

FRI Astronomy Lab #1

Part I: *Unix*

Goal: The purpose of this lab is to get you acquainted with the use of Unix commands. You may very soon see the command list in this lab to be invaluable for future reference since most of the work we do is on a Unix interface [Note: Linux and OSX are both “Unix”]. You will

Learn basic unix commands and the purpose for using the interface

Learn to navigate the domain through the unix interface

Procedures

[Note: you will need to reference the table of Basic Unix Commands on the next page often.]

1. Click on the magnifying glass icon on the upper right corner of the screen to access Spotlight Search. Type in "Terminal" and click on the Top Hit. A new terminal window will open. Since we will be using the terminal extensively all semester, right click on the Terminal icon in the dock on the bottom of the screen and make sure that “Options > Keep in Dock” is selected for quick access in the future.
2. Log onto the rocky computer by typing:

```
ssh -XY fri . [username]@rocky. as. utexas. edu [not a link]
```

Where you use your specific username in place of [username] above.

Generally, this is the argument for the secure **shell** client command:

```
[username]@[computer].[domain]
```

Note: The command `ssh` is a program for logging into a remote computer given the desired directory followed by the address. For example, `fri.[username]` is the desired user under the address `rocky`. The term `-XY` is a trailing option that allows for the use of running other programs with a graphical representation on the terminal computer.

3. The first thing to do after successfully logging onto `rocky` is to change your password to something else; type `passwd` (and then hit “Enter”). Follow the onscreen instructions.
4. Next, have a look around your files and folders. Type `pwd` to **print** your (current) **working directory**. Then type `ls` to **list** the subdirectories and files under the directory `fri` (notice that the items in the directory have different color schemes).
5. Now, look around this directory using the `cd` (**change directory**) and `ls` commands (details for use on next page). When you have realized there aren’t any more directories left to `cd` into, type `cd .. /` to navigate one directory up. [*Tip:* A `cd` command without an argument will take you to your home directory. Also, press TAB as you type folder and file names to autocomplete as you go!]

6. In the terminal, next press the “up” arrow, and notice that this retrieves the previous command(s) executed. This is very important in becoming an efficient (and lazy O.O) scientist. From here, execute what you know about `cd` to return to the home directory. Then, find your way back using the previous commands listed.
7. Now comes the interesting part: Can you find the directory “*Part2*”? How about some Easter Eggs? Or even the Easter *Bunny*? (you need to be real unix guru for this last one...)
8. Once you find the folder, return to your home directory (if you have strayed) and use the `tar -cvf` (archaic, **t**ape **a**rchive) command to compress *only* the files in the the “*Part2*” folder named “*sphericaldemo.nb*” and “*lab1.pdf*”. Name your .tar file something unique to you (with your name or EID, perhaps). Next, open another terminal window on your Mac and `cd` into your home directory *on your Mac*, not rocky, and transfer the folder:

```
scp fri . [username]@rocky.as.utexas.edu: [path to file] .
```

Note: There *is* a space before the period at the end of the command. The “.” tells the command `scp` (**s**ecure **c**opy) to use the *current directory* as the place to which to copy the file(s).

Use the `tar -xvf` command to unarchive this file(s) and do Part II.

Note: To learn more about the options in the `tar` command—or for that matter, any unix command—type `man [desired command]`. To exit `man` (**m**anual), simply type `q` (**q**uit).

Basic Unix Commands

<code>ls</code>	lists files in current directory
<code>pwd</code>	print (current) working directory
<code>cd [optional directory argument]</code>	change d irectory
<code>.. /</code>	navigate one directory higher
<code>mkdir [name]</code>	m ake d irectory (<i>c.f.</i> “New Folder”)
<code>rm [file]</code>	r emove file
<code>rmdir</code>	r emove <i>e</i> mpty d irectory
<code>ssh [username]@[host]</code>	secure s hell client
<code>cp [path to file] [destination, or “.” for current directory]</code>	c opy file
<code>mv [file1] [file2]</code>	m ove file
<code>more [file]</code>	output the contents of file
<code>scp [host]:[path to file] [destination]</code>	secure c opy via secure shell
<code>man [command]</code>	display m anual for selected command
<code>locate [filename]</code>	lists all occurrences of specified name
<code>grep [file or directory]</code>	print lines matching a pattern
<code>tar -cvf [target].tar [file1] [file2] [...]</code>	create file.tar from [files]
<code>tar -xvf [file].tar</code>	extract files from [file].tar
<code>passwd</code>	change the password for your current account
<code>xterm &</code>	open xterm in the background (&)
plus many, many more...	

Part II: *Mathematica*

Goal: In this part of the lab you will learn some basic functionality of the program *Mathematica*. This program provides an integrated interface for doing symbolic and numerical computations, and for creating plots and other graphics of data.

Assignment: You will run through a couple of short *Mathematica* tutorials to acquaint yourself with its basic functionality. You will then open a *Mathematica* notebook and find ways of calculating (“evaluating”) a list of mathematical expressions which I give below. **You will be required to save and submit this notebook file on Canvas** before the next in-class lecture. The URL for Canvas is <http://canvas.utexas.edu>.

In order to do this assignment you may need to look things up in the online documentation or in the Documentation Center by going to Help: Documentation Center. This is a good resource for looking up proper syntax, function names, and other uses.

The tour...

Start *Mathematica* by clicking on its icon. Find the required tutorials by bringing down the “Help” menu and opening the “Virtual Book.” Please work through

- a. Introduction > Getting Started > Your First *Mathematica* Calculations
- b. Visualization and Graphics > Graphics and Sound > Basic Plotting

Things to Calculate

1. Use the `Integrate` function to calculate the indefinite integrals with respect to x of the following functions:

$$x; e^{-ax}; \frac{1}{1+x^2}; \frac{x^6}{1+x^4}; e^x \cos^5 x$$

2. Make a plot of the function $e^{-x} \sin(10x)$ for x in the interval 0 to 5.
3. Use the `Solve` command to solve for x in the following equation:

$$ax^2 + bx + c = 0$$

4. The intensity of radiation as a function of wavelength (in Å) of a blackbody with temperature T (in K) is given by

$$I(\lambda; T) = \frac{(hc/\lambda)^{-5}}{e^{(hc/\lambda)/T} - 1};$$

where $hc = 1.44 \cdot 10^8$ Å-K. Plot I from $\lambda = 0$ to 20,000 Å for (a) $T = 5500$ K and (b) $T = 4000$ K. Use the following options for the `Plot` command:

`PlotRange->All, Axes->False, Frame->True`

