



Project 0: The Unix Utilities

Command line utilities are powerful existences in the Unix world, as they provide end users convenient ways to navigate the Unix environment. In this project, we will be re-familiarizing ourselves with a UNIX shell and some common utilities. Unix environment is central to all projects for this course, as we will be using its various features during the implementation and testing phases. The project consists of two parts, each of which is designed to help with a different aspect. An overview of the three parts is as follows:

1. **Setup the Ubuntu VM:** students should setup a virtual machine that runs **Ubuntu 16.04LTS**. We strongly recommend working and testing all course related projects within the Ubuntu VM. For this part, students only need to take a screenshot of the terminal output when executing `uname -a` against the Ubuntu.
2. **Play with Command-line Utilities:** Students should first read the man page of a given utility and then try out the utility in the Ubuntu terminal. It is very useful for this course to get comfortable using shell/terminal/command lines, as most of our projects rely on students' familiarity with a Unix environment. So start early! Students should also learn at least ten more command-line utilities. This often can be accomplished by searching online for say *command line for Ubuntu*. For this part, students need to write down all the command-line utilities they tried in the README.txt.

We now describe each of the components in greater detail.

Setup the Ubuntu VM

As all course related projects will be done on a Unix environment, more specifically, a Linux distribution called Ubuntu. The successful installation of the **Ubuntu 16.04LTS** will allow students to work on the same development environment as the course staff, therefore ensuring smooth result reproduction and grading.

In this part of the assignment, students will setup a virtual machine (VM) that runs **Ubuntu 16.04LTS**. Depending on what the host machine's OS is, the exact steps to setup the VM vary and students are encouraged to look up resources online for host OS specific issues. A recommended way is to use a virtualization manager called **VirtualBox**, as it is free for all major host OSs.

Once the VM is up and running, students should launch a terminal and type the command `uname -a` to examine the standard output. An example output should look similar to the following:

```
1 $ uname -a
2 Linux ubuntu-xenial 4.4.0-194-generic #226-Ubuntu SMP Wed Oct 21 10:19:36 UTC 2020 x86_64
   x86_64 x86_64 GNU/Linux
```

Students should save a screenshot of the terminal output when executing `uname -a` against the Ubuntu.

Helpful Hints

A key goal of this assignment is for students to re-familiarize themselves with how to use the command line on a Unix-based system. If you do not have these skills already, this is not the right place to start. Students may find it useful to get up-to-speed with relevant concepts such as **shell** and **command prompt** via looking up online resources. As an example, this tutorial from digital ocean has some good information.

Students may also find it helpful to get used to working with command lines as early as possible for this course, as this skill can significantly improve the productivity.

Finally, students may find it convenient to use **Vagrant** to manage the **VirtualBox** VMs via command lines from the host machine's terminal. As an example, **Vagrant** allows easily sharing the project directory in the host machine to the `/vagrant` directory in the guest VM. As such, students could develop using familiar editors such as VSCode on the host machine and compile/run the executable on the guest Ubuntu VM.

Play with Command-line Utilities

Students will play with some very useful Unix utilities in this part of the assignment.

To get started, students should obtain access to the shell of the Ubuntu 16.04 VM. As an example, once inside the Ubuntu VM, this can be done by simply launching a terminal. If students are using **Vagrant** on a Mac OSX, the shell access to the Ubuntu can be obtained by running `vagrant ssh` in the host's terminal from within the project directory.

Students will start with the following common utilities by first understanding what each utility does and then trying out the utilities directly using the Ubuntu VM's terminal.

- `ls`
- `cd`
- `pwd`
- `cat`
- `grep`
- `wc`

Detailed information for each utility can often be found via reading the corresponding man page or by searching online. As an example, to read the man page (short for manual) for the utility `ls`, simply type `man ls` in the terminal and hit enter. All the information inside the man page is important and it does take practice to be an effective manual reader! Considering reading the manual a learning experience as well. Students who want to maximize information gain given the time constraint should at least read the **NAME**, **SYNOPSIS**, and the first few lines of the **DESCRIPTION** sections.

Next, students will explore three useful concepts: *pipe*, *redirect*, and *wildcards*. For example, for piping, Unix allows using `|` to connect two different utilities in which the second utility will take the standard output of the first utility as the input. Now, read up on the *redirect* and *wildcards* yourselves online. Students should leverage the above three concepts to answer the following questions and write down the one-liners in a plaintext writeup called `README.txt`.

- How to display all files whose names match a pattern `foo`?
- How to pass a file's content to a stdin of a C executable `bar`?
- How to count the number of lines in a file that match a pattern `foo`?

Lastly, students should look up and learn how to use ten more utilities by themselves. To find more utilities, students can search online with keywords such as *command line for Ubuntu*. For each command-line utility, students need to write down the tried invocations and the expected functionality in a plaintext writeup called `README.txt`.

Helpful Hints

Students may find it helpful to setup two side-by-side terminals and use one for reading the man page and the other for testing out the utility.

Students may find it useful to get used to navigate through the man page. Detailed information can be found by pressing `h` when inside any man pages.

Checkpoint Contributions

Checkpoint is not required for this project.

Deliverables and Grading

When submitting the project, please make sure to satisfy the following requirements:

- A document called `README.txt` containing your writeup for the *Play with the Command-line Utilities*, and anything that you feel the grader should know when grading the project. Only plaintext write-ups are accepted; Markdown is allowed.
- A screenshot (e.g., in png) for the *Setup the Ubuntu VM* part.

Please compress all the files together as a single .zip, named `YOUR.WPI.USERNAME.project_warmup.zip`, archive for submission. As with all projects, please **only use standard zip files** for compression; **.rar, .7z, and other custom file formats will not be accepted.**

Grading

The grading for this project is completion based. An on-time submission will gain 1 point that counts toward the participation category.