ASEN 4057 Assignment 4: Part 2

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Group 9

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1. The command to show directory contents is “ls”. The contents of the present directory can be found below.

```
matthew@matthew-VirtualBox:~$ ls
Desktop  Documents  Downloads  examples.desktop  Git  Music  Pictures
Public  Templates  Videos
```

2. The command to show all files in a “long” format is “ls -al”. These contents can be found below.

```
matthew@matthew-VirtualBox:~$ ls -al
total 156
drwxr-xr-x 22 matthew matthew 4096 Feb 22 10:32 .
drwxr-xr-x  3 rootroot  4096 Feb 19 17:33 ..
-rw-------  1 matthew matthew 1008 Feb 20 10:52 .bash_history
-rw-r--r--  1 matthew matthew  220 Feb 19 17:33 .bash_logout
-rw-r--r--  1 matthew matthew 3771 Feb 19 17:33 .bashrc
drwx------ 14 matthew matthew 4096 Feb 22 10:33 .cache
drwx------  3 matthew matthew 4096 Feb 19 17:46 .compiz
drwx------ 15 matthew matthew 4096 Feb 19 18:08 .config
drwxr-xr-x  2 matthew matthew 4096 Feb 19 23:24 Desktop
-rw-r--r--  1 matthew matthew   25 Feb 19 17:38 .dmrc
drwxr-xr-x 10 matthew matthew 4096 Feb 22 09:33 Documents
drwxr-xr-x  2 matthew matthew 4096 Feb 20 00:06 Downloads
-rw-r--r--  1 matthew matthew 8980 Feb 19 17:33 examples.desktop
drwx------  2 matthew matthew 4096 Feb 22 09:18 .gconf
drwxrwxr-x  3 matthew matthew 4096 Feb 22 10:33 Git
-rw-rw-r--  1 matthew matthew   58 Feb 22 09:52 .gitconfig
drwx------  3 matthew matthew 4096 Feb 22 09:18 .gnupg
-rw-------  1 matthew matthew 2562 Feb 22 09:18 .ICEauthority
drwxrwxr-x  3 matthew matthew 4096 Feb 19 19:04 .java
drwx------  3 matthew matthew 4096 Feb 19 17:38 .local
drwxrwxr-x  4 matthew matthew 4096 Feb 20 00:17 .matlab
drwx------  4 matthew matthew 4096 Feb 19 17:57 .mozilla
```

```
drwxr-xr-x  2 matthew matthew 4096 Feb 19 17:38 Music
drwxrwxr-x  2 matthew matthew 4096 Feb 22 10:18 .nano
drwxr-xr-x  2 matthew matthew 4096 Feb 19 17:38 Pictures
-rw-r--r--  1 matthew matthew  655 Feb 19 17:33 .profile
drwxr-xr-x  2 matthew matthew 4096 Feb 19 17:38 Public
drwxrwxr-x  3 matthew matthew 4096 Feb 20 00:17 .subversion
-rw-r--r--  1 matthew matthew 0 Feb 19 18:12 .sudo_as_admin_successful
drwxr-xr-x  2 matthew matthew 4096 Feb 19 17:38 Templates
-rw-r-----  1 matthew matthew 5 Feb 22 09:18 .vboxclient-clipboard.pid
-rw-r-----  1 matthew matthew 5 Feb 22 09:18 .vboxclient-display.pid
-rw-r-----  1 matthew matthew 5 Feb 22 09:18 .vboxclient-draganddrop.pid
-rw-r-----  1 matthew matthew 5 Feb 22 09:18 .vboxclient-seamless.pid
drwxr-xr-x  2 matthew matthew 4096 Feb 19 17:38 Videos
-rw-------  1 matthew matthew   63 Feb 22 09:18 .Xauthority
-rw-------  1 matthew matthew   82 Feb 22 09:18 .xsession-errors
-rw-------  1 matthew matthew 1367 Feb 20 10:52 .xsession-errors.old
```

3. The first character in the long list of characters represents one of three things. The character “l” implies that the component listed is a symbolic link. The character “d” implies that the component is a directory. The character “-” implies that the component is a file. The next three characters contain permissions offered to the owner of the file. For example, ‘-rwx’ means that the component is a file, and can be read, written to, and executed by the owner of the file. The next three contain the permissions for the members of the group owning the file, and the last three contain those for all others. So, for example, the line “-rwxr-x--x” describes a file that has read/write/execute permissions for the owner, read/execute permissions for members of the owning group, and only execute permissions for all others.

4. The command “df -h” accesses the disk usage in a human readable format.

```
matthew@matthew-VirtualBox:~$ df -h
Filesystem  Size  Used Avail Use% Mounted on
udev        476M  0  476M   0% /dev
tmpfs       100M  3.6M   96M   4% /run
/dev/sda1         15G   12G  2.3G  84% /
tmpfs       496M   41M  456M   9% /dev/shm
tmpfs       5.0M  4.0K  5.0M   1% /run/lock
tmpfs       496M  0  496M   0% /sys/fs/cgroup
tmpfs       100M   56K  100M   1% /run/user/1000
/dev/sr0          57M   57M   0 100%
/media/matthew/VBOXADDITIONS_5.1.14_112924
```

5. The command “[program_name] --help” provides information on the programs seen in the /bin directory. The following programs have functions which were previously unknown.
   i. sleep:

```
matthew@matthew-VirtualBox:/bin$ sleep --help
Usage: sleep NUMBER[SUFFIX]...
  or:  sleep OPTION
```

```
Pause for NUMBER seconds.  SUFFIX may be 's' for seconds (the default),
'm' for minutes, 'h' for hours or 'd' for days.  Unlike most
implementations
that require NUMBER be an integer, here NUMBER may be an arbitrary
floating
point number.  Given two or more arguments, pause for the amount of time
specified by the sum of their values.

      --help      display this help and exit
      --version  output version information and exit

GNU coreutils online help: <http://www.gnu.org/software/coreutils/>
Full documentation at: <http://www.gnu.org/software/coreutils/sleep>
or available locally via: info '(coreutils) sleep invocation'
```

ii. uname:

```
matthew@matthew-VirtualBox:/bin$ uname --help
Usage: uname [OPTION]...
Print certain system information.  With no OPTION, same as -s.

  -a, --all             print all information, in the following order,
                              except omit -p and -i if unknown:
  -s, --kernel-name     print the kernel name
  -n, --nodename        print the network node hostname
  -r, --kernel-release  print the kernel release
  -v, --kernel-version  print the kernel version
  -m, --machine         print the machine hardware name
  -p, --processor       print the processor type (non-portable)
  -i, --hardware-platform  print the hardware platform (non-portable)
  -o, --operating-system   print the operating system
      --help      display this help and exit
      --version  output version information and exit

GNU coreutils online help: <http://www.gnu.org/software/coreutils/>
Full documentation at: <http://www.gnu.org/software/coreutils/uname>
or available locally via: info '(coreutils) uname invocation'
```

iii. ed:

```
matthew@matthew-VirtualBox:/bin$ ed --help
GNU Ed - The GNU line editor.

Usage: ed [options] [file]

Options:
  -h, --help                  display this help and exit
  -V, --version               output version information and exit
  -G, --traditional           run in compatibility mode
```

```
  -l, --loose-exit-status     exit with 0 status even if a command fails
  -p, --prompt=STRING         use STRING as an interactive prompt
  -r, --restricted            run in restricted mode
  -s, --quiet, --silent       suppress diagnostics
  -v, --verbose               be verbose
Start edit by reading in 'file' if given.
If 'file' begins with a '!', read output of shell command.

Exit status: 0 for a normal exit, 1 for environmental problems (file
not found, invalid flags, I/O errors, etc), 2 to indicate a corrupt or
invalid input file, 3 for an internal consistency error (eg, bug) which
caused ed to panic.

Report bugs to bug-ed@gnu.org
Ed home page: http://www.gnu.org/software/ed/ed.html
General help using GNU software: http://www.gnu.org/gethelp
```

iv. openvt:

```
matthew@matthew-VirtualBox:/bin$ openvt --help
Usage: openvt [OPTIONS] -- command

This utility help you to start a program on a new virtual terminal (VT).

Options:
  -c, --console=NUM   use the given VT number;
  -e, --exec      execute the command, without forking;
  -f, --force     force opening a VT without checking;
  -l, --login     make the command a login shell;
  -u, --user      figure out the owner of the current VT;
  -s, --switch    switch to the new VT;
  -w, --wait      wait for command to complete;
  -v, --verbose   print a message for each action;
  -V, --version   print program version and exit;
  -h, --help      output a brief help message.
```

v. mt:

```
matthew@matthew-VirtualBox:/bin$ mt --help
Usage: mt [OPTION...] operation [count]
control magnetic tape drive operation

  -f, --file=DEVICE           use device as the file name of the tape
drive to
                              operate on
      --rsh-command=COMMAND  use remote COMMAND instead of rsh
  -?, --help                  give this help list
      --usage                 give a short usage message
  -V, --version               print program version
```

```
Mandatory or optional arguments to long options are also mandatory or
optional
for any corresponding short options.

Report bugs to <bug-cpio@gnu.org>.
```

6. A list of the command line operations necessary to complete this step follows below.

```
matthew@matthew-VirtualBox:~/Documents$ mkdir ASEN4519
matthew@matthew-VirtualBox:~/Documents$ cd ASEN4519
matthew@matthew-VirtualBox:~/Documents/ASEN4519$ touch ASEN4519test.txt
matthew@matthew-VirtualBox:~/Documents/ASEN4519$ nano  ASEN4519test.txt
[enter text in text file and then exit file]
matthew@matthew-VirtualBox:~/Documents/ASEN4519$ chmod 777
ASEN4519test.txt
matthew@matthew-VirtualBox:~/Documents/ASEN4519$ ls -al
total 12
drwxrwxr-x  2 matthew matthew 4096 Feb 25 22:50 .
drwxr-xr-x 11 matthew matthew 4096 Feb 25 22:48 ..
-rwxrwxrwx  1 matthew matthew  105 Feb 25 22:50 ASEN4519test.txt
matthew@matthew-VirtualBox:~/Documents/ASEN4519$ cat ASEN4519test.txt
Tucker Emmett
Class of 2017
Favorite Movie: Superbad

Matt Funk
Class of 2018
Favorite Movie: Star Wars
matthew@matthew-VirtualBox:~/Documents/ASEN4519$ mv
~/Documents/ASEN4519/ASEN4519test.txt ~
matthew@matthew-VirtualBox:~/Documents/ASEN4519$ cd
matthew@matthew-VirtualBox:~$ ls
ASEN4519test.txt  Desktop  Documents  Downloads  examples.desktop  Git
Music  Pictures  Public  Templates  Videos
matthew@matthew-VirtualBox:~$ mv ASEN4519test.txt ASEN4519.txt
matthew@matthew-VirtualBox:~$ ls
ASEN4519.txt  Desktop  Documents  Downloads  examples.desktop  Git  Music
Pictures  Public  Templates  Videos
matthew@matthew-VirtualBox:~$ rm -r ASEN4519.txt
matthew@matthew-VirtualBox:~$ ls
Desktop  Documents  Downloads  examples.desktop  Git  Music  Pictures
Public  Templates  Videos
```

7. Starting MATLAB from the command line as a background process requires two things. One, the user must be in the directory which contains the symbolic link (‘matlab’, in my case). Two, the user must run matlab and add an ampersand to run it as a background process. The command line text looks like this: “./matlab &”. Upon running the MATLAB lines with an input of 5000 instead

of 9973 to avoid running out of memory, it was determined that the maximum %CPU and memory utilizations were 48.5 % and 75.5%, respectively. MATLAB's time counter displayed a computational time of 1.556721 seconds to complete this process. After the computation finished, MATLAB is now only using 1% of the CPU. However, MATLAB is still using 68.8 percent of the memory. It appears that storing the 5000 random values and the FFT data takes up a significant portion of the available RAM. Because this virtual machine is contained on a flash drive, it is expected that these CPU and RAM values are significant percentages of the total available system. If this same operation was carried out on a normal computer, one should expect significantly smaller percentages to appear.

a. Now, we pursue "nice"-ing MATLAB. With the command "nice -15 ./matlab &", one can 'nice' MATLAB and start it as a background process. Initial impressions include the fact that MATLAB now is taking significantly longer to boot up in the VM. Now, running the same rand() and fft() operations as before takes MATLAB a full 2.051446 seconds. Using the nice process with MATLAB takes about thirty percent longer to run the computation. This is in line with what was expected as it was hypothesized that "nice"-ing a process pulls less power from the CPU. This process obviously comes at increased time costs; internet searches reveal that "nice"-ing a process is useful in large parallel computing processes. In these cases, the user employs "nice" to reduce the computational load demanded by their MATLAB code. In this fashion, it becomes possible to direct CPU power to the most expensive processes and throttle ones which are relatively inexpensive

8. The executable MATLAB is located in /usr/local folder. It can be started without the full path name on the command line because it is a symbolic link. This means that typing 'matlab' at the command line points to this actual location and runs the program.

9. The bash shell searches for programs to run on the VM in the directories contained in the PATH environment variable. This is a series of colon separated absolute paths which are stored in plain text files. PATH can be seen and changed using the following commands in the command line:

```
matthew@matthew-VirtualBox:~$ echo $PATH
/home/matthew/bin:/home/matthew/.local/bin:/usr/local/sbin:/usr/local/bin
:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin
matthew@matthew-VirtualBox:~$ PATH="usr/sbin:$PATH"
matthew@matthew-VirtualBox:~$ echo $PATH
usr/sbin:/home/matthew/bin:/home/matthew/.local/bin:/usr/local/sbin:/usr/
local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap
/bin
```

10.
```
matthew@matthew-VirtualBox:~$ ls /bin /usr/bin | sort> 
~/Documents/usefulprograms.txt
```

11. The default terminal for the VM is an environmental variable known as TERM. This variable's location can be seen with the env command and its name can be seen with the echo command.

```
matthew@matthew-VirtualBox:~$ echo $TERM
```

```
xterm-256color
```

12. It can be verified that there is not a default text editor associated with a VM by using the env command. If EDITOR is not one of the environment variables listed, then it does not have a default value. A default editor can be set for login or just for the current session. One can be set for login by using the following commands.

    ```
    matthew@matthew-VirtualBox:~$ nano ~/.bashrc
    ```

    Here the command to set the default editor (nano) was inserted into the file:

    ```
    VISUAL=nano; export VISUAL EDITOR=nano; export EDITOR
    ```

    This default editor can then be verified by:

    ```
    matthew@matthew-VirtualBox:~$ echo $EDITOR
    nano
    ```