

# COMP 7500 Advanced Operating Systems

## Project 1 – Installing CentOS

Version 2.7

Revised: January 16, 2025

Points Possible: 100

**(Important)** There should be no collaboration among students. Each student should NOT share any project code with any other students. Collaborations among students in any form will be treated as a serious violation of the University's academic integrity code.

### Objectives:

- Prepare a Linux operating system
- Get to know the CentOS operating system
- Learn basic Linux commands

### Requirements:

- Each student should **independently** accomplish this laboratory assignment.
- You should install a new CentOS 7 operating system.

## 1. Instructions

- Insert your CD and reboot the system, press direction key to enter the next booting page.
- If you don't have a CentOS CD, you may download CentOS DVD ISO or Minimal ISO here: <https://www.centos.org/download/>
- You may choose to install VirtualBox or VMWare on your PC, followed by installing CentOS.
  - a. Download VirtualBox here: <https://www.virtualbox.org/wiki/Downloads>
  - b. A Guideline: [How to Perfectly Install CentOS on VirtualBox](#)
- Enter "Welcome to centos-7-x86\_64-LiveCD" page, choose install.
- Choose "Basic Storage Devices" for the device and "Use All Space" for the partition.
- After you reboot the computer, please follow the steps to finish the configuration.
- Open a terminal and do "yum -y update" to update all the packages. You need to be the root to do this.

## 2. The script Command

The script command line tool allows you to save a session of your terminal. In addition to saving each command per line in a text file, the script command makes a typescript of everything that happens on your CentOS terminal. Screencasting tools to a desktop

session(GUI) is what script is to a terminal. Let us demonstrate the usage of script through the following example:

```
$ script
$Script started, file is typescript
$ cd
$ ls
file1 file2 file3
$ exit
exit
Script done, file is typescript
```

Then, you may use the `mv` command to change the file name from `typescript` to any name you like. Alternatively, you may specify the name of your log file upfront as below:

```
$ script sample.script
$Script started, file is typescript
$ cd
$ ls
file1 file2 file3
$ exit
exit
Script done, file is sample.script
```

**Important!** All script output files must have the extension name `.script`

## 2. Questions

Script the following session using the `script` command. You may save each session (i.e., each task below) in one script file. Using the `tar` command to submit a tarred and compressed file named `project1.tgz` (see Section 3.2 for details).

2.1 (40 points) Please practice the installation of a Linux Operating System on your computer. The CentOS can be downloaded from the following web link.

<http://mirrors.tummy.com/mirrors/CentOS/7/>

- Set your preferred root password
- Please make sure the following packages are installed: **gcc, gcc-c++, vim-enhanced, emacs gdb, ethtool, hdparm, file** and **pciutils**. They most likely are already installed. You can run the following commands to confirm their availability and install as needed.

```
yum -y install gcc
yum -y install gcc-c++
yum -y install vim-enhanced
yum -y install emacs
yum -y install gdb
yum -y install ethtool
```

```
yum -y install pciutils
yum -y install file
```

- If you install Ubuntu instead of CentOS, you should use APT to install packages. Please try the following commands.

```
apt -y install gcc
apt -y install gcc-c++
apt -y install vim-enhanced
apt -y install emacs
apt -y install gdb
apt -y install ethtool
apt -y install pciutils
apt -y install file
```

2.2 (30 points) When the computer system is up, you should get to know it in more detail. You are asked to find out their attributes, including **CPU frequency, cache size, memory size, the list of PCI devices, hard drive, network MAC address and link speed, and the devices generating interrupts**. The following system commands can help you. Many of these commands are for system administration, so you should run them as root if needed.

```
# more /proc/cpuinfo
# more /proc/meminfo
# /sbin/lspci
# /sbin/ethtool eth0
# /sbin/ifconfig eth0
# more /proc/interrupts
```

Please store the output from all these commands and include them as a part of your project report.

You may pipe the output of any Linux command to a file on Linux. For example:

```
#ls > test.txt
```

The above command writes all files in the current directory to a file called “test.txt” instead of displaying the files on a monitor. If you choose this option, please include the pipeline output file(s) in your submitted tarball.

2.3 (30 points) With the computer up and running, you should give it a try to see if you can use the utilities on the system. For a system programmer, these include at least the editor, the compiler, the libraries, and the debugger. You are asked to do the following

2.3.1. Using your favorite editor, code a program (simple.c) that processes an array of 10 numbers, calculates the average of their square roots, and prints it out.

I recommend either **emacs** or **vim** as an editor for COMP 7500/7506. If you are not yet proficient with either of them, you should be able to type the `simple.c` program without too much effort.

- 2.3.2. The GNU compiler is the default open source compiler on Linux. You should check a little on what gcc you have, and then compile your program as follows. Please do not forget the flag `'-g'` for using debugger in Step 4.

```
# gcc -v
# gcc -g -lm -o simple simple.c
```

- 2.3.3 Practice the command **ldd**, and understand the libraries on which your program is dependent upon for execution.

```
# man ldd
# ldd simple
```

- 2.3.4 The debugger is a friend you must get acquainted with to be a good programmer. Here is a little trick in using the GNU gdb debugger.
- (1) First run your program, **simple**, alone
  - (2) Prepare a file name as `.gdbinit` in the current directory with the following content:

```
file simple
break main
break sqrt
info registers
```

- (3) Run the gdb debugger and then type these characters (`'r'`, `'s'`, `'n'`, and `'c'`), one at a time complete the program

```
# gdb
# r
# n
# s
# c
```

**Note:** You don't have to follow the above command sequence in gdb. You will receive full credit if you demonstrate that you are familiar with the basic gdb commands such as `run`, `next`, `step`, `continue`.

- 2.3.5 Your project report should include the source program, and the output from Steps (1)-(4).

### 3. Deliverables

You must submit a single compressed file – called tarball (see Section 3.1), which contains script files and a report (see Section 3.2).

### 3.1 Tarball: A Single Compressed File

If you have generated multiple script files, please save all the script files in one directory say (project1). Then, you should archive all the script files (see Sections 2.1, 2.3) and text files (see Section 2.2) along with your report (See Section 3.1) and the source code (simple.c) into a single tarred and compressed file. Assume that the script files, text files, and your report are located in ~/comp7500/project1, then you can follow the instructions below to prepare a single compressed file.

```
%cd ~/comp7500
%tar vfcz project1.tgz project1
```

### 3.2 Project Report

Please submit your project report with needed contents as specified in the questions (see Section 2). You must submit your report through Canvas (no e-mail submission is accepted). Please report any problems you have solved when you install CentOS and the utility programs. You should include your report in the tarball created in Step 3.1.

The file name should be formatted as:

“project1.pdf” or “project1.txt”

## 4. Grading Criteria

- 1) Install centOS: 40%
- 2) Get to know your OS: 30%
- 3) Use utility programs: 30%
- 4) **Important!** All script output files must have the extension name .script

## 5. Late Submission Penalty

- Ten percent (10%) penalty per day for late submission. For example, an assignment submitted after the deadline but up to 1 day (24 hours) late can achieve a maximum of 90% of points allocated for the assignment. An assignment submitted after the deadline but up to 2 days (48 hours) late can achieve a maximum of 80% of points allocated for the assignment.
- Assignment submitted more than 3 days (72 hours) after the deadline will not be graded.

## 6. Rebuttal period

- You will be given a period of **one week** to read and respond to the comments and grades of your homework or project assignment. The TA may use this

opportunity to address any concern and question you have. The TA also may ask for additional information from you regarding your homework or project.

## **7. References**

- [1] [Compile C Program in Linux Using GCC \(linuxhint.com\)](http://linuxhint.com)
- [2] [gdb command in Linux with examples - GeeksforGeeks](http://www.geeksforgeeks.org/gdb-command-in-linux-with-examples/)