Mid-Term Exam – CSE 30264 –Fall 2014

This assignment is individual work. Students should not discuss the problems or answers with classmates, nor should jointly developed solutions be submitted.

NAME: John F. Lake, Jr.

1) **(5 pts)** Latency can be defined as (select all that apply):
   a) RTT + (1 / Bandwidth) X transfer_time
   b) Delay x Bandwidth product
   c) (Distance / Speed_of_light) + (Size_of_message / Bandwidth) + Queue_time
   d) Time it takes to send a message from one end of a network to the other and back.

   Your Answer: C and D

2) **(5 pts)** The Delay x Bandwidth product can be used to measure (select all that apply):
   a) the endian-ness of a network node
   b) the time it takes to send a message from one end of a network to the other and back.
   c) the throughput that a use would achieve on a network link
   d) the maximum number of bits that could be in transit at any given instant

   Your Answer: D

3) **(5 pts)** Which of the following is a valid Ethernet Media Access Controller address (select one):
   a) 02:44:3c
   b) 08:00:20:3a:ee:f9
   c) 239.1.17.36
   d) 08:fe:77:63:87:01:11:00

   Your Answer: B

4) **(5 pts)** Which of the following is a description of shared Ethernet access control?
   a) Carrier Sense Multiple Access with Collision Avoidance
   b) Carrier Sense Multiple Access with Collision Detection
   c) Collision Sense Multiple Access with Carrier Detection
   d) Collision Sense Multiple Access with Carrier Avoidance

   Your Answer: B

5) **(5 pts)** You have been instructed to assign the IP address 239.2.11.71 to an Ethernet interface of a host on your network. The address will be used as the unicast address for that host. Is this a reasonable request? Why, or why not?

   This isn't reasonable. The host should have a MAC address as the unicast address for the host, not an IP address. If an IP address is the only thing used, then every host on the switch will receive the data, causing a unicast flood.

6) **(30 pts)** Your company is assigned the network address 214.56.78.0/24. The company has five work groups to support: Administration (11 hosts), Sales (32 hosts), Customer Support (41 hosts), Support servers (8 hosts), Web and Database Services (37 hosts). Management would like to provide for 10 percent growth in each group. Management would also like to have a "pool" of unused addresses for future use. The corporate

security group wants you to set the network up such that the work groups are on different network segments. Use subnetting to break the /24 network into smaller networks as described above (6 pts). List the networks **(6pts),** the netmasks **(6pts),** the "zero" **(6pts)** and "ones" hosts **(6 pts)** on each subnet in your design.

Network	**# Addresses**	**Netmask**	**Zero host**	**Ones Host**
214.56.78.0	16	255.255.255.240	214.56.78.0	214.56.78.15
214.56.78.16	64	255.255.255.192	214.56.78.16	214.56.78.79
214.56.78.80	64	255.255.255.192	214.56.78.80	214.56.78.143
214.56.78.144	16	255.255.255.240	214.56.78.144	214.56.78.159
214.56.78.160	64	255.255.255.192	214.56.78.160	214.56.78.223
214.56.78.224	32	255.255.255.224	214.56.78.224	214.56.78.255

7) **(5 pts)** Why was the file length (size) an important piece of information to send in your file transfer program (Project 1)? Does endian-ness of this value matter? If so, why, if not, why not?

The file length was very important so that the server would know exactly how many bytes to expect. The endian-ness does matter. If we didn't account for endian-ness, it is possible that a wildly different value would be used for the size on the other end of the network, causing the server to incorrectly wait for more or less data than it should.

8) **(5 pts)** What is the motivation for ATM having extremely small frames (cells)? What are the tradeoffs that must be considered when using such small cells?

With small, fixed size cells, the transmission time is much lower, and thus with small amounts of data this is optimal. A downside of ATM is the fact that there is a huge header to data overhead, so with large amounts of data you will be wasting quite a bit of it on the headers for each frame.

9) **(10 pts)** Compare and contrast the link state approach versus the distance vector approach to building routing tables. **Give an example** of a protocol for each approach.

With link state, you know everything about the network, and you distribute knowledge to everybody on the network, including the states of each link and the cost of using each link. Every router must know how to get to every other router on the network. An example of a link state routing protocol is Open Shortest Path First (OSPF).

With the distance vector approach, you only know the information about your neighbors and who they are able to reach. You don't have any direct information from routers not directly connected to you. The distance vector approach relies on the number of hops made between two destinations. An example of a distance vector routing procotol is Interior Gateway Routing Protocol (IGRP).

10) **(5 pts)** Suppose that you sign up with a local Internet Service Provider for home Internet service. You pay for a plan which touts 16 megabit/second down, and 4 megabit/second up. You notice that most of the time you do not get the advertised throughput. What circumstances might lead to degraded throughput?

Bottlenecks in switches and routers can definitely affect the amount of throughput, as packets will be held in buffers until bandwidth is available. Another factor that could lead to degraded throughput is the idea that the advertised amount is based on packets being used efficiently – if a packet isn't filled fully, for example, you will not get the same throughput.

Network overhead lowers throughput as well; TCP overhead, for example, can significantly lower the amount of throughput you will get.

11) **(5 pts)** Several years back, the Duke campus network experienced issues related to Apple devices overwhelming the wireless network. One of the causes examined was with respect to devices being overly aggressive in their ARP (ARP timeout was too low). The Duke network at the time was similar to the University of Notre Dame network at the time: a single switched network where all wireless APs (access points) were part of a single switched network segment. Given your understanding of how ARP works, was the above cause plausible, i.e. could an overly aggressive ARP timeout cause havoc in a purely switched network?

Note: While we have not covered wireless technology in depth, the concepts of ARP are the same across wired or wireless devices. Think to the root of what ARP does and how it works for your answer.

If there are aggressive ARP timeouts and a lot of devices on the network, then the network clients will need to constantly flush their ARP caches. Because of this, many broadcasts will be required, and performance will be seriously hindered.

12) **(5 pts)** Would a **routed** network between the wireless APs rather than a **switched** network between the wireless APs experience the same problems as exhibited in question 11?

Because ARP is used on single networks, and is not routed, each single AP would have far fewer devices requiring broadcasts. This would reduce the problems caused by short ARP timeouts, but it would not eliminate them completely.

13) **(5 pts)** Your parents recently had their laptop into a big box store because the network connection was not longer working. The technician tells them that their dynamic address has expired and that it will cost $60 to reset the dynamic address lease while flushing the ARP cache. Is this a plausible service? Why or why not?

It is not a plausible service because your computer will have its dynamic address reset through the usage of DHCP. You don't have to get a new dynamic address with a lease in the same way that you would lease a car or an apartment; it is simply carried out by DHCP. As for the ARP cache, that is something that you normally would not need to deal with; if you needed to clear the ARP cache manually, it takes a very short amount of time to do so.

14) **(10 pts)** Compare / relate the terms in the context of your coding: *socket, accept, connect, recvfrom, listen*.

A *socket* call is used in both TCP *and* UDP programming, and is called to create a socket descriptor that you can use later in your program for sending and receiving data.

Listen is used when you are waiting for connections. You utilize *listen* to wait for a connection, and then use *accept* to take and use a particular connection. These are used with TCP programs.

Connect is used with the socket descriptor to connect to a remote host. This is used in TCP programming.

Recvfrom is used with the socket descriptor to accept datagram packets (UDP).

15) **(5 pts)** Why are long streams of all zero, or all one bits a problem on a communication link? What techniques can be used to transmit long strings of zeros or ones without encountering these problems?

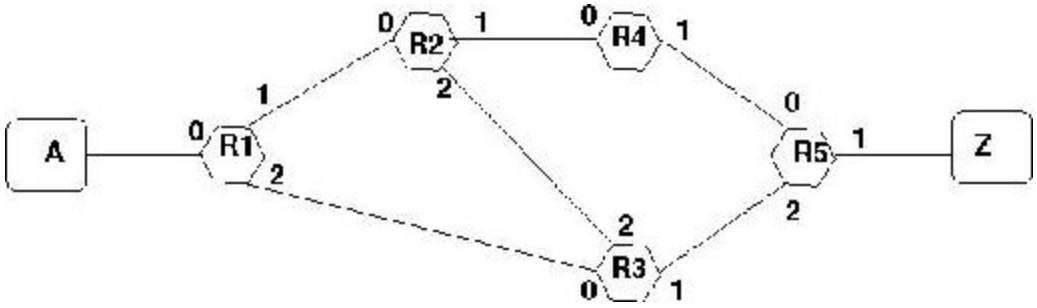
Long streams of all zeros or ones can lead to baseline wander; the clock cannot be recovered if the signal isn't changing. A few techniques to compensate for this are non-return to zero inverted (NRZI) encoding, Manchester encoding, and 4B/5B encoding. These are used to prevent long streams of zeros and ones.

16) **(5 pts)** Name three framing techniques used on communication networks, and an example protocol for each technique.

1.) Sentinel based approach – BISYNC
2.) Byte counting approach – DDCMP protocol.
3.) Bit oriented approach – HDLC protocol.

17) **(20 pts)** Using the figure as a reference, give a **hop by hop description detailing** how a 1400 byte packet would travel from Host A to Host Z given the following conditions. Explain why you chose the route that you describe. You do not need to build routing tables for the routers...assume that the tables exist, and support the route that you decide to use.

a) All links have an MTU of 1500 bytes, all links provide the same bandwidth, and the cost of every link is "1". You want the "lowest cost" route.
b) The links from R1 to R3, and R2 to R4 have an MTU of 1024 and operate at 1 megabit/second. All other links have an MTU of 1500 and operate at 10 megabit/second. The cost of the one megabit links is 2, while the cost of the 10 megabit links is 1.. You want the route with the "best throughput/least delay".
c) The links from R1 to R3, R2 to R4, have an MTU of 1024 bytes. The link from R3 to R5 has an MTU of 512 bytes. All other links have an MTU of 1500 bytes. The links with an MTU of 512 provide 512 kilobit/second with a cost of 2. Other links are 1 megabit/second with a cost of 1. You want to select the route with the "lowest total overhead".



a. For this route, I would take **R1 to R3 to R5**, as the total cost would be 2. You simply would take the path with the fewest links.
b. I would take **R1 to R2 to R3 to R5**; the total cost will be 3, as all of those paths have large MTUs and large bandwidths; they would maximize my throughput. Taking paths from R1 to R3 or R2 to R4 would make the transfer very slow; my strategy would be to avoid these routes at all costs, as they would make it much slower.
c. Here, I would try to use the routes with the largest Maximum Transfer Units, as this would minimize my overhead. Because of this, I would take **R1 to R2 to R4 to R5.** I would avoid the path from R3 to R4, as the MTU is very small, and the throughput is very, very small.

18) **(15 pts)** Suppose we have the following struct defined in our code.

```
struct ClassInfo
{
 char szName[41];
 char bTTH;
 uint16_t   nCredits;
 uint16_t   nStartTime;
 };
```

Sketch the C code to send the instance of that struct (listed below) to port 9265 at address 129.74.20.40 using TCP. You may assume all appropriate header files have been included and that endian-ness is not a problem.

```
struct ClassInfo  myClass;
strncpy(myClass.szName, "Computer Networks");
myClass.bTTH = TRUE;
myClass.nCredits = 3;
myClass.nStartTime = 1230;

/* sketch the code required to send the above instance of myClass as
described above */
//This assumes that a socket named mySock was set up correctly with all of the information pertaining to port
//9265 and IP address 129.74.20.40

//Send each part of the structure independently, and the recipient will take the values and will create a
//Classinfo object.
int BUFSIZE = 1000;
char buf[BUFSIZE];

write(mySock, myClass.szName, strlen(myClass.szName));        //Send the string
write(mySock, myClass.bTTH, sizeof(myClass.bTTH));            //Send the Boolean
write(mySock, myClass.nCredits,sizeof(myClass.nCredits));      //Send first numerical value
write(mySock, myClass.nStartTime,sizeof(myClass.nStartTime)); //Send second numerical value
read(mySock,buf,BUFSIZE);   //Get an acknowledgement message from the other end.
//Done
```

Provide your answers in a file *midterm.pdf* and place this file in your dropbox. Improper submissions will not be graded. Submissions made after the deadline (10/16/14 at 12:30pm) will not be graded.

Submitting this assignment signifies that this submission is individual work, and that the student has not discussed/completed the assignment with assistance from others.

Do not forget to put your name on your submission!