UNIVERSITY
OF
JOHANNESBURG

FACULTY OF SCIENCE

ACADEMY OF COMPUTER SCIENCE AND SOFTWARE ENGINEERING

MODULE	**IT00297** DATA COMMUNICATION
CAMPUS	**APK**
EXAM	**26 MAY 2016**

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DURATION 2 HOURS	**MARKS** 100

NUMBER OF PAGES: 5 (cover page included)

INSTRUCTIONS
ANSWER ALL THE QUESTIONS
WRITE NEATLY AND LEGIBLY
PLEASE NUMBER IN SEQUENCE

REQUIREMENTS
NONE

1. (2 marks) Briefly explain what is meant by a Linux "distro" and provide an example.

2. (1 marks) Name the kind of resources that one will find at http://tldp.org.

3. Provide English descriptions of the following bash commands:

   (a) (2 marks) `cat student.txt | sort > students2.txt`

   (b) (2 marks) `tail 100f program.log`

   (c) (2 marks) `ln -s /var/www/test.com/index.html /home/john/index.html`

   (d) (2 marks) `for i in *; do md5sum $i >> md5; done;`

   (e) (2 marks) `echo "aabcdee" | tr abcde 12345`

4. Provide bash commands to accomplish each of the following tasks:

   (a) (2 marks) Find all the `.log` files in the current user's home directory (including sub-directories).

   (b) (2 marks) Search for the running process 'firefox' (to obtain the PID) amongst **all** running processes. Only show lines which contain 'firefox'.

5. Consider the following bash script and answer the questions that follow:

```
(1)   #!/bin/bash
(2)   # Script, 17/05/2013
(3)   FILE=$1
(4)   FILE_LIST_A=$2
      FILE_LIST_B=$3
(5)   if [[ $# != 3 ]]; then
(6)     echo 'usage: check.sh <input file> <list_file_1> <list_file_2>'
        echo '<input file> is a text file containing a list of files'
        echo '<list_file_1> and '<list_file_1> contains the results.'
(7)     exit 1
      fi
(8)   rm $FILE_LIST_A $FILE_LIST_B
(9)   for i in 'cat $FILE'; do
(10)    if [ ! -f ${i} ]
          then
(11)        echo "${i} NO"
(12)        echo ${i} >> $FILE_LIST_A
(13)    else
            echo "${i} YES"
            echo ${i} >> $FILE_LIST_B
          fi
      done
```

(a) (2 marks) Give a high-level explanation of the purpose of this script.

(b) (14 marks) Give an explanation of the script by referring to each numbered line in the script.

(c) (2 marks) Give the command to give full read,write,execute rights to the group/owner only.

6. (5 marks) A user wants to wake every morning at 05:30 with his favourite music track (in .mp3 file format). At the same time, he wants a reminder to go to bed at 22:00 using a different track. Explain how you would use a Raspberry Pi to accomplish this task (choose the most straightforward approach).

7. Consider the hypothetical network architecture as depicted in Figure 1 and answer the questions that follow. In Figure 1, four subnets are interconnected with four routers. Routers R1, R2 and R3 each connects two networks, while R4 connects three networks. Static IP addresses have already been allocated to the routers. Only three computers are indicated in the diagram, labelled PC1, PC2 and PC3.
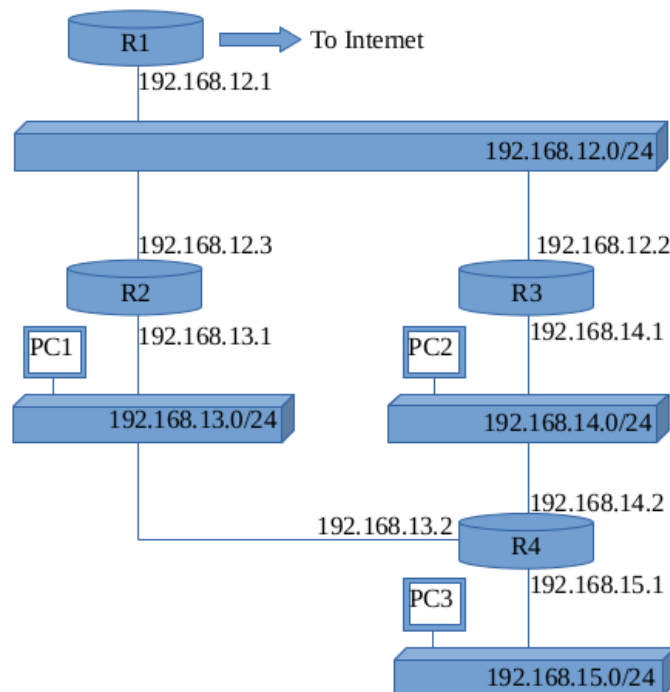

Figure 1: Hypothetical network architecture

(a) (2 marks) How many nodes (desktops, laptops, phones, tables, etc.) can be connected to the 192.168.14.0 subnet? Motivate your answer.

(b) (5 marks) Provide the most optimal routing table for PC1 on subnet 192.168.13.0/24. (Only list the Destination, Gateway, Genmask and Iface fields.)

(c) (4 marks) Provide the most optimal routing table for router R4. Assume that eth0 is connected to 192.168.13.0/24, eth1 to 192.168.14.0/24 and eth2 to 192.168.15.0/24. (Only list the Destination, Gateway, Genmask and Iface fields.)

(d) (2 marks) Lighting strikes and destroys router R2. Given an optimal routing table (least number of hops), explain the communication difficulties that node PC1 will experience to PC2, PC3 and the Internet.

8. (4 marks) The 7-layer OSI model is based on a technique called 'enveloping'. Briefly discuss what 'enveloping' is and the primary advantage of this technique.

9. A new company is setting up a network in a small office building. They want **three** equally sized subnets where each will have an absolute maximum of 15 computers each. The entire network will be interconnected with a single router (a standalone Linux machine) which will also be connected to the Internet using an ADSL router.

   Based on the description provided, answer the following questions:

   (a) (6 marks) Use the standard class C address for private networks and allocate a network address and broadcast address to each of the **three** subnets. Write the network address in CIDR notation.

   (b) (2 marks) Provide a network mask for the network.

   (c) (1 marks) How many Network Interface Cards (NICs) does the router require (assume the ADSL modem connects to the Internet via a USB port).

10. (2 marks) Is it good practice to enable services on a system that will most probably be used in future? Motivate your answer.

11. The 'ssh' utility is a useful tool to administer/maintain servers on a network infrastructure. Answer the following question on 'ssh':

   (a) (3 marks) The 'ssh' utility allows authentication through public/private key pairs instead of passwords. One key remains on the user's local machine, while the other is copied to the remote server running the server. Explain which key (public or private) needs to be copied to the server machine and motivate clearly.

   (b) (5 marks) A legacy client/server application communicates insecurely using a TCP connection. The legacy applications binds on IP 192.168.12.20 and listens to port 9900. Briefly explain how communication can be made secure using the 'ssh' utility. Give any commands that needs to be executed.

   (c) (4 marks) The 'scp' utility is an extension to 'ssh' that can be used to copy files to remote systems securely. Give the command to copy the file 'allthesecrets.doc' to the directory /home/julian/wikileaks on a remote host. The remote host has IP 43.21.12.1 and the user is 'julian'.

12. Explain whether each of the following passwords can be considered good or bad. Clearly motivate.

(a) (1 marks) `secret`

(b) (1 marks) `h%AsOg&b3YrtzQ64&yuxc_1991`

(c) (1 marks) `SimpleBlueMonkeyTeaGardenFor2!`

13. (8 marks) Security within the Information Technology environment has become very important. Security can be seen from two perspectives. Firstly, security on the local machine and secondly, security within the network environment. Discuss at least **four** kinds of security threats that plague these environments as well as method(s) that can be used to guard against each of these threats.

14. (2 marks) Briefly explain the purpose and primary advantage of the **a2ensite** nad **a2dissite** commands used by Apache 2.

15. (4 marks) Briefly explain how the NFS server (3 marks) and the NFS client (1 mark) should be configured so that the directory '/opt/exports/repo' (on the server) is available to the client.

16. (3 marks) You are considering using both your mobile device and laptop to read your email. Considering the South African environment, which of IMAP or POP3 would be best suited. Give **two** reasons why.