Introduction to Systems Programming (Systems I)

Homework #4 (Part A)

Due: Wednesday February 27 2019 before 11:59 PM

Email-based help Cutoff: 5:00 PM on Mon, Feb 26 2019

Maximum Points: 20

Submission Instructions

This part of the homework assignment must be turned-in electronically via Canvas. Ensure you name this document `MUid_homework4_PartA.docx`, where `MUid` is your Miami University unique ID.

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

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**
Uses a numbering system to identify other phones in order to connect with them.	Uses a numbering system to identify networks (IP address) in order to connect with them
Rings to announce incoming call request, and requires the receiver to pick up (confirm call), or not pick up (refuse call)	Sends a request to that requires the receiver to accept or decline the future passage or data

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

   Circuit switching takes place on a dedicated channel and consists of point to point connection where data is passed in full, while packet switching will split its data into smaller units, that is then passed and processed independently before reaching the destination.

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

   Frame is the whole collection of bits of data. The frame encapsulates packets, while packets are broken up pieces of data within this frame. Also, the frame includes the devices MAC address while a packet includes the devices IP address.

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

   In connection-less communication, you do not need to establish connection between the two points in which data is flowing between, but in a connection-oriented communication, both the sender and receiver must be established before passing data.

5. Write the expansion of the following acronyms [**0.25×8 = 2 points**]:

a. OSI	Open Systems Interconnection
b. IP	Internet Protocol
c. TCP	Transmission Control Protocol
d. MAC	Media Access Control
e. NIC	Network Interface Card
f. LAN	Local Area Network
g. UDP	User Datagram Protocol
h. CIDR	Classless Inter-Domain Routing

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**]

1. Physical Layer: this is the transceiver that drives the signals on the network
2. Data Link Layer: responsible for creaing the frames that move across the network
3. Network Layer: responsible for creating the packets that move across the network
4. Transport Layer: establishes the connection between applications on different hosts.
5. Application Layer: group of applications requiring network communications to complete task

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 System
HTTP	80	Hypertext Transfer Protocol
SSH	22	Secure Shell

8. Briefly describe the 3-way handshake used to establish a TCP connection between two hosts [**3 points**]

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

Step 1: A node send a data packet over an IP network to a server on the same network, it asks if the server is open for new connections.

Step 2: The server receives the request and returns a confirmation (or) in the form of another packet to be sent back.

Step 3: The node receives the response packed from the server and responds with a new packet.

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

UDP	**TCP**
Connection-less protocol	Connection oriented protocol
No guarantee that all messages will	Guaranteed delivery of messages

deliver in order, or even deliver at all.	
Does not have an option for flow control.	Has a congestion control mechanism that can regulate the transport-layer sender.