THE UNIVERSITY OF BRITISH COLUMBIA
Computer Science 317, Section 201
Quiz 2
March 2, 2020

Last Name: _____

First Name: _____

Student ID: _____ **CSID:** _____

Date	March 2, 2020
Time Period	3:05AM - 3:50
Duration of Exam	45 minutes
Number of Test Pages	7 pages (pages double-sided, excluding top sheet)
Total Possible Marks	52 (5 questions)
Additional Materials Allowed	None. (SIMPLE CALCULATORS)

Instructions

1. Write your name and ID number at the top of this page.
2. Please note that there are questions on both sides of the page.
3. Answer the questions in the spaces provided. If you require additional space to answer a question, please use the second last page and refer to this page in your solutions. You may tear off the last page to use for rough work.
4. **Your grade will be influenced by how clearly you express your ideas, and how well you organize your solutions. Numerical answers should be in exact values.**
5. **DO NOT WRITE FORMULAS ON THIS COVER PAGE.**

1. (16 points) Answer the following questions in the space provided.

   (a) (2 points) Name two of the services provided by the Data-link layer.

   Solution: M3a
   Packetizing, addressing, error control, flow control, access control

   (b) (2 points) The "protocol address" for a TCP socket is the 4-tuple consisting of what four entities?

   Solution: M4b
   local IP and Port, remote IP and port

   (c) (2 points) What are the four steps in DHCP for a host to obtain an IP address (give the names of the steps in order)?

   Solution: M3c
   1 discover, 2 offer, 3 request, 4 ack

   (d) (2 points) What is the main purpose of the Address Resolution Protocol (ARP)?

   Solution: M3b
   Map IP addresses to MAC addresses. Needs to mention IP addresses and MAC addresses

   (e) (2 points) What is an authoritative name server for a domain?

   Solution: M4a
   Nameserver responsible for domain names and mapping of IP addresses to names in the domain.

   (f) (2 points) Briefly explain what happens in the kernel when the accept() function is called? What does accept() return on a non-error return in the application.

   Solution: M4b
   (1) It takes a connection from the completed queue allocates a new socket,
   (2) returns the file-descriptor for the new socket.

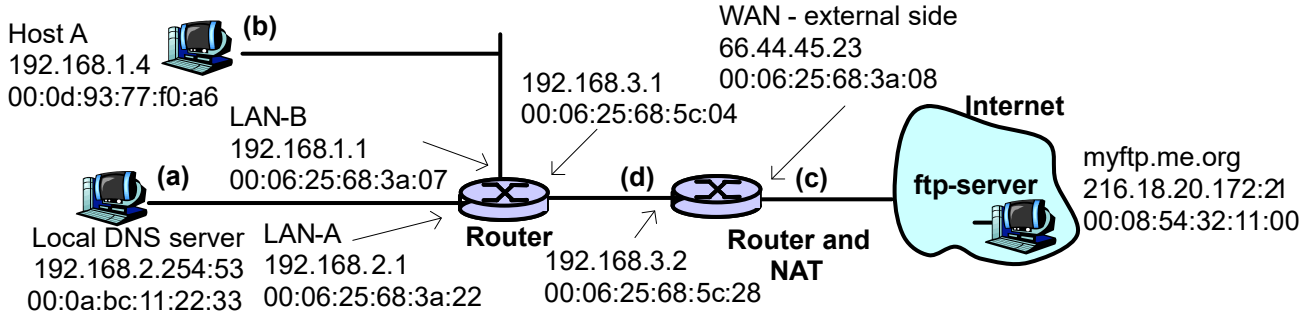
   (g) (2 points) What layer in the Internet is responsible for de-multiplexing communication between processes on a host machine?

   Solution: M4b
   Transport protocol

(h) (2 points) Name two transport layer services provided by TCP but **NOT** provided by UDP.

> **Solution:** M4b
> any of the following services: reliable delivery, flow control, congestion control, ordered delivery, segmentation, data bundling, non-duplication, , signalling.

2. (14 points) Consider the following network connected to the Internet with a router and a NAT enabled router as shown below. In completing the question, put `UNK` for any unknown addresses except for ephemeral ports assigned by the kernel put an `E`. For the "protocol" indicate whether the protocol is TCP or UDP. For MAC-IDs you can just put the last two octets (e.g. f0:a6)



(a) (3.5 points) Host A queries the local DNS server. Fill in the boxes below with the value of the fields for the packet at (a) in the diagram, as the **reply** to Host A's query leaves the local DNS server's adapter.

There are two typos in the solution to Question 2.

2a. The destination MAC address should be 3a:22. Its the LAN-A side of the router.

2b. The source MAC address should be f0:a6 instead of f0:ab. i.e. Host As MAC address.

Frame		Datagram		Protocol	UDP
SRC	**22:33**	SRC	**192.168.2.254**	SRC	**53**
DST	**3a:22**	DST	**192.168.1.4**	DST	**E**

(b) (3.5 points) Now having received the DNS server's reply, Host A sends a packet to the ftp server at myftp.me.org. Fill in the boxes for the packet at (b) as it leaves Host A's adapter.

Frame		Datagram		Protocol	TCP
SRC	**f0:a6**	SRC	**192.168.1.4**	SRC	**E**
DST	**3a:07**	DST	**216.18.20.172**	DST	**21**

(c) (3.5 points) For the packet sent by Host A in question (b), fill in the boxes below for the same packet at (c) in the diagram as it leaves the NAT-enabled router.

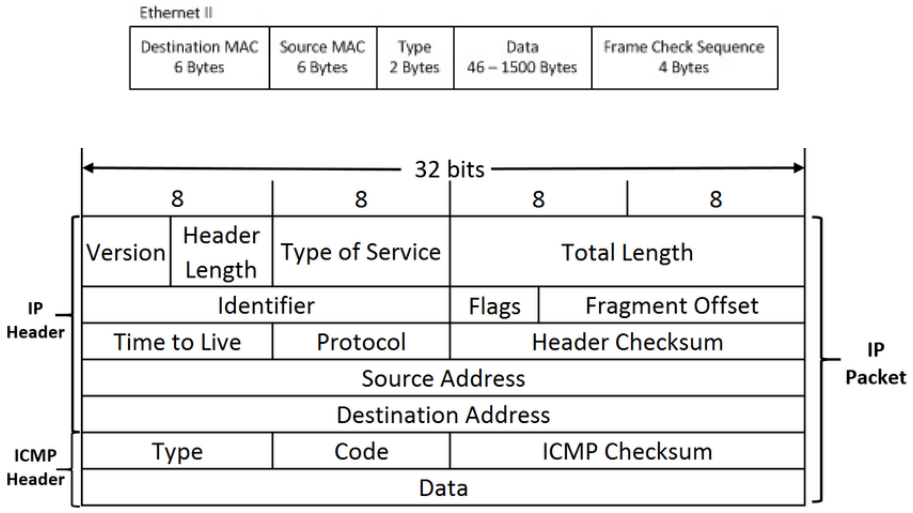
Frame		Datagram		Protocol	TCP
SRC	**3a:08**	SRC	**66.44.45.23**	SRC	**UNK**
DST	**UNK**	DST	**216.18.20.172**	DST	**21**

(d) (3.5 points) Finally complete the boxes for the packet at (d) sent by myftp.me.org in reply to the packet in question (b) that was sent to myftp.me.org by Host A.

Frame		Datagram		Protocol	TCP
SRC	**5c:28**	SRC	**216.18.20.172**	SRC	**21**
DST	**5c:04**	DST	**192.168.1.4**	DST	**E**

3. (8 points) Consider the following capture of an Ethernet frame and a portion of the payload from wireshark that contains an ICMP packet for a ‘‘`Echo (ping) request`’’ from a host.

bytes				
0000	00	06	25	da
0004	af	73	00	08
0008	74	4f	36	23
000c	08	00	45	00
0010	00	5c	d2	d5
0014	00	00	01	01
0018	08	5c	c0	a8
001c	01	65	8a	60
0020	92	02	08	00
0024	51	fe	02	00
0028	a4	01	00	00



(a) (6 points) Answer the following questions about the above wireshark capture.

i. (1 point) In Hex, what is the type of an ICMP Echo ping? **08**.

ii. (2 points) What is the protocol number for ICMP? **01**.

iii. (1 point) What is the TTL value? **01**.

iv. (2 points) What is the Windows or Linux command that could have generated this message? (Assume that no options are specified and the only parameter is an IP-address. Give the best answer!)

> **Solution:** traceroute (given that the TTL is 1, it is the first stage of a traceroute – a ping would have set it to 64.)

(b) (2 points) On a computer with IP address 152.14.62.38, I purged the ARP cache (using the "arp -d *" command). Then I "ping"ed host 132.151.6.75, while monitoring network traffic. I observed that my host first used ARP to get the MAC address for IP address 152.14.62.65, and then sent an ICMP Echo Request to 132.151.6.75. Why was the ARP packet necessary?

> **Solution:** Needs to first obtain the MAC-ID for the IP address of the router.

4. (8 points) End-point A sends a 16 bit message to end-point B. Both A and B agree to use a 2-dimensional EVEN parity scheme with the message split up into 4 bit chunks of data as shown below.

0	0	1	0	**1**
1	0	0	1	**0**
1	1	1	1	**0**
0	0	1	0	**1**
0	**1**	**1**	**0**	**0**

(a) (4 points) In the above, fill in all of the parity bits needed to send the above message from A to B.

(b) (4 points) Suppose B receives A's message and the parity for one of the columns is incorrect and the parity of one of the rows is also incorrect. All other rows and columns have the correct parity.

i. (2 points) Assume only a 1-bit error occurs. Can B correct this error? Answer yes or no and briefly explain why or why not.

> **Solution:** If there was only one error, then only one row and column will be affected and the error can be corrected. This is just the standard case of a 1-bit error.

ii. (2 points) Assume two 1-bit errors occur. What, if anything, can be said about the location of these two errors?

> **Solution:** This is simply not possible given that one row and one column is incorrect.

5. (6 points) Suppose end-station A wishes to send the bits below to end-station B using a CRC error-detection scheme where the generator polynomial is $x^4 + x + 1$. What does end-station A send to end-station B? Show the final message sent and show all work.

1 0 1 1 1 0 1 0 1 1 1

Show Work:

Solution:
Generator is 10101

1 0 1 1 1 0 1 0 1 1 1 0 0 0 0
1 0 0 1 1
0 0 1 0 0 0 1 0 1 1 1 0 0 0 0
– – 1 0 0 1 1
0 0 0 0 0 1 0 0 1 1 1 0 0 0 0
– – – – – 1 0 0 1 1
0 0 0 0 0 0 0 0 0 0 1 0 0 0 0
– – – – – – – – – – 1 0 0 1 1
0 0 0 0 0 0 0 0 0 0 0 0 0 1 1

Data sent to end-station B:

Solution: send 1 0 1 1 1 0 1 0 1 1 1 0 0 1 1 (remainder is the 0011 at the end)