National University of Computer and Emerging Sciences, Lahore Campus

Course:	**Computer Networks Lab**	**Course Code:**	**CL-3001**
Program:	**BS (Computer Science)**	**Semester:**	**Fall 2022**
Duration:	**2 hrs 30 mins, including submission**	**Total Marks:**	**50**
Paper Date:	**22nd October, 2022 (Saturday)**	**Weight**	**25%**
Section:	**Section A, B & E**	**Page(s):**	**04**
Exam:	**Lab Midterm**	**Roll. No**	

Read the instructions below carefully:

- **Understanding the question statement is also part of the exam, so do not ask any questions whatsoever. In case of any ambiguity, make suitable assumptions.**
- You have to complete the exam in **2 hours and 30 minutes** including the submissions, no late submissions will be acceptable whatsoever.
- Midterm exam materials are placed on your **Google classroom**
- Rename your submission folder to your Roll number in the format 20L-XXXX, by putting your roll number. Submission path is your google classroom. Folder has already been created for this purpose.
- Your code should be indented and commented properly. Use meaningful variable names. Failure to comply will result in marks deduction. Submit screenshots where suitable.
- Any kind of cheat sheet/code if found in your PC will result in immediate disqualification from midterm exam and '**F**' as final grade in Computer Networks Lab. So, make sure you **delete** everything from Desktop of your windows as well as Ubuntu. Also delete all the files permanently from Recycle Bin and Trash respectively for Windows and Ubuntu. Delete all files from your Z Drives before starting the exam.
- If any student is found browsing any website, his/her exam will be **CANCELLED IMMEDIATELY**.
- **INTERNET USAGE IS ONLY ALLOWED TO MAKE SUBMISSION ON GOOGLE CLASSROOM.**
- It is your responsibility to save your code from being copied. All matching codes will be considered cheating cases. **PLAGIARISM** will result in forwarding of case to Disciplinary Committee.
- In case of missing or corrupted submission, **ZERO** marks will be awarded.
- You are immediately disqualified from the exam if:
    i. You are seen talking, whispering, borrowing or looking at someone's PC.
    ii. A USB is found attached to your PC.
    iii. You are seen using cell phone/smart watch.
    iv. You are caught accessing internet.

Question No. 01: C Programming Task — Marks: 10

Your task is to write a simple C language program which reads the input from the *input.txt* (already given in the *helping_files.zip* folder) file. Then it counts:

1. Number of lower-case alphabets
2. Number of upper-case alphabets
3. Numbers from 0-9
4. Special characters

It should save the output in an output.txt file which will be created on runtime.

Sample Input:

This is the Sample Input 123

Output: (in the output.txt file)

No. of upper case alphabets: 3

No. of lower case alphabets: 17

Numbers: 3

Special characters: 2

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Question No. 02: Wireshark Packet Analyzer — Marks: 15

****Submission: You have to submit your (Roll-No.docx) word file in answer to this question. You should provide proper explanation along with screenshots. Make your word file with a proper format indicating all the question numbers and the corresponding answers****

*******Use file *Capture 1* for questions 1-4******

1. Filter out all TCP packets which are either going to or coming from IP: 128.119.245.12 on Port: 80. Write your filter as answer. [1]
2. Suppose we take the fifth filtered packet as Packet No. 1, with each successive packet increasing one in number, then what is the request made in Packet No. 16 and what is the response from the server. Mention the packet no. of server response. After how many packets the server send the response? How many data containing TCP Segments are present between the request made and response received? [2]
3. Filter out all the TCP SYN packets. How many SYN packets are sent through the host? Write your filter as answer. [1]
4. Apply simple HTTP filter and answer what is the data length in bits returned by the server in Packet No. 2 and 4, considering 1st filtered packet as packet No. 1. [1]

*******Use file *Capture 2* for questions 5-8********

5. Apply a capture filter to obtain all the packets that are either going from client IP: 192.168.1.2 to server TCP Port: 21 or from server IP:195.89.6.167 and server TCP Port: 20 or 21. Write the filter which you have applied? [1]
6. Apply a filter to get all the packets which are directed from client with MAC Address: 00:0e:f4:d2:2a:bf to other ports but not to Server UDP Port: 53. What filter did you apply? [2]
7. Apply a filter to get all the UDP packets which are directed towards Port Number 53 either by client or by server. What filter did you apply? If we take the first filtered packet as Packet No. #1 with each successive packet increasing one in number, then what will be the acknowledgement number of the DNS request made in Packet No. 12? [2]
8. Filter UDP packets containing particular sequence 192.168. [1]

*******Use file *Capture 3* for questions 9-10********

9. Apply a filter to obtain all those packets which are either going from client with IP:192.168.1.102 to server tcp port: 80 or from server with IP:128.119.245.21 to client tcp port: 1161. What is the filter which you applied? [2]
10. In packet 13, why the acknowledgement number is 1? In which packet (write packet number) we have received the acknowledgement for the TCP Segment being carried in the packet number 13? What is the acknowledgement number and sequence number in the packet received? Show clear calculations how the server has sent the corresponding acknowledgement number? (You can use flow graph) [2]

Question No. 03: TCP SOCKET PROGRAMMING Marks: 25

A file named *users.txt* has been given to you in the *helping_files.zip* folder, it contains the users with different types.i.e: admin or normal user.
You need to design a tax calculator system using TCP client/server architecture. Your system should have the following functionalities:

1. No sign up is required for admin, but for normal users you should implement sign-up function. Once the user is added, the same file, users.txt should be updated accordingly. For ease, one normal user is already created in the file for you.

2. If the admin signs in, your system should allow him to add normal users. When an admin signs in, the system should show him details of all current users.

3. Once the normal user is logged in, you then need to ask him about his annual income from July 2021 to June 2022. When the user enters his income, the server should then calculate the tax based upon his annual income and store the total income as well as total tax in a separate *output_q3.txt* file.

4. An admin can see the tax details of all the current users.

5. Use the following tax slabs:

   - Income cannot be less than 0
   - For income 0 to 600,000, tax percentage will be 12.5%
   - For income 600,001 to 12,00,000, tax percentage will be 25%
   - For all incomes above 12,00,000, tax percentage will be 50%

6. The system should detect on its own the type of user, you should only ask username and password from the user.

7. Considering the types of users, you can make a little menu for them, which shows what they can actually do.

NOTE: This is a simple TCP client-server problem and does not require multi-threaded functionality.

Best of Luck ☺