OPERATING SYSTEMS
UCCD 2103
JAN 2020

ASSIGNMENT REPORT
Part B

No.	Student ID	Name	Programme (CN/CS/CT/IA)
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Assignment

Guideline:

This assignment is a **group assessment**. Each group (max. 3 students per group) has to practice the following and submit the hardcopy reports. There is no restriction of forming a group out of your tutorial group. **Maximum marks for this assignment (Part B) is 110.** It requires you to use the Linux OS. Running a virtualized Linux (Virtualbox or VMWare Player) is acceptable. You can use either **32-bit** or **64-bit** Linux, depending on your host OS if you use virtualization. For example, if your computer runs on Windows 7 32-bit, then you have to use Linux 32-bit on your virtual machine. To limit uncertainties and possible issues you might run into, you are recommended (but not limited) to use Fedora or CentOS for this assignment. Make sure you allocate at least 50GB for your Linux partition. **The username of your Linux system must be set to your first name.** For example, the username of my system is *cheesiang*. Your report shall contain all group member's names and IDs, and your group leader's email address. Also, write down the specification of the system that you use to perform this assignment at the last page of your report. If you are using a Virtual Machine like VMWare/Virtualbox, then you should write down the specification of your VM. i.e. How many virtual processors and RAM size are set? Your report should provide the **screenshots** of the terminal to support **all** your answers. If the screenshot size is too big and resulting to a very small font size in your printout, you may resize your desktop resolution to 800x600 before taking the screenshot. If the screenshot is still too large (or the font is too small), you may crop it; **as long as you can proof the originality of your work, by showing the username in your terminal**. For example, for command lines-based question, you should not crop out your username as it is used to identify your group's work. Any group reports that have the same screenshots or usernames will be counted as plagiarism and be given 0 marks. The report and source codes shall be printed in black and white colour, double sided, and without comb binding to minimize cost. Please compress the softcopy of your report and source codes and upload it to the WBLE. Use the following naming format: `yourname_tutorialgroup`. Please cite all the references you use. The compressed file for WBLE submission shall have the following:

- Folder: `Part B source codes`
  - `Q1a.sh`
  - `multi.sh`
  - `count_logfile.sh`
- PDF file: `Report.pdf`
- Text file: `Group_members.txt` (Group members list)

Only the group leader needs to upload the soft copy to WBLE. Please cite all the references you use. due date is 9th April 2020, 11AM. The submission process in WBLE later on.

Part B: Linux Administration

1. *Basic Bash*

   a. A shell script is a sequence of shell commands written in an executable script file. Executing this file instructs the shell to execute all commands in the order of their appearance in the script file. There exist several shell scripting tutorials available on the web, e.g. search by entering the keywords Linux shell script tutorials. Go through one of these tutorials and then write a **shell script** that displays the following system parameters/information:

      i. Your username
      ii. The kernel version of your Linux OS
      iii. The number of cores in your processor
      iv. The current directory of the terminal
      v. The local IP address of your system
      vi. The total main memory (RAM) and free memory the system has
      vii. All secondary storage in your system
      viii. The current disk scheduler (also known as IO scheduler) used in your Linux
      ix. Completely Fair Scheduler's period (Hint: it is stored in `/proc/sys/kernel/sched_latency_ns`)
      x. The directory(ies) of `firefox` is stored. (Use `whereis` command)

   You need to include the script and also screenshot of the results after the script is executed in your hardcopy report. Please include the shell script codes into softcopy as well. (10 marks)

   b. Write a CPU resource monitoring program for Morzilla Firefox browser using a shell script. Upon the completion of this shell script, it should be able to monitor and record down the percentage of CPU ~~and RAM~~ consumed by Firefox for every `n` second(s). The user can decide the value of `n`.

      i. Morzilla Firefox is using multi-threading technique. The `ps -eLf` command will show the resource consumption for all task in the system. However, you are only interested with the Firefox threads. Find out how to filter that information. Then, read the current total CPU ~~and memory~~ consumed by Firefox by summing up the CPU% ~~and MEM%~~ columns, respectively. Output them to a file called `morzilla.log`.
      ii. Let the user determines the period of recording down the CPU% ~~and MEM%~~ reading. The user will execute the shell script via this command if the period is set to 2 seconds: `./monitor.sh 2`

   (40 marks)

2. *Kernel compilation*

   The objective of this question is to learn how to manually patch and compile a Linux kernel from source codes. Conservatively, we will use the kernel version that your Linux currently has; *x.y* as the baseline kernel, where `x` and `y` are the major and minor version numbers, respectively. As an exercise, this question requires you to update it to *x*.(*y*+1)

   First, identify your kernel version (Q1(a)(ii) answer). For example, you may get something like `5.3.2-300.fc31.x86_64`. This means, your Linux is running on version 5.3.2 and the distro is Fedora Core 31 x86-64 architecture. In that case, to

accomplish this assignment, the target version to be updated to is 5.3.3 if your current version is 5.3.2. The following are the steps to do that:

a. Locate and download kernel source files version `x.y` from https://mirrors.edge.kernel.org/pub/linux/kernel/
   For the example above, that would be located at https://mirrors.edge.kernel.org/pub/linux/kernel/v5.x/linux-5.3.tar.xz
b. Locate and download the version `x.(y+1)` patch. For the example above, it can be located at https://mirrors.edge.kernel.org/pub/linux/kernel/v5.x/linux-5.3.3.tar.gz
c. List down the steps of commands to unpack the linux-5.3.tar.xz and patch it with version 5.3.3.
d. After patching, go to the linux-5.3 folder (which you unpacked in (c)) and start configuring your kernel. You may use `make menuconfig` command. This step is used to configure your kernel. However, the configuration list is extremely long and detailed. I suggest you to reuse the configuration file that comes with your distro. Depending on distro, it is normally located in `/boot` folder.
e. List the steps to compile and install the 5.3.3 kernel. The compilation will take a very long time. For this step, you just need to screenshot the beginning and last page of your terminal when you typed in the command to compile.
f. Reboot your system. At the bootloader, choose and boot the 5.3.3 kernel. Finally, verify the kernel version in the terminal. Show that you are running on 5.3.3 kernel.

(20 marks)

3. *File processing using gawk- loop and variables*

The directory *netstat* contains daily internet usage log files for different months of the year. The log files are arranged into folders, one for each month. Each log file contains the following fields separated by semi-colon (;).

Name	Department ID	Accessed website	Usage (KB)	Time

Complete the bash shell script *check_usage.sh* that computes the total internet usage recorded in the log files in the *netstat* directory.

Requirement:

a. To sum the internet usage in a particular log file, you are use the `gawk` command.
b. The shell script receives the path of the *Netstat* directory.

Input and output samples are given below. Assume the *Netstat* directory is inside `~/Workspace/Assignment` directory:

```
utar@ubuntu:~/Workspace/Assignment$ ./check_usage.sh NetStat
Total usage = 245067 KB
```

Show the *check_usage.sh* script and the screenshot (of input & output of the script, like the example above) in your hardcopy report. Attach the file in softcopy submission.

(40 marks)

References:

- Linux Shell Scripting Tutorial v1.05r3: A Beginner's handbook. 2018. [ONLINE] http://www.freeos.com/guides/lsst/ . [Accessed 01 November 2018].
- How to use POSIX semaphores in C language2018. [ONLINE] https://www.geeksforgeeks.org/use-posix-semaphores-c/. [Accessed 01 November 2018].