University of Colombo, Sri Lanka

University of Colombo School of Computing

DEGREE OF BACHELOR OF INFORMATION TECHNOLOGY (EXTERNAL)

Academic Year 2023 — 3^{rd} Year Examination — Semester 5

IT5406 — Systems & Network Administration

Structured Question Paper

(2 Hours)

To be completed by the candidate

Index Number | | | | | | | |

Important Instructions

- The duration of the paper is **2 hours**.
- The medium of instructions and questions is English. Students should answer in the medium of English language only.
- This paper has **4 questions** on **11 pages**. Answer **all** questions.
- All questions carry **equal** marks.
- Write your answers **only on the space provided** on this question paper.
- Do not tear off any part of this question paper. Under no circumstances may this paper (or any part of this paper), used or unused, be removed from the Examination Hall by a candidate.
- Note that questions appear on both sides of the paper. If a page or part of a page is not printed, please inform the supervisor/invigilator immediately.
- Any electronic device capable of storing and retrieving text, including electronic dictionaries, smartwatches, and mobile phones, is not allowed.
- Calculators are **not allowed**.
-

To be completed by the examiners

1	
2	
3	
4	
Total	

Index No: .....

1) (a) Write three (3) ways of installing a software into a GNU/Linux environment.

(3 marks)

ANSWER IN THIS BOX

Installing using precompiled packages

Building software from source code

Installing from using web scripts

(Page 22 - 24)

(b) Describe the use of each given GNU/Linux kernel boot options using a single sentence.

(6 marks)

ANSWER IN THIS BOX

1.) debug — **Turns on kernel debugging**

2.) init=/bin/bash — **Starts only the bash shell; useful for emergency recovery**

3.) root=/dev/hda — **Tells the kernel to use /dev/hda as the root device**

4.) single — **Boots to single-user mode**

(pages 38)

(c) Describe the function of given subcommands of the **systemctl** command.

(6 marks)

ANSWER IN THIS BOX

1.) enable *unit* — **Enables unit to activate at boot**

2.) stop *unit* — **Deactivates unit immediately**

3.) status *unit* — **Shows unit's status and recent log entries**

(page 47)

(d) In a GNU/Linux system, **/etc/passwd** and **/etc/shadow** files are owned by the **root** user. However, regular users can change their own passwords without having to be the **root** user. Explain how this has been implemented in a GNU/Linux system.

(5 marks)

ANSWER IN THIS BOX

passwd command has been setuid bit set to cater the requirement.

(page 68)

(e) Assume that you are required grant privileges to execute a GNU/Linux command that needs the **root** user privileges. You can either grant access to the root user through **su** or grant the required privileges through the **sudo** command. Explain the benefit of using the **sudo** command over the **su** command in granting privileged access to a command.

(5 marks)

ANSWER IN THIS BOX

sudo can be configured to allow a user to do a specific task where su would generally give free ride on the system as the root user

(p.g. 70)

2) (a) The kernel's internal data structures record various pieces of information about each process. Write four (4) such information.

(6 marks)

ANSWER IN THIS BOX

(i) The process's address space map

(ii) The current status of the process (sleeping, stopped, runnable, etc.)

(iii) The execution priority of the process

(iv) Information about the resources the process has used (CPU,memory,etc.)

(v) Information about the files and network ports the process has opened

(vi) The process's signal mask (a record of which signals are blocked)

(vii) The owner of the process

(Page 91)

(b) What is the process level signal passed to the terminal driver when a user presses the key combination Ctrl+c? State whether it can be catch, blocked, or core dumped.

(5 marks)

ANSWER IN THIS BOX

(i) INT

(ii) Can be catched, can be blocked, but cannot be core dumped

(Pages 95)

(c) Write four (4) methods / tools used to explore the behaviour of a process in a GNU/Linux system.

(4 marks)

ANSWER IN THIS BOX

ps, logs, file system, strace (p.g. 105)

(d) Explain the difference between a hard link and a symbolic link. Use GNU/Linux commands for the explanation.

(8 marks)

ANSWER IN THIS BOX

The difference between hard links and symbolic links is that a hard link is a direct reference, whereas a symbolic link is a reference by name. Symbolic links are distinct from the files they point to.

ls -l to identify links, ls -i to identify inodes.

Hard links will point to same inode as the file where symbolic links will point to an inode different from the inode of the file.

(p.g. 129 - 135)

(e) Using a single sentence, describe the importance of logging.

(2 marks)

ANSWER IN THIS BOX

debugging errors, finding issues, regulatory requirements and standards (p.g. 295)

3) (a) Domain Name System (DNS) servers implement negative caching. Write four (04) scenarios where negative caching would keep answers for requests.

(6 marks)

ANSWER IN THIS BOX

(i) No host or domain matches the name queried.

(ii) The type of data requested does not exist for this host.

(iii) The server is not responding.

(iv) The server is unreachable because of network problems.

(p.g. 508)

(b) A directory service is just a database, but one that makes a few assumptions. Write four (04) assumptions made when implementing a directory service.

(6 marks)

ANSWER IN THIS BOX

(i) Data objects are relatively small.

(ii) The database will be widely replicated and cached.

(iii) The information is attribute-based.

(iv) Data are read often but written infrequently.

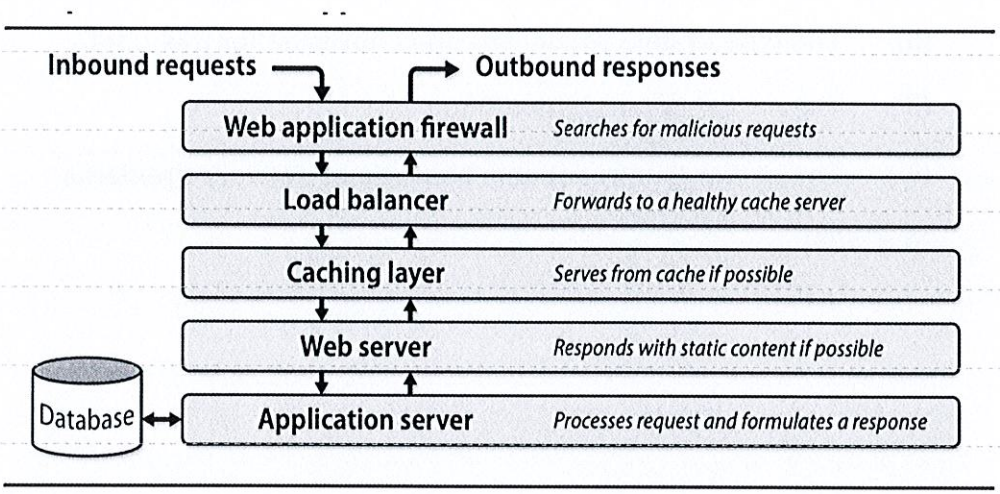
(v) Searching is a common operation.

(p.g. 580)

(c) Draw a diagram to illustrate the components of a web application stack and describe the function of each layer using a single sentence.

(10 marks)

ANSWER IN THIS BOX



(1)

(2)

(3)

(4)

(5)

(d) Write down which services are by default configured to run on the TCP ports given in the **answer box**.

(3 marks)

ANSWER IN THIS BOX

(i) 3389 - RDP

(ii) 88 - Kerberos

(iii) 25 - SMTP

4) (a) Assume that you are required to get the unique list of shells assigned to the users of a GNU/Linux systems you administer. The file containing the information is `/etc/passwd` file and the assigned shell is located at the 7th field when delimited using ':'. Write the complete command, using generally available GNU/Linux utilities, to accomplish the task.

(6 marks)

ANSWER IN THIS BOX

$ cut -d: -f7 < /etc/passwd | sort -u

(Page 191)

(b) Consider the below shell script called myScript.sh with execution permission for all users.

```
#! /bin/sh
echo -n "Enter a suffix: "
read suffix_name
if [ -n "$suffix_name" ]; then
   for script in files/*.log; do
       newscript="$script.$suffix"
       mv -f $script files/$newscript
       touch $script
   done
   exit 0
else
echo "You need to enter a suffix!"
   exit 1
fi
```

The above script is intended to execute and rename files with .log extension in files directory to a file with additional suffix provided by the user. Then it should create new empty files with the original file name within the same directory. However, the program does not run as intended. Rewrite the corrected program to get the intended output and run without errors within the space given.

(7 marks)

ANSWER IN THIS BOX

```
#! /bin/sh
echo -n "Enter a suffix: "
read suffix_name
if [ -n "$suffix_name" ]; then
   for script in files/*.log; do
       newscript="$script.$suffix_name"
       mv -f $script $newscript
       touch $script
   done
   exit 0
else
echo "You need to enter a suffix!"
   exit 1
fi
```

(c) Draw a √ in front of each corresponding layer of which the Cloud Service Provider (CSP) is responsible of managing.

(12 marks)

ANSWER IN THIS BOX

Layer	IaaS	PaaS	SaaS
(1) Application			√
(2) Databases			√
(3) Application runtime			√
(4) Operating system		√	√
(5) Virtual network, storage, and servers		√	√
(6) Virtualization platform	√	√	√
(7) Physical servers	√	√	√
(8) Storage systems	√	√	√
(9) Physical network	√	√	√
(10) Power, space, and cooling	√	√	√

(page 277)

****