भारतीय सूचना प्रौद्योगिकी संस्थान, पुणे
Indian Institute of Information Technology, Pune
(An Autonomous Institute of National Importance under act of Parliament)

Lab Assignment 1
BT23104: Computer Network

Instructions:

a) In this assignment, you will explore the various network diagnostic tools. An end user makes use of these tools to discover how a machine is connected to the network and how the network looks like beyond the first hop

b) Solve the questions individually. Prepare a single report (PDF only) for all these experiments. The file name should be same as your roll number. Example: *190101001.pdf.* Once done, submit the report in Google Classroom on or before the submission deadline.

c) All the experiments need to be performed on a Unix/Linux-based computer (preferably Ubuntu 16 or newer).

d) **Submission deadline: 10:00 AM (Morning, Before Lab Section Start), 18 Jan 2024 (Hard Deadline).**

e) These are some additional formatting related information:
   - Make sure that you include your name and roll number on the first page of the report.
   - The font size of the report body should be a value from 10 to 12 points, and
   - maximum line spacing is1.5.
   - Your grade is not proportional to the number of pages you submit.
   - Clear and concise writing is preferred.
   - Make sure that the report can be opened using any standard PDF viewer.
   - PDFs consisting of photographs of handwritten assignments will not be considered for grading.
   - Screenshots should be avoided unless there is a good reason to use them (or specifically mentioned in the question).
   - Please structure your report such that your answers are clearly indicated for each question of the assignment. The evaluator should not need to search for your answers.
   - The report should not contain more than 4 pages (+1 page allowed in exceptional case).

Questions (Full Marks:35)

Q1. The Internet Ping command bounces a small packet(s) to test network communications, and then shows how long this packet(s) took to make the round trip. The Internet Ping program works much like a sonar echo-location, sending a small packet of information containing an ICMP ECHO_REQUEST to a specified computer, which then sends an ECHO_REPLY packet in return. Explore more about the ping command and answer the following questions (Unix or GNU/Linux version only):

a) What is the option required to specify the number of echo requests to send with ping command? **(0.5)**

b) What is the option required to set time interval (in seconds), rather than the default one second interval, between two successive ping ECHO_REQUESTs? **(0.5)**

c) What is the command to send ECHO_REQUEST packets to the destination one after another without waiting for a reply? What is the limit for sending such ECHO_REQUEST packets by normal users (not superuser)? **(0.5 + 0.5)**

d) What is the command to set the ECHO_REQUEST payload/data size (in bytes)? If the payload size is set to 32 bytes, what will be the total packet size? **(0.5 + 0.5)**
Total marks: 3

Q2. Select six hosts of your choice in the Internet (mention the list in your report) and experiment with pinging each host 25 times at three different hours of the day. Use your command to perform this.
If you face problems you may use the following online tools for this experiment:

i) http://www.spfld.com/ping.html

ii) https://www.subnetonline.com/pages/network-tools/online-ping-ipv4.php

a) List out the average RTT for each host in tabular form, and explain whether RTT has a correlation with the geographical distance of the destinations from source. **(0.5+0.5)**

b) Check if in any case, packet loss is greater than 0% and provide reason for the same. **(1)**

c) Pick one of the above used hosts, and repeat the experiment with different packet sizes ranging from 64 bytes to 2048 bytes. Plot average RTT vs packet size. **(1)**

d) Explain how change in packet size, and time of the day impact RTT. **(1)**

Total marks: 4

Q3. Select an IP address of your choice (mention the address in your report) and capture the outcome of 1,000 pings in two separate files by executing the following ping commands.
   • ping -n <IPAddress>
   • ping -p ff00 <IPAddress>
Come up with a method to read and analyze the observations captured in the files and answer the following questions. You are free to look for a tool, programming/scripting language that is best suitable for the task and learn just enough of it to get the analysis done.

a) What was the packet loss rate for each command? **(1)**

b) What was the minimum, maximum, mean, and median latency of the pings that succeeded? Ignore pings that failed in the calculation. **(2)**

c) Give plot to show the normal distribution of the ping latency. **(1)**

d) The two experiments are almost similar except in few aspects. Describe the significant network behavior difference (if any) you observed between the two experiments. **(1)**

Total marks: 5

Q4. With regard to *ifconfig* commands, answer the following questions:
a) Run *ifconfig* command and briefly describe its output (important attributes). **(2)**

b) What are the different uses of *ifconfig* command? Mention and explain at least four functions. **(1)**

c) Mention and explain at least four options of the *ifconfig* command. Execute the *ifconfig* command with these four options and explain the output. **(2)**

Total marks: 5

Q5. Answer the following questions related to *netstat* command.

a) What is the command netstat used for? **(1)**

b) What parameters for netstat should you use to show the established TCP connections? Include a screenshot of the command and output **(1)**

c) What does "netstat –r" show? Explain all the fields of the output. **(1)**

d) What option of netstat can be used to display the status of all network interfaces? By using netstat, figure out the number of interfaces on your computer. **(1)**

e) What option of netstat can be used to show the statistics of all UDP connections? Run the command on your computer and show the output. **(1)**

f) Show and explain the function of loop-back interface. **(1)**

Total marks: 6

Q6. Perform a traceroute experiment (with same hosts used in Q2) at three different hours of the day, and then answer the questions below. If your network service provider does not allow traceroute, then you can use any one of the following online tools for this experiment. However, show explicitly why you are unable to run traceroute with your ISP and give possible reasons.
   ▪ http://ping.eu;
   ▪ http://www.cogentco.com/en/network/looking-glass;
   ▪ https://www.ultratools.com/tools/traceRoute;
   ▪ http://network-tools.com;

a) What is the use of traceroute tool? **(1)**

b) List out the hop counts for each host in each time slot. Determine the common hops between two routes if they exist. **(1)**

c) Check and explain the reason, if route to same host changes at different times of the day. **(1)**

d) Inspect the cases when traceroute does not find complete paths to some hosts, and explain the reasons. **(2)**

e) Is it possible to find the route to certain hosts which fail to respond with ping experiment? Give reasoning. **(2)**

Total marks: 7

Q7. Answer the following questions regarding ARP.

a) do you see the full ARP table on your machine? Explain each column of the ARP table. **(2)**

b) What command is used to add or delete an entry into the ARP table. Use this mechanism to add at least two new hosts to the ARP table and include a screenshot. **(1)**

c)Can there be an entry for any IP from different subnet in the ARP table of your PC? Explain your answer. **(2)**

Total marks: 5