

Introduction to Python

Day One Exercises

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1 UNIX Exercises

1. Launch a Terminal session and navigate to your home directory with the `cd` command. Remember, there are three ways to do this:

```
cd
cd ~
cd /path/to/home/directory/ # replace your home directory's full path
```

Using the commands `cd`, `pwd`, and `ls` (and `ls -la`), examine the directory structure of your system. Spend a few minutes (no more than 5!!!) figuring out where different files and directories are located so that you understand your file system organization by navigating forward into sub-directories and back into parent directories and listing contents. *The purpose of this task is to become comfortable with your computer's organization.*

2. Navigate to your home directory, and perform the following tasks. After performing a task that copies, moves, or removes a file/directory, enter the command `ls` to see how things have changed.
 - (a) Use the command `mkdir` to create a new directory called "blob".
 - (b) Use the command `touch` to create a new file called "blerg.txt".
 - (c) Use the command `echo` along with the symbol `>` to add the sentence "I'm writing to a file!" to `blerg.txt`.
 - (d) Use the command `mv` to move this file into the directory `blob`. Then, enter `ls`. What do you notice?
 - (e) Navigate into the directory "blob". Make a copy of `blerg.txt` called "blerg2.txt".
 - (f) Use the command `echo` and the symbol `>` to write the line "Another sentence!" to `blerg2.txt`. Now use `less` to examine the contents of `blerg2.txt`. What do you notice?
 - (g) Make a new copy of the file `blerg.txt` using the command `cp`, called `blerg3.txt`. Enter `ls`. What files now exist in this directory?
 - (h) *Append* the line "Another sentence!" to `blerg3.txt` using `echo` and the symbol `»`.
 - (i) Navigate back to your home directory (try using the code `cd ..` for this), and use the command `rm -r` to delete the `blob` directory.
 - (j) Use the `rm` command to delete the file `blerg.txt`.
3. For this exercise, you will use the included file "flu_sequences.fasta". This file contains sequences from the Influenza virus PB2 gene. You can open this file in a text editor, or use `less`, to see its contents. Navigate to the directory where this file is located, and perform the following tasks:

- (a) The UNIX command `wc` stands for "word count". This command counts the number of lines, characters, and bytes in a given file. Enter the command `wc sequences.fasta` to display this information. Compare the result with the file size as displayed by `ls`. Do you see any overlapping numbers?
- (b) Use `wc` with the argument `-l` to determine just the number of lines in `sequences.fasta`.
- (c) Enter the command `head sequences.fasta` to view the top few 10 lines of this file. Consult the documentation for `head` using the command `man head`, and figure out how to specify a different number of lines. Enter `q` to exit from the man documentation, and use your new knowledge to display the first 16 lines of the file.
- (d) Create a new file called "lastseqs.fasta" which contains the *last* 8 lines of `sequences.fasta` (hint: the command `tail`, which is basically the opposite of `head` should be useful!). For this task, *do not use touch*.

2 Python Variables Exercises

You can write Python code in two different ways: directly via the Python interpreter or via a script, which you can then call from the command line. To use the interpreter directly, simply type `python` into your command line. Directly interfacing with the Python interpreter is an excellent way to test out small pieces of code, but it is *not a good way* to develop code. Using scripts, on the other hand, preserves your code in a text file (with the extension `.py`) so that you always have your Python code saved and accessible.

For these exercises, you can use either the interpreter or a script, although I strongly recommend that you save all code in a script (with lots of comments!) for future reference!!

Most importantly, you should *always print your results after every step you take*. Printing output is the only way to be sure your code has worked properly!

2.1 Working with Lists

1. Define a list variable called `animals` which contains the following six entries: "monkey", "giraffe", "shark", "caterpillar", "ctenophore", and "squid". Perform the following tasks on this variable:
 - (a) Use indexing to create a new list with just the items "monkey", "giraffe", and "shark".
 - (b) Use negative indexing to extract "squid" from this list.
 - (c) Use the list method `.append()` to add the animal "spider" to the end of the list. Use the `len` function to see the length of the `animals` list after appending.
 - (d) Use indexing to change the second entry in `animals` to "cat".
 - (e) Use the list method `.pop()` to remove the 3rd entry from this list.
 - (f) Create a second list called `plants` which contains the entries "tree", "flower", "bush", and "grass". Next, create another list called `organisms`, in which the first entry is the `animals` list and the second entry is the `plants` list, using this code: `organisms = [plants, animals]`. You have just created a "list of lists", or a nested list. Use the `len()` function to determine the length of this new list. Is this what you expected or not?

- (g) Using indexing, replace the word "tree" in organisms with "redwood".
- (h) Using indexing, extract the words "grass" and "caterpillar" from the organisms list in order to create this new list: ["grass", "caterpillar"]. Bonus - for this question, try to incorporate the `.index()` list method.

2.2 Working with Strings

1. Define two string variables, one with the value "hello" and the other with the value "goodbye". Using concatenation (the + sign), create this new string: "helloGOODBYEHELLOgoodbye". Print your result to be sure it is correct.
2. Create a string variable with the contents "abcdefg". From this variable, create a new string in which the "e" has been replaced with "X", i.e. "abcdXfg". Hint: use indexing and concatenation. Print a final statement that says: "My new string is abcdXfg."
3. Define a string variable with the following value: "Hi, my name is Joe. I got a wife and three kids. I work in a button factory." Perform the following tasks on this variable:
 - (a) Extract the first 10 characters from the string.
 - (b) Count of the number of occurrences of the letter "e" in the string.
 - (c) Extract characters 8 - 14 from the string, and save this as a variable. Then, convert this new string to uppercase.
 - (d) Convert this string into a list of lower-case words like this:
["hi", "my", "name", "is", "joe", "i", "got", "a", "wife", "and", "three", "kids", "i", "work", "in", "a", "button", "factory"]. For this task, you will need to use the `.split()` string method and indexing. Finally, use the `len()` function to determine how many words are in this new list.