



UNIVERSITY OF COLOMBO, SRI LANKA



UNIVERSITY OF COLOMBO SCHOOL OF COMPUTING



DEGREE OF BACHELOR OF INFORMATION TECHNOLOGY (EXTERNAL)

Academic Year 2022 – 3rd Year Examination – Semester 5

IT5406 - Systems and Network Administration
Structured Question Paper
(TWO HOURS)

To be completed by the candidate

BIT Examination Index No:

Important Instructions:

- The duration of the paper is **02 (Two) hours**.
- The medium of instruction and questions is **English**.
- Students should answer in English language **only**.
- This paper has **04 questions** and **12 pages**.
- Answer **ALL** questions. All questions carry equal marks.
- Do not tear off any part of this answer book.
- Under no circumstances may this book, 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 is not printed, please inform the supervisor immediately.
- **Calculators are NOT allowed.**

Questions Answered

Indicate by a cross (x), the numbers of the questions answered.

	Question Numbers				Total
	1	2	3	4	
To be completed by the examiners:					

- 1) (a) List down four (4) critical responsibilities of a system administrator.

(4 marks)

ANSWER IN THIS BOX

Any of the following:

controlling access, adding hardware, automating tasks, overseeing backups, installing and upgrading software, monitoring, troubleshooting, maintaining local documentation, monitoring security, tuning performance, firefighting, etc

(Page 4)

- (b) Since BIOS was replaced by UEFI, start-up routines have undergone significant change. What is UEFI and how does it vary from BIOS?

(4 marks)

ANSWER IN THIS BOX

Basic Input/Output Systems (BIOS) were supersede by a more formalised and modern standard, the Unified Extensible Firmware Interface (UEFI). The UEFI specification includes a modern disk partitioning scheme known as GPT (GUID Partition Table) and at boot time, the firmware consults the GPT partition table.

UEFI provides faster boot time. UEFI has discrete driver support, while BIOS has a drive support stored in its ROM, so updating BIOS firmware is a bit difficult. UEFI offers security like "Secure Boot", which prevents the computer from booting from unauthorized/unsigned applications.

(pages 32 & 33)

- (c) What is the purpose of Request for Comments (RFC) documents?

Are RFCs considered to be authoritative documents?

(4 marks)

ANSWER IN THIS BOX

Request for Comments documents describe the Protocols and Procedures used on the Internet. Most of these are detailed and technical but some are written as overviews.

RFCs are absolutely authoritative documents and many are quite useful for system administration. (page 17)

- (d) Write down the essential steps required to add a new user into a Linux system.

(4 marks)

ANSWER IN THIS BOX

1. Edit the passwd and shadow files to define the user's account
2. Set initial password
3. Create, chown, chmod the users home directory
4. Configure roles and permissions

- (e) Explain the difference between the Linux commands **cp** and **ln** in the context of below example.

```
%cp file1 file2
%ln file1 file2
```

(4 marks)

ANSWER IN THIS BOX

The command **cp oldfile newfile** creates a copy of oldfile called newfile, and **ln oldfile newfile** makes the name newfile an additional reference to oldfile. (p.g. 129)

- (f) Given below is an entry from the `/etc/passwd` file. Name the fields of the entry delimited by the colon character.

dotty:x:101:20:: /home/dotty:/bin/tcsh

(5 marks)

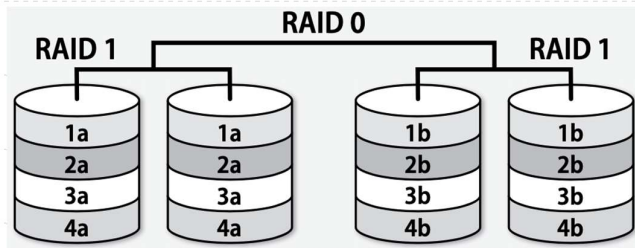
ANSWER IN THIS BOX

Login name, Encrypted password placeholder, UID, GID, Home directory, Login shell
(p.g. 245)

- 2) (a) Assume you have four (04) one (1) TB disks that can be used in your server?
- Draw a diagram to show how you can use all the above disks to configure a **RAID 1+0** array. (4 marks)
 - Calculate the estimated usable space after configuring **RAID 1+0**. (3 marks)
 - Assume you have configured **RAID 5** with even parity instead of **RAID 1+0**. Calculate the estimated usable space in the new configuration. (3 marks)

ANSWER IN THIS BOX

- (i) Refer the diagram below.



(Page 755)

- (ii) It is 2 TB (Page 755)
- (iii) 3 TB, 2.68 TB is also acceptable (Page 755)

- (b) In relation to UNIX/Linux Process Control, respond to the questions below.
- (i) Runaway processes are the ones that consume a huge proportion of the system's CPU, disk, or network resources compared to how they typically operate. Write down two (2) UNIX/Linux commands that can be used to find processes that are consuming excessively CPU time
(2 marks)
- (ii) What happens when the following UNIX/Linux command is executed?
\$ kill -9 2031
(3 marks)

ANSWER IN THIS BOX

(i) The “top” and “ps” commands

(ii) The kill command will terminate a process. The above command guarantees that the process 2031 will die because signal 9 is issued with the kill command.

(Pages 97 & 107)

- (c) Assume you have given a server. You are not able to connect to it remotely via SSH due to a connectivity problem. You have to troubleshoot and solve this problem. You can assume any IP addresses as the server IP and the client IP. Further, there are no Firewalls configured between the network path from your computer to the server. You can also access the server physically to troubleshoot the problem. Write five (05) steps you will follow to troubleshoot the problem.

Hint: Start troubleshooting from server. Answer following questions for each step you do to troubleshoot the problem.

- What do you do? (in a single sentence)
- How you do it? (write the command)
- What do you do if your test fails? (in a single sentence)

(10 marks)

ANSWER IN THIS BOX

Do you have physical connectivity and link light? (ethtool)

Is the interfaces configured correctly? (ifconfig, ip)

Can you ping loopback and another local IP addresses? (ping)

Can you ping other hosts in local network? (ping)

Can you ping hosts on other networks? (ping)

Do SSH service up, running and accepting connections? (netstat)

(p.g. 428)

- 3) (a) Zone synchronization is an important function of DNS to its resilience. Following are three clauses/options related to zone synchronization settings on DNS. For each clause/option, state whether it is used to configure either the master server or the slave server and the purpose of each clause/option.
- (i) notify
 - (ii) also-notify
 - (iii) allow-notify

(6 marks)

ANSWER IN THIS BOX

- (i) **Notify – master – if set to yes, upon expiry of SOA record, the zone files will be synchronized**
 - (ii) **Also-notify – master – if notify set to explicit, the master server only notify the given list of slaves**
 - (iii) **Allow-notify – slave – generally used to get notifications from the servers in addition to the master**
- (p.g. 529)

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

(4 marks)

ANSWER IN THIS BOX

- | | | |
|-------|-------|-------|
| (i) | 22 - | SSH |
| (ii) | 53 - | DNS |
| (iii) | 389 - | LDAP |
| (iv) | 443 - | HTTPS |

- (c)
- (i) Single sign on (SSO) enables multiple applications to use single authentication mechanism. Write down the four (04) elements required to implement an SSO solution. (4 marks)
- (ii) Write down two (02) Directory server examples that support LDAP. (2 marks)

ANSWER IN THIS BOX

(i) A centralized directory store containing user identity and authorization information

A tool for managing user information in the directory

A mechanism for authenticating user identities

Centralized identity and authentication aware versions of library routings that lookup user attributes

(p.g. 579)

(ii) Microsoft Active Directory

Open LDAP Directory server

(p.g. 580)

(d) There are multiple methods defined in HTTP to send requests to a web server. Write the answers for the below questions in the table provided in the answer box.

- (i) Write down six (06) such methods
- (ii) State whether each of these methods is safe or not
- (iii) Write down the purpose of each method

(9 marks)

ANSWER IN THIS BOX

	Method	Safe?	Purpose
(1)	GET	YES	Retrieves the specified resource
(2)	HEAD	YES	Like GET, but requests no payload, retrieves metadata only
(3)	DELETE	NO	Deletes the specified resource
(4)	POST	NO	Applies request data to the given resource
(5)	PUT	NO	Similar to POST, but implies replacement of existing contents
(6)	OPTIONS	YES	Shows what methods the server supports for the specified path

- 4) (a) Genuine hits get hidden when the below command is run, which typically results in a large number of "permission denied" error messages. How can we change that command such that it only shows matches without "permission denied" messages at the terminate?

```
$ find / -name core
```

(3 marks)

ANSWER IN THIS BOX

Modify the command as:

```
$ find / -name core 2 > /dev/null
```

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

```
#!/bin/sh
suffix=-IT5406
for script in *.conf; do
    newscript="$script.$suffix"
    mv -f $script $newscript
done
```

Assume the directory /tmp/IT5406 contains the following five (5) files: **syllabus.doc**, **named.conf**, **readme.txt**, **httpd.conf** and **MyCode.conf** and the below command is executed.

```
$ ./MyCode /tmp/IT5406
```

Once the above command is issued, what are the files in the /tmp/IT5406 directory? Justify your answer.

(5 marks)

ANSWER IN THIS BOX

The code will move three files with suffix "-IT5406" and two files will not be moved. After the command, files in /tmp/IT5406 will be:

syllabus.doc

named.conf-IT5406

readme.txt

httpd.conf-IT5406

MyCode.conf-IT5406

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- (c) Explain briefly why system administrators now choose to employ Python for scripting over bash or other shell scripting.

(4 marks)

ANSWER IN THIS BOX

Bash scripts are mostly just shell commands that have been chained together, sometimes along with loops or conditional statements. But Python is a full-fledged programming language, capable of creating everything from basic automation scripts to programs with graphical user interfaces. The Python code is easier to read and maintain, runs a little faster, and can have a proper unit test suite.

(Page 215)

(d)

- (i) In the context of virtualization, what is a “hypervisor”?

(2 marks)

- (ii) What are "Type 1" and "Type 2" hypervisors?

(3 marks)

ANSWER IN THIS BOX

- (i) A hypervisor is a software layer that mediates between virtual machines and the underlying hardware on which they run.

(Page 901)

- (ii) A Type 1 hypervisor runs directly on the hardware without a supporting Operating System and are also called bare-metal or native hypervisor.

Type 2 hypervisors are user-space applications that run on top of another general-purpose operating system.

(Page 903)

(e) What are the three (3) fundamental cloud service models.

(3 marks)

ANSWER IN THIS BOX

They are:

- I. Infrastructure as a Service model
- II. Platform as a Service model
- III. Software as a Service model

(Page 276)

(f)

(i) In the context of virtualization, what is a “Container”?

(2 marks)

(ii) What differentiates a "Container" from a "Virtual Machine" in terms of their core characteristics?

(3 marks)

ANSWER IN THIS BOX

- (i) Containerization is an OS-level virtualization. It is a different approach to isolation that does not use a hypervisor. Instead, it relies on kernel features that isolate processes from the rest of the system. Each process container has a root file system and process namespace.

(Page 904)

- (ii) A true virtual machine has an OS kernel, an init process, drivers to interact with hardware, and the full operating system. A container on the other hand is merely a façade of an operating system. It provides individual processes a suitable execution environment.

(Page 905)
