CS 315: Computer Networks Lab
Spring 2023-24, IIT Dharwad

Mid-semester Exam
February 19, 2024,
2:30 PM to 4:30 PM

Total Marks: 45 marks

Instructions

1. Login to the Ubuntu OS on your machine using the following credentials:
    a. Username: `cs101`
    b. Password: `cprg@123`
2. Use the provided `part_1_capture.pcap` file to solve Part 1, `part_2_capture.pcap` for Part 2, and the Python Socket API docs to solve Part 3.
3. Archive your answers in a single .zip file named after your roll number containing the following files, and save it in the `/home/cs101/mid_sem_cn_lab_24/` directory.
    - `<your_roll-number>_traces.txt` (containing answers to Parts 1 and 2)
    - `<your_roll-number>_client.py` (containing the answer to Part 3)
    - `<your_roll-number>_server.py` (containing the answer to Part 3)
4. At the end of your exam, ensure that the `/home/cs101/mid_sem_cn_lab_24/` folder contains only one zip file, which is your final submission created as per the above instructions.

Part-1: *Answer the following questions considering the* `part_1_capture.pcap` *file.*

1. [1 mark] How many TCP handshakes are present in the packet trace?
2. [2 marks] What is the packet number of the *retransmitted TCP segment data* packet, and how many TCP segment bytes are retransmitted?
3. [1 mark] List the hostname(s) of the server with which your system does the three-way handshake.
4. [1 mark] What is the HTTP version used during the request to the URLs?
5. [2 marks] What are the source and destination IPv4 addresses for the packet having the first GET request? Also, provide the server hostname.

Part 2: *Answer the following questions considering the* `part_2_capture.pcap` *file.* This packet trace was captured while performing the following network activities.

- Running `nslookup gaia.cs.umass.edu` in terminal
- Running traceroute www.mit.edu

6. [3 marks] How many DNS responses do you observe for the domain `gaia.cs.umass.edu`, and list the types of DNS responses?
7. [2 marks] What is the IP address for www.mit.edu, and what is the total number of UDP packets

transmitted from the client to the www.mit.edu site?

8. For the last UDP packet transmitted from the client to the www.mit.edu site, answer the following questions:
    a. [2 marks] Provide the values of TTL, Identification number, header length, and payload length in the IPv4 datagram.
    b. [1 mark] What is the upper layer protocol field in this IPv4 datagram's header? c. [2 marks] What can be the minimum and maximum value of the port numbers? d. [2 marks] What is the maximum number of bytes can be included in the UDP payload?
9. [3 marks] How many hops have responded with ICMP packets for the request made to www.mit.edu? List out those IP addresses.
10. [1 mark] List the answers with their types received from the DNS query made to the www.mit.edu site.

Part 3: Socket Programming for Rock-Paper-Scissors game.

Develop a socket programming application that facilitates a Rock-Paper-Scissors game between **two** clients.

Server Program

a. [4 marks] Create a server socket that accepts only two client requests to maintain the integrity of the game.

b. [1 mark] Ask the clients to enter their choice (rock, paper or scissors) (e.g., `Please enter your choice (rock, paper, scissors)...`)

c. Receive the responses from the clients and compute the winner by determining the logic of Rock-Paper-Scissors, where

i. [1 mark] If both clients make the same choice, it's a tie.

ii. [2 marks] Otherwise, one client wins based on predefined rules as follows: ● Rock beats Scissors
- Paper beats Rock
- Scissors beat Paper

d. [2 marks] Notify the clients on which player won the game.

i. For the tie, result notify with a message ("`It's a Tie!`") and,

ii. If one of the two clients wins a round reply with a message ("`Player 1 wins.`"). e. Ask both clients if they wish to continue. Use two conditions namely, `YES` and `QUIT`: i. [2 marks] If both the clients respond with a `YES` message then continue the steps from (b) to (d)

ii. [2 marks] If any one of the clients responds with a `QUIT` message then, close both client connections.

iii. [1 mark] Keep the server running to accept new client requests.

f. Follow steps (b) to (e) for new client connections.

Client Program:

a. [3 marks] A client connects to the server.

b. [1 mark] It sends their name as a user input to the server upon successful connection.

c. [1 mark] During gameplay, each client takes turns making guesses (i.e. enters one of the three words: Rock, Paper, Scissors), and their messages should be displayed with appropriate tags on the server.

d. [1 mark] Receive and print the winning status for every round from the server. e. [1 mark] If the client wishes to leave the game, then send a `QUIT` message to the server. Otherwise, send a `YES` message to continue the game.