Due before:	11:59 PM (before Midnight) on Wed June 19, 2019

CSE278: Introduction to Systems Programming (Systems I)

Homework #4

Due: Wednesday June 19 2019 before 11:59 PM

Email-based help Cutoff: 5:00 PM on Tue, June 18, 2019

Maximum Points: 50

Submission Instructions

This part of the homework assignment must be turned-in electronically via Canvas. Ensure you name this document *HW4_MUID.docx*, where *MUid* is your Miami University unique ID. (Example: HW4_ahmede.docx)

Copy pasting from online resources is **Plagiarism**. Instead you should read, understand, and use your own words to respond to questions.

Submission Instructions:
Once you have completed answering the questions save this document as a PDF file (**don't just rename the document; that is not the correct way to save as PDF**) and upload it to Canvas.

General Note: Upload each file associated with homework (or lab exercises) individually to Canvas. Do not upload archive file formats such as zip/tar/gz/7zip/rar etc.

Objective

The objective of this homework is to:

- Review basic concepts of data communication networks from lecture slides

Required reading

Prior to answering the questions in this homework briefly review the following chapters from the E-book titled "Computer and Communication Networks" (all students have free access to the electronic book):

• Chapter 1: Packet-switched networks
• Section 4.1 (LAN and Basic Topologies) & 4.2 (LAN Protocols)
• Section 8.1 (Overview of Transport Layer), Section 8.2 (UDP), Section 8.3 (TCP)

1. Data communication networks are comparable to telephone systems. Briefly (1 sentence each, no more) describe 2 similarities between the two, in the table below [**2 points**].

Telephone systems	**Data communication networks**
It is telecommunicating network which is used to take the phone call with the persons.	The data between the two or more systems, and which is present by the 0 and 1.
It used by the telephone wires, mobile can move every place in the world, and it can be moved everywhere in the world,	It is also communicated by the auxiliary cables and optic fibers. The communication is not only possible through by the wires, it is also wireless.

2. What is the key difference between a Circuit switched and Packet switched network? [**1 points**]

Circuit switching:

1. Send messages from one point to another which is point-to-point link
2. each data unit know the entire path address and it is provided for sources
3. Delay between data units in circuit switching is uniform and it is very stable and reliable.
4. Data will moved it by itself, and data doesn't carry the signaling information.

Packet Switching:

1. It will break the message into small units called data packets and it will find the most valuable and fast routing by itself.
2. each data unit just knows the final destination address intermediate path.
3. data units in packet switching will delay the thing which is not uniform. And it is less reliable.
4. Each data packet will carry the signaling information and also the destination information.

3. What is the difference between a "Packet" and "Frame"? [**1 points**]

1. Packets
    1. It is units of data in the Network Layer
    2. It includes the source and destination IP address
    3. The segment is encapsulated within a packet
2. Frames
    1. It is the units of data in the Data-Link Layer

2. It will include the source and destination MAC address.
3. Packet will be encapsulated within a frame

4. What is the difference between "Connection-less" and "Connection-oriented" communication/networking? [**1 points**]

Connection-oriented:

(1) packets are sent which will not be creating any virtual connection over the internet.

(2) It transfers the data message and which will not use authenticating destination.

(3) The connection between them does not ensure reliability.

(4)No handshaking happens when we send our package.

(5) It is faster than connection-oriented protocol service.

Connection-less :

(1) It is the communication service, and the virtual connection is created before sending the packet.

(2) It needs authentication of the destination node before we want to transfer the data.

(3) This is a more reliable connection.

(4) The handshaking is used which can help us to let them all get the message.

(5) It is slower than the connectionless service. Before sending a packet.

5. Write the expansion of the following acronyms [**0.5×10 = 5 points**]:

a. OSI	Open Systems Interconnection model. It will standardize the communication functions which include the telecommunication system and its internal structure.
b. IP	Internet Protocol. It can help internet to have the principal protocol in Internet protocols, used for enabling internetworking.
c. TCP	Transmission Control Protocol. It defines how packets of data are shared between every computer to the network.

d. MAC	Media Access Control. It is a unique identifier and it can list a networking device.
e. NIC	Network Interface Controller. This is a hardware component , and it can help us to connects a computer to the network.
f. LAN	Local Area Network. This can help some computer in a small area to connect to each other.
g. UDP	User Datagram Protocol. It is an alternative to TCP, it can be used for establishing low-latency and loss-tolerating connections between applications.
h. CIDR	Classless Inter-Domain Routing. It is a good method for flexibly allocating the IP addresses and different IP routing.
i. NAT	Network Address Translation, it is the process where a network device, and it will be usually used as a firewall, assigns a public address to a computer
j. IETF	The Internet Engineering Task Force, it is the premier Internet standards body, which can be developed as open standards through open processes.

6. Briefly (1 sentence each) state the 5 key layers in a network and their key functionality (in order starting with closest to hardware) in the 5-layer model [**5 points**]

There are seven and I talk 5 in here,

1. Network layer: It is used to transmit the data from one host in computer to another host and it are located in different networks.

2.Transport layer: It will give services to the Application layer and it will get the services from the Network layer.

3. Session Layer: It is responsible for maintaining sessions, establishing the connection and authentication.
4. Presentation Layer: It will get the data from the application layer and manipulate according to the format to transmit over the network.

5. Application Layer: This layer is implemented by the network applications. These applications will generate the data, tend data will be transferred above the network.

7. Write the expansion for the following application-layer protocols and the "well known port numbers" for each [**0.5×4 = 2 points**]

Protocol	**Port Number**	**Expansion**
SMTP	25	Simple Mail Transfer Protocol
DNS	53	Domain name service
HTTP	80	Hyper Text Transfer Protocol
SSH	22	Secure Shell

8. Briefly describe the 3-way handshake used to establish a TCP connection between two hosts. What is the benefit of the TCP three-way handshake mechanism? [**6 points**]

In order to establish a TCP connection between host A and host B

Step 1: the client node will send a syn data above the IP network, the object will be asked if the server is open.

Step 2: Server responds to the client request with SYN-ACK signal bits set. Acknowledgement(ACK) signifies the response of segment it received and SYN signifies with what sequence number it is likely to start the segments with.

Step 3: the client node receive the SYN from the server respond that ack packet.

Benefits: So that the connection is established and the host and server can communicate. Let both of them synchronize the segment sequence number used during the transmission

9. Tabulate 3 significant differences between UDP and TCP [**3 points**]

UDP	**TCP**
UDP is a connectionless protocol.	TCP is a connection-oriented protocol.
UDP is suitable for applications that need fast, efficient transmission	TCP is suited for applications that require high reliability
UDP is faster but it's error prone.	The speed for TCP is slower than UDP.

10. Explain the purpose/behavior of the commands from the SMTP Protocol

Command	**Purpose**
HELO	The client sends this command to the SMTP server to identify itself and initiate the SMTP conversation.
DATA	The DATA command starts the transfer of the message contents
. (on a line by itself)	To set end of the mail.

11. What are the two components of an endpoint? Why are both needed? [3 points]

An endpoint is consisted of an IP address and a port number.
IP address is required to communicate on the Internet.
A port number is associated with process on the host.

12. How is a *well-known* port different from an *ephemeral* port?

This is a Well-know are ports number between 0 to 1023, and for this, ephemeral port are the short live endpoints which ports number between 1024 to 65535.

13. What is meant by saying that HTTP is a *stateless* protocol?

HTTP has HTTP Cookies. Cookies allow the server to track the user state, the number of connections

HTTP has persistent connections where several requests can be sent from the same TCP Connection

14. Do port addresses need to be unique? Why or why not? Why are port addresses shorter than IP addresses?

Port address need not to be unique as long as each ip address/port address pair uniquely identities a particular process running on a particular host.

Port address are shorter than IP address because there domain, it is a single system is smaller than the domain of IP address address, and all system is one the internet.

15. Consider an HTTP client that wants to retrieve a Web document at a given URL. The IP address of the HTTP server is initially unknown. What transport and application-layer protocols besides HTTP are needed in this scenario?

Typically The HTTP client needs to obtain the IP of server which is hosting the document,before GET request sent for web document. So that DNS request is sent out to get the hostname for IP mapping. We need to recall DNS runs over UDP. When the mapping is established, client will builds up a TCP connection with the server . and for this, GET request is also for the web document is sent over that TCP connection. The following are the protocols that are used for establishing connection:
DNS and HTTP protocols in Application layer

16. Suppose you purchase a wireless router and connect it to your cable modem. Also suppose that your ISP dynamically assigns your connected device (that is, your wireless router) one IP address. Also suppose that you have five PCs at home that use 802.11 to wirelessly connect to your wireless router. How are IP addresses assigned to the five PCs? Does the wireless router use NAT? Why or why not?

Usually, the wireless router includes a DHCP server. And the DHCP is used to assign IP addresses to the 5 PCs and the router interface.
For second question, yes, it also uses NAT (Network Address Translation) as it obtains only one IP address from the ISP.

Submission

- No late assignments will be accepted!
- This work is to be done individually

Due before: 11:59 PM (before Midnight) on Wed June 19, 2019

- The submission file will be saved with the name ***HW4_yourMUID.pdf***
- Assignment is due before Midnight Wed June 19, 2019.
- On or before the due time, drop the *electronic copy* of your work in the *canvas*
- Don't forget to Turn in the file! HW4_yourMUID.pdf