the test is understanding the question, as written, without supplemental information. If you feel additional data is needed to solve the problem, make (and state) an assumption and then work the problem.
- v. This is a time-limited test. All papers must be turned in 45 minutes after the start. The Georgia Tech Honor Code applies (see last page).

Question 1 – The Internet. Write the correct answer in the space along the right edge.

Answers

- a. What is AT&T, in terms of an Internet entity? a. Internet Service Provider (ISP)
- b. What is Georgia Tech, in terms of an Internet entity? b. Autonomous System (AS)
GT does not sell Internet Service (ISP). It is an AS with IP addresses, and DNS servers for "gatech.edu"
- c. Two Cows is a registrar that assigns what to Internet organizations or individuals? c. Domain Names
- d. Where in the "intelligence" located in the Internet? d. At the edges.
- e. IANA is the single central organization that assigns what to Internet organizations? e. IP Addresses

Question 2 – Data Throughput. If the data in a pipeline is less than a "Window" size, the transfer rate is "transmission rate limited" (limited by the data rate of the path), and the Utilization factor is 1.0 (to first order) . Otherwise it is "Window Limited."

*The "data in the pipeline", D, is given by "RTT * R". The Utilization, U, is W/D for W<D and 1.0 for W>D. In the Window limited case (U < 1), the Throughput is W/RTT = R * U.*

- If the round-trip-time, RTT, is 25 ms and the rate, R, is 100 Mb/s:
- a. What is D ("data in the pipeline", in bits). a. 2.5 Mbits
 $0.025s * 100 \text{ Mbits/s} = 2.5 \text{ Mbits}$
 - b. When the Window is 65,000 bytes, is this connection Window Limited (yes/no) ? b. Yes
 $W = 8 \text{ bits/Byte} * ,000 = 0.52 \text{ Mbit} < D$
 - c. What is the Utilization? c. 20.8 %
 $0.52 \text{ Mbit} / 2.5 \text{ Mbit} = 0.208$
 - d. What is the Throughput? d. 20.8 Mbits/s
 $8 * 128,000 / 0.025 = 41.0 \text{ Mbit/s or } 0.309 * 100 \text{ Mbits/}$
 - e. If RTT to a local server is 8 ms, what would the throughput become? (Rate limited) e. 100 Mbits/s

Question 3 – Clients and Servers. What is a host that sends a datagram with the characteristic below? Possible answers are (DS) definitely a server, (PS) probably a server, (In) inconclusive, (PC) probably a client, (DC) definitely a client.

- a. Application layer is HTTP "get" (answer DS, PS, IN, PC, DC). a. **DC** _____
Only browsers send get requests.
- b. Source TCP port is 35624, destination TCP port is 144. b. **PC** (DC, IN: half credit)_
It is usually true that servers have a low port number (<2048) and clients a high port.
- c. TCP flags SYN and ACK are both set (=1). c. **DS** (or PS) _____
"PS" if one remembers the data channel of original (non-passive) FTP
- d. TCP flags RST (reset) and ACK are both set (=1). d. **IN** _____
Client or server can send a RST.
- e. TCP flags FIN (finish) and ACK are both set (=1). e. **IN** _____
Client and server both send a FIN-ACK. Either could send it first..

Question 4 – TCP

Please show calculations under these questions and answers (integers for (a) through (e) in blanks at right.

The sender buffer SendBase is 1000. Four TCP segments have been sent with sequence numbers 1000, 1500, 2000, 2500 with 500 bytes of data.

A segment is received with TCP acknowledgement number 2500 and window 4000. The CongWin is now 14000. MSS is 1420. Until another ACK is received:

- a. What is the new value of SendBase? a. 2500
Sendbase is the highest TCP acknowledgement number received.
- b. What is the last byte (number) that can be sent with certainty that the receiver's buffer will not overflow? b. 6500
Last byte \leq Last (largest) byte acknowledged (2500) + (its) window (4000) [p.263]
- c. What is the last byte (number) that can be sent without violating Congestion Control rules? c. 16500
Last byte \leq Last (largest) byte acknowledged (2500) + CongWin (14000) [p.263]
- d. Three more TCP segments are received with TCP acknowledgement number 2500. d. 2500
 What is the next byte (sequence number) that will be sent?
The receiver is saying "2500 is the next missing byte." Send the segment whose 1st byte (segment no.) is 2500
- e. What is the new value of CongWin. e. 8250
CongWin is cut in half after 3 duplicate ack's (acknowledgement numbers).

5– Running Average for Calculating the Retransmit Time Out (RTO) value.

Use space under table for calculations. Round up all results (including intermediate results) to an interger (ms).

Measured Round-Trip Time, M SampleRTT	Average RTT, A Alpha = 1/8 EstimatedRTT	Deviation (M - old-A) (+/-)	Average Deviation, D Beta = 1/4 DevRTT	RTO = A + 4D Retransmit Time TimeOut
40	35	-10	10	75
25	34	-10	10	74

Please show calculations for after new Sample RTT of 25 is received. Use the back of page 1, if not enough room here.

$$estRTT = 0.875 * 35 + 0.125 * 25 = 33.25 \rightarrow 34$$

$$avgDev = 0.75 * 10 + 0.25 * |25 - 35| = 7.5 + 2.5 = 10 \quad RTO = 34 + 4 * 10 = 74$$

- a. What is the new value of Estimated RTT (round results up to 1 ms) ? a. 34
- b. What is the new value of Average Deviation (round results up to 1 ms)? b. 10
- c. What is the new value of RTO (round results up to 1 ms)? c. 74
- d. If a timeout occurs next, what is the temporary new value of RTO? d. 148
After a timeout, the value of RTO time is temporary doubled.
- e. The RTO timer protects the TCP connection from locking up after what? e. lost packets

Honor Code - I affirm that I have obeyed the rules of the Georgia Tech Honor Code*.

Signature _____

*Basically, I did not cheat, and I reported any observed cheating. A grade will not be recorded if there is no signature.