THE UNIVERSITY OF BRITISH COLUMBIA

Computer Science 317, Section 201
Quiz 2
February 26, 2015

Instructor: Norm Hutchinson **Time: 45 minutes** **Total marks: 40**

This quiz consists of 6 pages (including this cover page). When instructed to do so, verify that you have a complete quiz.

This is a closed book quiz. Notes, books, electronic devices or aids, or other materials are not allowed.

Answer all the questions on this paper. Use the backs of pages if you need more space. Be be sure to indicate that an answer is being continued on the back of a page. Give short but precise answers. Always use point form where appropriate. Marks will be deducted for answers that ramble, repeat information, or contain information not relevant to the question.

The marks for each question are given to the left of each question. Use this to manage your time.

READ AND OBSERVE THE FOLLOWING RULES GOVERNING EXAMINATIONS:

1. Each candidate must be prepared to produce, upon request, a UBCcard for identification;
2. Candidates are not permitted to ask questions of the invigilators, except in cases of supposed errors or ambiguities in examination questions.
3. No candidate shall be permitted to enter the examination room after the expiration of one-half hour from the scheduled starting time, or to leave during the first half hour of the examination.
4. Candidates suspected of any of the following, or similar, dishonest practices shall be immediately dismissed from the examination and shall be liable to disciplinary action:
   - Having at the place of writing any books, papers, calculators, computers, sound or image players/recorders/transmitters (including telephones), or other memory aid devices, other than those authorized by the examiners;
   - Speaking or communicating with other candidates;
   - Purposely exposing written papers to the view of other candidates or imaging devices. The plea of accident or forgetfulness shall not be received.
5. Candidates must not destroy or mutilate any examination material; must hand in all examination papers; and must not take any examination material from the examination room without permission of the invigilator.
6. Candidates must follow any additional examination rules or directions communicated by the instructor or invigilator.

<u>**Additional Rules and Directions:**</u>
You are *<u>not permitted to ask questions</u>* of the invigilators during the exam. If you are unsure of a question state your assumptions and answer the question to the best of your ability.

Marks

1.	/8
2.	/8
3.	/10
4.	/14
Total	/40

8 1) Short Answers. Answer each question with at most one or two sentences. Be as brief and as clear as possible, while making sure the answer is properly justified.

a) Is 255.255.192.0 a valid netmask? Justify your answer.

2 Yes a valid netmask as to be all 1's followed by all 0s when being looked at in binary form. If we write this out we have

FF.FF.FF.C0.00 in hex. The only part of this address of interest is therefore the hex digits C0. When we write that in binary we get 1100 0000. Prior to C0 everythng is 1s and everything after is 0. Further the C0 also has all 1s followed by 0s, therefore this is a valid subnet address.

b) What is the ARP protocol used for?

2 We use it to determine the MAC address of IP addresses on the same subnet as the sending machine (The subnet part is important as it isn't used to determine the MAC addresses of IP addresses not on a machine's subnet.)

c) There are 4 types of delay that contribute to the end-to-end delay when sending a packet. What are they? Name each and give a very short explanation of each.

4 Processing delay – time taken by the machine to decide what to do with the packet

Queueing delay – time taken waiting for the outgoing link to be free so the packet can be sent

Transmission delay – time taken to put the packet on the "wire"

Propagation delay – time taken for the signal to travel to the receiver

8 2) Answer the following questions concerning the operation of DNS. Start assuming that all the DNS caches are empty but as the queries in this question are answered caches are filled, as appropriate. Also assume that iterative DNS lookups are done (i.e., what we did in class.) Justify your answers. **<u>You will be awarded 0 if you simply write a number without an appropriate justification.</u>** You may assume that intermediate results return IP addresses or FQDN (Fully Qualified Domain Names) along with their associated IP addresses (typically in the additional records section of a response) so that you don't have to perform additional DNS queries to lookup the FQDNs

a) What is the most (reasonable) number of DNS servers that could be queried to lookup the name *ecos.vs.gov.bc.ca?* What is the least (reasonable) number? Assume this is a valid name.

1) Root name server, 2) ca nameserver 3) bc name server 4) gov name server and it could be responsible for the vs domain, if not there could be 1 more for the vs domain. So the answers are 4 if gov covers the vs domain or 5 if it doesn't. (5 and 6 are acceptable provided one clearly indicates that the application is querying a local name server which then does the other queries)

3 points

b) After 5 minutes we again do a lookup of *ecos.vs.gov.bc.ca*. What is the most (reasonable) number of DNS servers we would need to query to resolve the address now? What is the least (reasonable) number. Carefully justify your answer.

If the server has the name cached then we will get it back immediately and the answer is 0 (1 if local name server is identified). If nothing is left in the cache then the most is 5 (6) based on the argument in 1.

2 points

c) What is the most (reasonable) number of name servers we would now need to query to resolve the address *doonesbury.washingtonpost.com* whose cname is *site.doonesbury.com*. (Keep in mind the caching rules in the question's preamble.) Clearly explain how the number was arrived at.

1) root server 2) com 3) washingtonpost at which point we get back a cname and have to look it up. So we need to do a lookup of site.doonesbury.com. We don't need to go to the root as we know where the com server is so 4) query to com DNS 5) query to doonesbury.com

Total is 5, (6 if you query your local server.)

3 points

10 3) Consider the following system:

- Machines A and B are directly connected by a network cable.
- The bandwidth of this connection is 8.8Megabits/s (Mb/s)
- Machine A and B exchange data with a set of layered protocols where the headers are exactly 100 bytes regardless of payload size.
- The one-way propagation delay between A and B is 1 millisecond (1×10^{-3} s)

a) What is the maximum possible throughput for this connection when the payload size is 1000 bytes? Express your answer in both packets/s and Megabytes/s and show all work. Circle your answers.

First convert the BW to bytes/s 8.8megabits/8 = 1.1 Megabytes/s ← This is the maximum throughput

In packets/s divide 1,100,000 bytes/s by 1100 bytes/packet to get 1000 packets/s

2 points

b) Suppose that for packets with a 1000 byte payload a throughput of 0.22Megabytes/s is observed. What is the goodput in bytes/second? Show your work and justify your answer.

This is simply the ratio of the payload to the total packet size times the observed throughput.

(1000/1100) * 220,000 = 200,000 bytes/second
2 points

c) Suppose that we use a protocol where packets with 1000 bytes of payload are sent from the sender to the receiver, each followed by a 1 bit reply from the receiver to the sender. The sender waits for each reply before sending the next packet. Assume all packets arrive correctly and there is no queueing. What throughput is achieved from the sender to the receiver? Give your answer in packets per second. Show your work and justify your answer.

Time for 1 round trip is the transmission delay + 2 * the propagation delay.

The transmission delay for 1100 bytes = 8800 bits / 8.8×10^6 bits/s = 10^{-3}s = 1 ms.

The propagation delay each way is 10^{-3}s so the total time for one round trip is 3ms.

Throughput is therefore 1/0.003s = 333 packets per second.
3 points

d) Suppose that for problem (c) the propagation delay were now 0.25 milliseconds. What would the throughput in packets/second be now? Show your work and justify your answer.

The transmission delay doesn't change but the propagation delay is now 0.25 ms each way.

The total time for one round trip is 1.5ms.

Throughput is therefore 1/0.0015s = 667 packets per second.
3 points

14 4) Answer the following questions based on a picture of part of the Internet as presented on the next page. (You may remove page) Fill in the blanks with the appropriate values.

a) Assume that all IP addresses are routable. A packet is sent from A to C. When the packet arrives at C, the packet's destination IP address is 133.16.2.17 and its source IP address is 133.16.2.195.

b) Assume that all IP addresses are routable. As a packet makes it way from B to H it passes through router E. As the packet leaves router E the packet's destination IP address is 8.17.7.125 its source IP address is 133.16.2.125, its link layer destination MAC address is associated with the interface that has IP address 93.18.51.67 and the source MAC address is associated with the interface that has IP address 93.18.41.67.

c) Suppose that 2 browsers on machine A, and and one browser on machine C, are connecting to an http server on machine G using TCP/IP. This results in 3 sockets being open/active on G. What information on machine G does the protocol stack make use of to ensure that the packets from the various browsers go to the proper socket?

It makes use of the source and destination IP addresses and the source and destination port numbers. When packets from the different sources arrive they all the have the same destination port and IP addresses so that information alone isn't enough to separate the streams of packets. If we also use the source IP address that will allow us to distinguish between machines and then the source port will allow us to separate the various socket sources on the same machine.

4 points

1 points each for IP addresses in each other blank.

d) Now Suppose that router F is a NATting router for the machines G, H, and I. When a packet is sent from H to B, the destination IP address when the packet arrives at router E is 133.16.2.125 and the source IP address is 93.18.51.67. When the response packet goes from B to H, the destination IP address of the packet when it leaves router E is 93.18.51.67 and the source IP address is 133.16.2.125.

You may remove and keep this page, you do not have to hand it in.