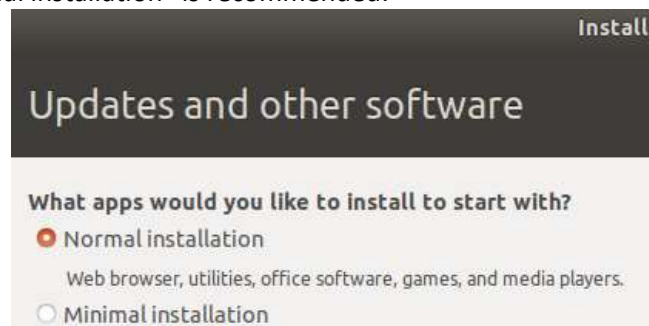# Assignment 0
Familiarization with Linux

Due Date: Thursday April 22nd, 2021 @ 11:59 pm
Version: 0.14

Objective
The purpose of this assignment is to create a local Linux Virtual Machine for use in future TCSS 422 projects and gain some experience using Ubuntu. Please download and install Ubuntu 20.04. During the installation, a "normal installation" is recommended:

This option should include the Linux kernel headers required for kernel mode programming. Ubuntu 20.04 is Debian based open source/free distribution of Linux, and is a leading commercial distribution of Linux. The most widely used open source Linux distributions in industry include Ubuntu, Red Hat/CentOS, and SUSE.

Here is a recent article describing Microsoft's adoption of Linux on the Azure cloud:
https://www.zdnet.com/article/linux-now-dominates-azure/

For those new to Linux, before completing this assignment, please review the BASH shell and command line online tutorial found here:

Learn the BASH command line: **https://ryanstutorials.net/linuxtutorial/**

Task 1 – Install Oracle Virtual Box
Oracle VirtualBox can be downloaded from: https://www.virtualbox.org/wiki/Downloads

Assuming you have access to a computer, choose the appropriate link from the list for your host operating system to download VirtualBox:

Version 6.1.x is now available:

- Windows hosts
- OS X hosts

Once you've downloaded VirtualBox, follow the instructions to complete the installation.

If you do not have access to a computer for Virtual Box and Ubuntu, Stephen Rondeau, senior computer specialist for the School of Engineering and Technology, is setting up Ubuntu 20.04 based VirtualBox VMs to support TCSS 422. If you haven't already requested a VM to be setup, please do so by emailing the instructor or sending a message via Canvas.

Task 2 – Create a Ubuntu 20.04.2 LTS Virtual Box VM
Ubuntu can be downloaded from: https://www.ubuntu.com/downloads/desktop

If configure your virtual machine with 4GB RAM (2GB minimum), **2+ CPU cores**, and a minimum of 20 GB free disk space. 20-40+ GB could be useful in the future if continuing to use Ubuntu after TCSS 422 if sufficient space is available. Previously students have run out of disk space near the end of the quarter leading to headaches.

Video on 64-bit Ubuntu 20.04 Installation (Windows 10):
https://youtu.be/x3Zpe1rIPFE

Video on 64-bit Ubuntu 20.04 Installation (MAC):
https://youtu.be/Hzji7w882OY

After installing Ubuntu, install the **Linux Guest Additions**:
https://youtu.be/Kbez-XdXqrw

 "Guest Additions" enable sharing of the Host OS Hard Disk (e.g. Windows, Mac) with the Virtual Machine. Guest Additions also enable sharing of the clipboard, and provide mouse pointer integration. Please spend the additional time to install the Guest Additions. You'll be happy that you did !

Task 3 – Become familiar with Linux
For this task you will use the internet, and/or a good Linux book to discover Linux commands that provide answers to each of the questions. The commands will help describe information about your Ubuntu Virtual Machine. The goal is to become familiar with common Linux commands and to provide an opportunity to gain experience using the internet and various references *to discover* <u>how</u> to navigate and introspect information about Linux.

50% of the credit is for determining a command to display the answer. The other 50% is for interpreting the output of the command to answer the question.

Discover a Linux command (*sequence*) that provides an answer to each question. Each question potentially has *many* valid Linux commands that **could** answer the question. You're only responsible for finding <u>one</u> possible command. Any command, or sequence of commands, is OK as long as the correct answer is obtained.

Note #1: manually printing out the answer using the "echo" statement, is not sufficient. Answers must be from using Linux system commands

Note #2: It is not necessary to parse the value from the command(s) to provide an EXACT answer. Reporting the full output of a command that contains the correct answer is OKAY!

Questions

Question 1 – How many total **processes** are present shortly after the Ubuntu VM boots up?

Question 2 – How many total **threads** are present shortly after the Ubuntu VM boots up?

Question 3 – What is the version number of the Linux kernel installed on your Ubuntu VM?

Question 4 – What is the model name of the CPU(s) of the VM? According to wikipedia or Intel/AMD specification pages, how many CPU cores does this CPU have? If the information is available, what was the release date of the CPU, and the original retail price?

Question 5 – What is the total size of the memory **swap space** (virtual memory) in MB on the VM?

Question 6 – What is the free disk space of the root disk partition in MB? In Linux, the root partition is always mounted at "/". A mount point is the directory or location in the file system where an I/O device has been mounted. The mount point is used to access the device through a file system.

Question 7 – What is the total number of inodes on the root filesystem? If unfamiliar with what an inode is, look up the definition and how to display the number of free/used inodes on Linux/Ubuntu.

Question 8* – What is the average round trip time (RTT) of 10 ICMP ping packets from your Ubuntu VM to www.google.com?

Question 9* - What is the interface name of the network interface device used to route the ICMP ping packets to www.google.com?

Question 10 – Identify the file system type of the "/" root partition? Briefly describe this file system type (1-2 sentences). Using the Linux man pages, look up the file system, and identify the name of two features added in the latest release/version. Search the man page and include a description for one of these features.

> * - These questions require networking to be configured on the Ubuntu VM.

BONUS QUESTIONS

Question 11 – What is the IP address of your network interface device used to route ICMP ping packets to www.google.com (from question 9)?

Question 12 - Look up a Linux command you are unfamiliar with. Provide an example of using the command in your script. In the textfile that contains the answers to the questions, provide a description *in your own words* of what the command does.

What to Submit

Produce three files for submission to Canvas:

File #1: BASH SCRIPT (a0.sh file)

For the assignment, submit a BASH script that contains the list of commands to answer each of the questions.

How to create a simple bash script:

Create a "bash" script which provides the commands to answer each of the questions. Include separator lines and comments for each command. Also include "echo" statements to label command sequences on the output, and provide spacing "breaks" between commands.

Use an editor such as "gedit", "vi", "pico", or "nano" to create a script, "a0.sh":

Sample Script:
Question #1: What is the command to show the user's current working directory?

```
# Question #1
# ------------------------------------------------------------------
echo ; echo "command #1: pwd"
pwd
# Question #2
# ------------------------------------------------------------------
...
```

To run the script assign the script to have execute permission
Give the "user" (u) "execute" (x) permission with chmod (u+x):
```
$ chmod u+x a0.sh
```

File #2: BASH SCRIPT OUTPUT (a0.out file)

Next, capture the output of the script file to a text file, and submit this text file to Canvas.

Using I/O redirection, capture the bash script output to a text file:
```
$ ./a0.sh > a0.out
```

Check the output for proper formatting by printing to the screen:
```
$ cat a0.out
```
```
command #1: pwd
/home/fred
$
```

File #3: ANSWERS FILE (a0_answers.txt file)

Create a text file called "a0_answers.txt".
Interpret the output from a0.out to answer each of the questions:

```
$ gedit a0_answers.txt
```

```
[Add text to answer each question]

1. /home/fred

2. (q2 answer)

…

[Save the file, Exit GEDIT.]
```

For this example, you will then submit three files to Canvas:
"a0.sh"
"a0.out"
"a0_answers.txt"

To submit the assignment, upload the three files to Canvas:

1- **BASH SCRIPT:** (e.g. a0.sh)
   Contains the list of commands to answer each of the questions

2- **BASH SCRIPT OUTPUT** (e.g. a0.out)
   Output captured by running a0.sh script, and redirecting the output using ">" to the a0.out output file.

3- **ANSWERS FILE** (e.g. a0_answers.txt) File provides your interpretation of the answers to each of the questions. Your answers must be based on output from your bash script output. (a0.out).

   In the ANSWERS FILE, for questions 11 and 12, include a written description of the commands you've researched. Your description should not be a copy of the man page. Your description should be *short and in your own words.* It should describe what the main functions of the command are.

Grading
This assignment will be scored out of 30 points. (30/30)=100%

Each question is worth 3 points: one point is for including command output that provides the answer in a0.out, one point is for answering the question correctly in a0_answers.txt, and one point is for including a valid command in a0.sh.

Two questions (11 & 12) are counted as bonus questions. Answering bonus questions enables a 100% score on the assignment while skipping, or incorrectly answering up to 2 questions.

Please create, format, and submit three text files to Canvas with the specified names to submit the assignment. Failure to provide the three files will result in the loss of 3 points:
File #1: a0.sh
File #2: a0.out
File #3: a0_answers.txt