(http://software-carpentry.org)

The Unix Shell

(index.html)

Creating Things

✹ Learning Objectives

- Create a directory hierarchy that matches a given diagram.
- Create files in that hierarchy using an editor or by copying and renaming existing files.
- Display the contents of a directory using the command line.
- Delete specified files and/or directories.

We now know how to explore files and directories, but how do we create them in the first place? Let’s go back to Nelle’s home directory, `/Users/nelle` , and use `ls -F` to see what it contains:

```
$ pwd
```

```
/Users/nelle
```

```
$ ls -F
```

```
creatures/  molecules/          pizza.cfg
data/       north-pacific-gyre/ solar.pdf
Desktop/    notes.txt           writing/
```

Let’s create a new directory called `thesis` using the command `mkdir thesis` (which has no output):

```
$ mkdir thesis
```

As you might (or might not) guess from its name, `mkdir` means “make directory”. Since `thesis` is a relative path (i.e., doesn’t have a leading slash), the new directory is created in the current working directory:

```
$ ls -F
```

```
creatures/  north-pacific-gyre/  thesis/
data/       notes.txt            writing/
Desktop/    pizza.cfg
molecules/  solar.pdf
```

However, there’s nothing in it yet:

```
$ ls -F thesis
```

Let’s change our working directory to `thesis` using `cd`, then run a text editor called Nano to create a file called `draft.txt`:

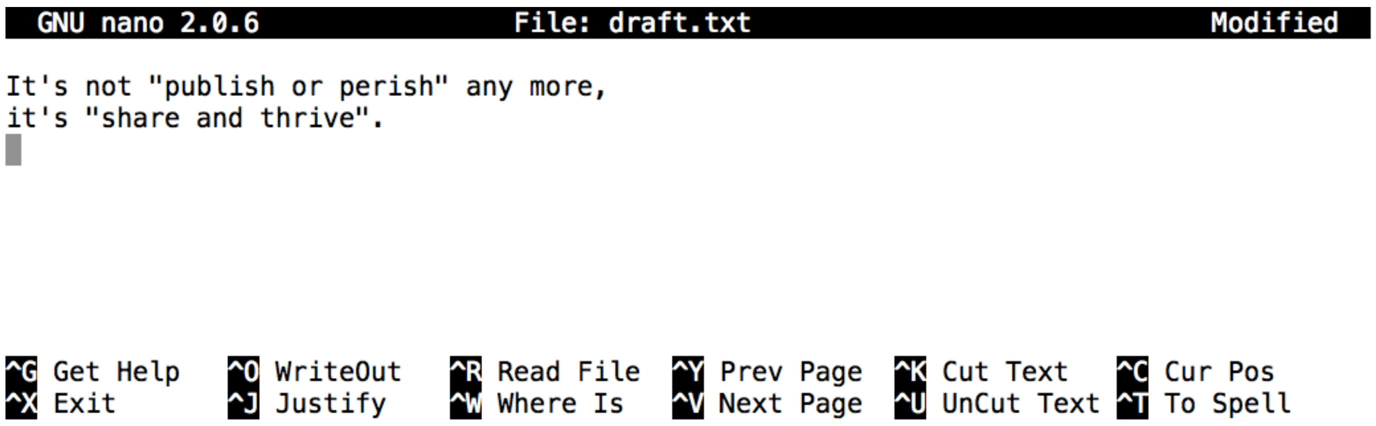
```
$ cd thesis
$ nano draft.txt
```

Which Editor?

When we say, “ `nano` is a text editor,” we really do mean “text”: it can only work with plain character data, not tables, images, or any other human-friendly media. We use it in examples because almost anyone can drive it anywhere without training, but please use something more powerful for real work. On Unix systems (such as Linux and Mac OS X), many programmers use Emacs (http://www.gnu.org/software/emacs/) or Vim (http://www.vim.org/) (both of which are completely unintuitive, even by Unix standards), or a graphical editor such as Gedit (http://projects.gnome.org/gedit/). On Windows, you may wish to use Notepad++ (http://notepad-plus-plus.org/).

No matter what editor you use, you will need to know where it searches for and saves files. If you start it from the shell, it will (probably) use your current working directory as its default location. If you use your computer’s start menu, it may want to save files in your desktop or documents directory instead. You can change this by navigating to another directory the first time you “Save As…”

Let’s type in a few lines of text, then use Control-O to write our data to disk:



```
GNU nano 2.0.6                File: draft.txt                        Modified

It's not "publish or perish" any more,
it's "share and thrive".
```

Figure: Nano in action

Once our file is saved, we can use Control-X to quit the editor and return to the shell. (Unix documentation often uses the shorthand `^A` to mean "control-A".) `nano` doesn't leave any output on the screen after it exits, but `ls` now shows that we have created a file called `draft.txt`:

```
$ ls
```

```
draft.txt
```

Let's tidy up by running `rm draft.txt`:

```
$ rm draft.txt
```

This command removes files ("rm" is short for "remove"). If we run `ls` again, its output is empty once more, which tells us that our file is gone:

```
$ ls
```

Deleting Is Forever

The Unix shell doesn't have a trash bin that we can recover deleted files from (though most graphical interfaces to Unix do). Instead, when we delete files, they are unhooked from the file system so that their storage space on disk can be recycled. Tools for finding and recovering deleted files do exist, but there's no guarantee they'll work in any particular situation, since the computer may recycle the file's disk space right away.

Let's re-create that file and then move up one directory to `/Users/nelle` using `cd ..`:

```
$ pwd
```

```
/Users/nelle/thesis
```

```
$ nano draft.txt
$ ls
```

```
draft.txt
```

```
$ cd ..
```

If we try to remove the entire `thesis` directory using `rm thesis`, we get an error message:

```
$ rm thesis
```

```
rm: cannot remove `thesis': Is a directory
```

This happens because `rm` only works on files, not directories. The right command is `rmdir`, which is short for “remove directory”. It doesn’t work yet either, though, because the directory we’re trying to remove isn’t empty:

```
$ rmdir thesis
```

```
rmdir: failed to remove `thesis': Directory not empty
```

This little safety feature can save you a lot of grief, particularly if you are a bad typist. To really get rid of `thesis` we must first delete the file `draft.txt`:

```
$ rm thesis/draft.txt
```

The directory is now empty, so `rmdir` can delete it:

```
$ rmdir thesis
```

With Great Power Comes Great Responsibility

Removing the files in a directory just so that we can remove the directory quickly becomes tedious. Instead, we can use `rm` with the `-r` flag (which stands for “recursive”):

```
$ rm -r thesis
```

This removes everything in the directory, then the directory itself. If the directory contains sub-directories, `rm -r` does the same thing to them, and so on. It’s very handy, but can do a lot of damage if used without care.

Let’s create that directory and file one more time. (Note that this time we’re running `nano` with the path `thesis/draft.txt`, rather than going into the `thesis` directory and running `nano` on `draft.txt` there.)

```
$ pwd
```

```
/Users/nelle
```

```
$ mkdir thesis
```

```
$ nano thesis/draft.txt
$ ls thesis
```

```
draft.txt
```

`draft.txt` isn't a particularly informative name, so let's change the file's name using `mv`, which is short for "move":

```
$ mv thesis/draft.txt thesis/quotes.txt
```

The first parameter tells `mv` what we're "moving", while the second is where it's to go. In this case, we're moving `thesis/draft.txt` to `thesis/quotes.txt`, which has the same effect as renaming the file. Sure enough, `ls` shows us that `thesis` now contains one file called `quotes.txt`:

```
$ ls thesis
```

```
quotes.txt
```

One has to be careful when specifying the target file name, since `mv` will silently overwrite any existing file with the same name, which could lead to data loss. An additional flag, `mv -i` (or `mv --interactive`), can be used to make `mv` ask the user for confirmation before overwriting.

Just for the sake of inconsistency, `mv` also works on directories — there is no separate `mvdir` command.

Let's move `quotes.txt` into the current working directory. We use `mv` once again, but this time we'll just use the name of a directory as the second parameter to tell `mv` that we want to keep the filename, but put the file somewhere new. (This is why the command is called "move".) In this case, the directory name we use is the special directory name `.` that we mentioned earlier.

```
$ mv thesis/quotes.txt .
```

The effect is to move the file from the directory it was in to the current working directory. `ls` now shows us that `thesis` is empty:

```
$ ls thesis
```

Further, `ls` with a filename or directory name as a parameter only lists that file or directory. We can use this to see that `quotes.txt` is still in our current directory:

```
$ ls quotes.txt
```

```
quotes.txt
```

The `cp` command works very much like `mv`, except it copies a file instead of moving it. We can check that it did the right thing using `ls` with two paths as parameters — like most Unix commands, `ls` can be given thousands of paths at once:

```
$ cp quotes.txt thesis/quotations.txt
$ ls quotes.txt thesis/quotations.txt
```

```
quotes.txt   thesis/quotations.txt
```

To prove that we made a copy, let's delete the `quotes.txt` file in the current directory and then run that same `ls` again.

```
$ rm quotes.txt
$ ls quotes.txt thesis/quotations.txt
```

```
ls: cannot access quotes.txt: No such file or directory
thesis/quotations.txt
```

This time it tells us that it can't find `quotes.txt` in the current directory, but it does find the copy in `thesis` that we didn't delete.

Renaming files

Suppose that you created a `.txt` file in your current directory to contain a list of the statistical tests you will need to do to analyze your data, and named it: `statstics.txt`

After creating and saving this file you realize you misspelled the filename! You want to correct the mistake, which of the following commands could you use to do so?

1. `cp statstics.txt statistics.txt`
2. `mv statstics.txt statistics.txt`
3. `mv statstics.txt .`
4. `cp statstics.txt .`

Moving and Copying

What is the output of the closing `ls` command in the sequence shown below?

```
$ pwd
/Users/jamie/data
$ ls
proteins.dat
$ mkdir recombine
$ mv proteins.dat recombine
$ cp recombine/proteins.dat ../proteins-saved.dat
$ ls
```

1. `proteins-saved.dat recombine`
2. `recombine`
3. `proteins.dat recombine`
4. `proteins-saved.dat`

Organizing Directories and Files

Jamie is working on a project and she sees that her files aren't very well organized:

```
$ ls -F
analyzed/  fructose.dat    raw/   sucrose.dat
```

The `fructose.dat` and `sucrose.dat` files contain output from her data analysis. What command(s) covered in this lesson does she need to run so that the commands below will produce the output shown?

```
$ ls -F
analyzed/   raw/
$ ls analyzed
fructose.dat    sucrose.dat
```

Copy with Multiple Filenames

What does `cp` do when given several filenames and a directory name, as in:

```
$ mkdir backup
$ cp thesis/citations.txt thesis/quotations.txt backup
```

What does `cp` do when given three or more filenames, as in:

```
$ ls -F
intro.txt    methods.txt    survey.txt
$ cp intro.txt methods.txt survey.txt
```

Listing Recursively and By Time

The command `ls -R` lists the contents of directories recursively, i.e., lists their sub-directories, sub-sub-directories, and so on in alphabetical order at each level. The command `ls -t` lists things by time of last change, with most recently changed files or directories first. In what order does `ls -R -t` display things?