

Command Line Interface Bootcamp

Presented by ACM & WACM

Slides: <http://bit.ly/2C561ad>

Windows users: *Command Prompt will not work.*

Linux/Mac users: you can use Terminal.

Syllabus

CLI Introduction

Usage

- File system navigation & manipulation

- alias

- echo, cat

- curl, grep

- nano

- diff

Shell Scripts

- I/O redirection

- Java in the CLI

- The Pipe, less

- Processes

- Q&A

What is a command line interface?

You may think of a command line interface (CLI) as a means of interacting with your operating system's *kernel*.

Kernel = OS - GUIs

You can perform various tasks (writing files, executing programs) that you normally would in computer usage, and many more with it, just with a *shell* instead of graphical user interface (GUI) application.

CLI Alternatives

Text Editor

E.g., Atom, Sublime

IDE (integrated development environment)

Usually have debuggers and code completion

E.g. BlueJ, Eclipse, Visual Studio

Editors and IDEs are examples of GUIs (graphical user interfaces)

“GUIs have the advantage of being able to visualize data in a meaningful way” —Konrad Rudolph

But using a CLI is often more efficient for programmers!

Why use a CLI?

Workflow (efficiency, organization, speed)

Can be used to do things in a second that a single user may take hours to do in a GUI (e.g. with scripting)

Control

Users have more control over files and processes (programs in execution)

Resources

CLI requires fewer system resources than GUI-based programs.

CLI vs GUI

The File System

On Windows, you can look through your folders and files via File Explorer.

On a Mac, use Finder to do the same thing.

These are graphical representations of the *file system*.

With the CLI, we can navigate the file system via a text-based CLI instead, which is a major boon if you know what to do...

file system navigation

After opening a new terminal window, we can print our current working directory (folder) with the `pwd` command:

```
$ pwd
```

```
/Users/myName
```

file system navigation

View files and folders in the current working directory with the ls (“list”) command

```
$ ls
```

```
Applications  
Desktop  
Documents  
[...]
```

file system navigation

To go into the Desktop directory (file), we can use the cd (“change directory”) command

```
$ cd Desktop
```

```
Desktop: myName$
```

file system navigation

If we want to go back up a directory, we can use `cd ..`

```
Desktop: myName$ cd ..
```

```
~myName$
```

file system navigation

Every directory has hidden pointers to files called `.` and `..`

`.` = pointer to the current folder

`..` = pointer to the above folder

Pointers that start with `.` are hidden, but we can look at them by adding `-a` to `ls`:

```
$ ls -a
```

file system navigation

Finally, if we want to go back to my home directory from anywhere, we can use:

```
$ cd ~
```

or

```
$ cd
```

file system navigation

We can make a new directory with the `mkdir` command:

```
$ mkdir CLI
```

```
$ cd CLI
```

```
CLI myName$ mkdir bootcamp
```

file system navigation

In CLI/, use `touch` to create a new file called `file.txt`:

```
$ touch file.txt
```

Move the file to a new directory with `mv`

Example:

```
$ mv file.txt ~
```

removing files and directories

Remove the file with `rm`

```
$ rm ~/file.txt
```

Be Careful!!! rm is forever!!!

Remove an empty directory with `rmdir`

```
$ rmdir bootcamp
```

Remove a non-empty directory with `rm -R`

```
$ mkdir temp
```

```
$ touch temp/empty.txt
```

```
$ rm -R temp
```

clear

Clear out the terminal output.

```
$ clear
```

echo

```
$ echo Hello World
```

```
Hello World
```

The echo command will simply print whatever string(s) come after it.

echo to a file, cat

Printing what we just typed is a bit boring.
What if we could save it to a new file
instead?

```
$ echo Hello World >> hello.txt
```

Now display the file's contents with `cat`.

```
$ cat hello.txt
```

alias

“In computing, **alias** is a **command** in various **command line interpreters** (shells) such as Unix shells ... which enables a replacement of a word by another string.”

[https://en.wikipedia.org/wiki/Alias_\(command\)](https://en.wikipedia.org/wiki/Alias_(command))

We can make an *alias* to save our favorite custom commands.

Syntax :

```
$ alias myAlias='[command]'
```

Example :

```
$ alias goToDocs='cd ~/Documents/'  
$ goToDocs
```

Aliases declared this way only exist for the life of the current terminal session.

curl

A tool for transferring data to or from a server using one of various protocols.

```
$ curl [url]
```

Retrieves the file given by the url.

Example:

```
$ curl www.something.com
```

Prints the HTML that creates this page.

(Yes, this is something that somebody made)

curl

Using the `-o` flag, we can output the contents of the result to a local file.

Syntax:

```
$ curl [url] -o file
```

Example (all on one line):

```
$ curl http://mathcs.pugetsound.edu/~aasmith/cs361/alice.txt  
-o alice.txt
```

grep

Searches any given input, printing lines that match one or more patterns.

Run `grep` to find lines containing references to the Mad Hatter. Be sure to do this in the directory containing `alice.txt`

```
$ grep Hatter alice.txt
```

Can be used in conjunction with *regular expressions*, a separate topic.

nano

view/edit text

Nano is a simplistic editor you can use without leaving the CLI.

```
$ nano alice.txt
```

Use arrowkeys to move the cursor, and backspace to delete characters.

Try replacing `Lewis Carroll` in the file with your name.

*To save a file, hit **ctrl + o** then enter*

*To exit nano, **ctrl + x**, enter (if you haven't made any changes)*

diff

Difference operator
on two I/O objects

```
$ diff [a] [b]
```

Will print the lines that are different between a and b.

Use the up arrow key to find your previous `curl` call to retrieve `alice.txt`, but output it to a new file called `alice2.txt`.

If you changed the author's name in `alice.txt`, what should this do?

```
$ diff alice.txt alice2.txt
```

Bash Scripts

A script is a file with a list of commands to be executed sequentially.

Let's make a script to build a directory that you might use to organize your CS 261 course content.

We're going to write this in `nano`.

Bash Scripts

Work on a new script file:

```
$ nano script.sh
```

Add these lines to the file:

```
mkdir CS261
```

```
cd CS261
```

```
mkdir homework lab notes slides
```

```
echo "script.sh script completed"
```

Bash Scripts

Finally, in Bash, we can execute the script via

```
$ bash script.sh
```

This may not work if you're not running Bash.

Sort

Sorts the lines of input. Run the command

```
$ sort
```

Then type some lines of text. When you're done entering lines you want to sort, make sure you're on a new line and hit Ctrl+D.

```
$ sort
```

```
fish
```

```
dog
```

```
cat
```

```
Ctrl+D
```

Redirecting I/O with `<` and `>`

We used `>>` earlier to *append* text to a file. We were actually redirecting the output of the command (`echo`) from the terminal into a destination.

`>` works the same way, but it *replaces* the contents in the destination with the output of the (left) command. (Try it on one of your non-important files)

`<` redirects *input* of the command to the right. Here's an example:

Try writing a file called `pets.txt`. We can sort the lines via
`$ sort < pets.txt`

Java compilation and execution

After we write a Java class in Sample.java, can compile it this way:

```
$ javac Sample.java
```

Then run the compiled code with

```
$ java Sample
```

(Note: the file generated by javac will have the .class extension)

Ever wonder what the args array in a Java main method is for? You're about to find out... (Next slide: walkthrough)

Sample Java program

1. Create a file with nano called `Sample.java` with these contents. (without the line numbers)

```
1 public class Sample {  
2     public static void main(String[] args) {  
3         for (int i = 0; i < args.length; i++) {  
4             System.out.println(args[i]);  
5         }  
6     }  
7 }  
8
```

2. Compile it as we did in the previous slide.
3. Now when we execute it, provide some arguments and redirect the output to a file like so:

```
$ java Sample command line args > out.txt
```

The Pipe

`|` combines `<` and `>` into a single operation.

Example: Suppose I run the Java class `MyClass` and I want to compare the program's output against the professor's expected output.

```
$ java MyClass | diff expected-output.txt
```

How it works: `MyClass` has output that gets redirected into the pipe. `diff` then reads its input from the pipe (in addition to `expected-output.txt`)

Make sense? When it all does, you're on your way to becoming a great CLI user!

less

Lets you scroll through output, instead of having to read it in the terminal output.

```
$ ls | less
```

Press q to quit.

Processes

Use `$ ps` to show what terminal *processes* (programs in execution) you're running.

`$ ps aux` will show all of your kernel's processes.

Try `$ sleep 5`. This will just stall for 5 seconds.

To use our terminal for other things while we wait, we can run it as a *background process* like this:

```
$ sleep 100 &
```

Processes

You can add `&` to any process that will take a while, so you can do other stuff in the same terminal while you wait for it to finish.

If you want to close the terminal, you'll have to `disown` first.

Continuing the previous slide's example, `$ ps -e | grep sleep` will display processes that contain `sleep`, if there are any.

Processes

What will this output?

```
$ ps -e | wc -l
```

Exercise: look up what `wc` does and figure it out.

bash_profile

You can save your aliases for later use in your `.bash_profile` file *if **bash** is your shell (terminal)*.

The equivalent file in other shells is usually called `.[shell]_profile` or just `.profile`.

Navigate to your home directory and run `ls -a`.

Hopefully, you'll see a file titled (something like) `.bash_profile`.

```
$ cd ~
```

```
$ ls -a
```

```
.bash_profile [ ... ]
```

source

In conjunction with `>>`, which places output in a destination, we can write to a file with `echo`. In one line:

```
$ echo "alias gtd='cd ~/Documents/'" >>  
~/.bash_profile
```

This will append the string containing the alias to the `.bash_profile`.

To use the alias without restarting the terminal:

```
$ source ~/.bash_profile
```

man

If you'd like to learn more about any command, just enter `$ man [command]`

Example: try `$ man ls`

Scroll down to read more. Press q to quit.

Unix tutorial

A very good place to start reading on your own about these commands is
<http://www.ee.surrey.ac.uk/Teaching/Unix/>

Telnet

```
$ telnet towel.blinkenlights.nl
```

(Use `ctrl-]` `ctrl-c` to exit)

If you want to learn what this is, take CS 325... for now, just enjoy.

```
$ cowsay "Thank you for listening"
```

< Thank you for listening >

```
      ^  ^  
      _  
  \  (oo)\_____  
   \  (__)\       )\/\  
      ||----w |  
      ||     ||
```

Shameless Plug

If you're eager to learn how to get a job as a software engineer, or are just interested in computer science, please attend:

Association of Computing Machinery (ACM)

~~Meets Sundays @ 5pm, Thompson 409~~

Women in the ACM (WACM)

Meets Mondays @ 5pm, outside Thompson 409

Q&A, acknowledgements

Have fun with it!

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Everyone who came to help out.

The programmers of the UNIX OS (ca. 1970)

Bonus knowledge: Git



(This was part of Spring '17's CLI bootcamp but has been deprecated)

Git

Git is a commonly used version control tool.

Can be used to associate code directories with repositories (repos). Then it keeps track of all the changes.

GitHub is a site for hosting Git repos and shows how files have changed over time, and by whom.

Git

Clone a repository from the internet into a directory with the repo name:

```
$ git clone [url].git
```

Or, initialize current directory as a Git repository:

```
$ git init
```

Pull new files from remote repository:

```
$ git pull
```

Git

Add files to a commit to the remote repo:

```
$ git add [filename]
```

This can actually be any pointer in your rep! `$ git add .` is a common use case.

Commit your files to your repository:

```
$ git commit -m "your commit message"
```

Push your files to your repository

```
$ git push
```


Git

Remove file from project:

```
$ git rm [filename]
```

Change filepath:

```
$ git mv [current_path] [new_path]
```

Git

Show modified files in your working directory:

```
$ git status
```

Show what has been changed but not yet added/committed:

```
$ git diff
```

Show all commits in current active branch history:

```
$ git log
```

Git

Learn more commands with this cheat sheet:

<https://education.github.com/git-cheat-sheet-education.pdf>