Strathmore
UNIVERSITY

STRATHMORE UNIVERSITY
FACULTY OF INFORMATION TECHNOLOGY
BACHELOR OF SCIENCE IN COMPUTER NETWORKS AND CYBERSECURITY
END OF SEMESTER EXAMINATION
CNS 2106 – NETWORK PROGRAMMING

DATE: 16 December, 2024 **Time: 10:30-12:30 Hours**

Instructions

1. This examination consists of **FIVE** questions.
2. Answer **Question ONE (COMPULSORY)** and any other **TWO** questions.

QUESTION ONE [30 Marks]

a. Name two Linux files that are used for holding login credentials for system users. [**2 Marks**]

a. Write a Linux command that will assign an **extra (alias)** IP address (10.20.113.45/24) to the network card eth0 [**2 Marks**]

b. Explain how daemons differ from regular processes. [**2 Marks**]

c. Describe how to send a running process to the background in Linux, and how to bring a background process to the foreground. [**3 Marks**]

d. Define a socket and explain its role in network programming. [**2 Marks**]

e. State the purpose of cron in Linux and write a cron job that runs a backup script (/home/user/backup.sh) every day at 2 AM. [**3 Marks**]

f. What are the four **tables** maintained by the Linux kernel for processing incoming and outgoing packets? [**4 Marks**]

g. What is the default location where the SSH public key is stored on a remote server? [**1 Mark**]

h. Write sample commands that will achieve the following
   i. Change the owner (user) of a file from jane to john [**1 Mark**]

ii. Change the owner of a directory and all its files from luke to lisa [**1 Mark**]

iii. Grant read and write permission to user and group, and no permission to others [**1 Mark**]

i. Explain why it is recommended to only permit remote SSH login with Public Key authentication. Give an example of problems with use of passwords for SSH authentication. [**4 Marks**]

j. Declare and initialise a BASH array named **week** whose elements are the days of the week [**4 Marks**]

QUESTION TWO [15 Marks]

a. Using an example, describe how you can use **sed** to manipulate text in a file. [**2 Marks**]

b. Using an example, describe how you can use **awk** to manipulate text in a file. [**2 Marks**]

c. Explain the concept of output redirection in Linux. Write a script that redirects the output of the **ls** command to a file named filelist.txt [**2 Marks**]

d. State the purpose of piping in Linux and provide an example where **grep** is used in combination with **ls** and explain the output. [**2 Marks**]

e. Show an example of a WHILE loop in BASH [**4 Marks**]

f. Write an example Bash script that uses a for loop to print numbers from 1 to 5. [**3 Marks**]

QUESTION THREE [15 Marks]

a. Explain how the libpcap library works for packet capture on Linux. [**2 Marks**]

b. Explain the purpose of the tc (traffic control) command in Linux and how it can be used to control network traffic. [**2 Marks**]

c. Using a functional diagram, discuss the functionality of Nagios in the context of SNMP-based network monitoring. [**6 Marks**]

d. How does an iptables based firewall decide which packets to subject to the INPUT chain of rules, which to the FORWARD chain of rules, and which to the OUTPUT chain of rules? [**5 Marks**]

QUESTION FOUR [15 Marks]

a. Explain the role of multithreading in a concurrent server. [**2 Marks**]

b. Describe the typical steps involved in setting up a socket for communication in a network application. [**2 Marks**]

c. Describe the purpose of the following system calls in socket programming: socket(), bind(), listen(), accept(), connect(). [**4 Marks**]

d. Write a Python program snippet that demonstrates how to create a TCP socket and bind it to a specific port. [**7 Marks**]

QUESTION FIVE [15 Marks]

a. Explain the concept of user space and kernel space in Linux, and state why this separation is important for system security and stability. [**3 Marks**]

b. Discuss the consequences of allowing a user-space program direct access to kernel space and explain how Linux prevents this. [**3 Marks**]

c. Describe the role of the "init" process in the Linux kernel startup sequence [**2 Marks**]

d. Outline the main steps required to create a daemon in Unix/Linux. [**2 Marks**]

e. Write a simple python program that implements a basic daemon. The daemon should perform a periodic task such as writing a timestamp to a log file every minute. [**5 Marks**]