

04 – The Find command, editing, and scripting

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The **find** Command

If you Leave this Class with Anything...

- Quite possibly the most underrated tool for your terminal:
 - **find**: searching for files / directories by name or attributes.

Search for Files in a Directory Hierarchy

`find [where to look] criteria [what to do]`

- Used to locate files or directories.
- Search any set of directories for files that match a criteria.
- Search by name, owner, group, type, permissions, last modification date, and *more*.
 - Search is recursive (will search all subdirectories too).
 - Sometimes you may need to limit the depth.
- Comprehensive & flexible. Too many options for one slide.

Some Useful Find Options

- `-name`: name of file or directory to look for.
- `-maxdepth num`: search at most **num** levels of directories.
- `-mindepth num`: search at least **num** levels of directories.
- `-amin n`: file last access was **n** minutes ago.
- `-atime n`: file last access was **n** days ago.
- `-group name`: file belongs to group **name**.
- `-path pattern`: file name matches shell pattern **pattern**.
- `-perm mode`: file permission bits are set to **mode**.

Of course...a lot more in `man find`.

Some Details

- This command is extremely powerful...but can be a little verbose (both the output, and what you type to execute it). That's normal.
- Modifiers for **find** are evaluated in conjunction (a.k.a AND).
- Can condition your arguments with an OR using the **-o** flag.
 - Must be done *for each* modifier you want to be an OR.
- Can execute command on found files / directories by using the **-exec** modifier, and **find** will execute the command for you.
 - The variable name is **{}**.
 - You have to end the command with either a
 - Semicolon (**;**): execute command *on each* result as you *find* them.
 - Plus (**+**): *find* all results first, *then* execute command.
 - Warning: have to escape them, e.g. **\;** and **\+**
 - The **;** and **+** are shell expansion characters!

Basic Examples

Find all files accessed at most 10 minutes ago

```
find . -amin -10
```

Find all files accessed at least 10 minutes ago

```
find . -amin +10
```

Comparing AND vs OR behavior

```
find . -type f -readable -executable
```

- All files that are *readable* and *executable*.

```
find . -type f -readable -o -executable
```

- All files that are *readable* or *executable*.

Display all the contents of files accessed in the last 10 minutes

```
find . -amin -10 -exec cat {} \+
```

On a Mac and ended up with **.DS_Store** Everywhere?

```
find . -name ".DS_Store" -exec rm -f {} \;
```

- Could be **;** or **+** since **rm** allows multiple arguments.

Solve maze in one line

Maze in 2 seconds

```
find / -iname victory -exec handin maze {} \+
```

- imagine how much more complicated **maze** could get in the real world...

More Involved Example

- Your boss asks you to backup all the logs and send them along.
- Combining some of the things we have learned so far (also zin)

```
# Become `root` since `/var/log` is protected:
```

```
$ sudo su
```

```
<enter password for your user>
```

```
# Make a containment directory to copy things to
```

```
$ mkdir ~/log_bku
```

```
# `find` and copy the files over in one go
```

```
$ find /var/log -name "*.log" -exec cp {} ~/log_bku/ \;
```

```
# The `cp` executed as `root`, so we cannot read them.
```

```
$ chown -R mpm288 ~/log_bku # My netID is mpm288
```

```
# Give the folder to yourself.
```

```
$ mv ~/log_bku /home/mpm288/
```

```
# Become your user again
```

```
$ exit
```

```
# Zip it up and send to your boss
```

```
$ zip -r log_bku.zip ~/log_bku
```

More Involved Example: Analysis

- Don't *have* to be **root**: **sudo find** was too long for slides.
 1. Make the directory **<dir>** as normal user.
 2. **sudo find ... -exec cp {} <dir> \;**
 3. **sudo chown -R <you> <dir>**
 4. **zip -r <dir>.zip <dir>**
- Cannot use **\+** instead of **\;** in this scenario:
 - Suppose you found **/var/log/a.log** and **/var/log/b.log**.
 - Executing with **\;** (**-exec** as you **find**):
 1. **cp /var/log/a.log ~/log_bku/**
 2. **cp /var/log/b.log ~/log_bku/**
 - Executing with **\+** (**find** all first, then **-exec** once):
 - **cp /var/log/a.log /var/log/b.log ~/log_bku/**
 - **cp** gets mad: you gave three arguments

Scripting

What is a Script?

- The high-level story is: nothing special.
 - Just a sequence of operations being performed.
 - Runs from top to bottom.
- Common practice:
 - Executable filetype.
 - Shebang.

Bash Scripting at a Glance

```
#!/bin/bash  
echo "hello world!"  
echo "There are two commands here!"
```

```
#!/usr/bin/python3  
  
print('hello there friend');
```

```
#!/bin/bash  
#this is a comment. Maze solution script!  
find / -iname victory -exec handin maze {} \+
```

- The *shebang* `#!/bin/bash` is the interpreter
- Run a command or two!
- Always test your scripts!

Some execution details

- Run your scripts by providing a *qualified path* to them.
 - path must start with a folder
 - Current directory? use `./scriptname`
 - somewhere else? specify the path to your script
- Scripts execute from top to bottom.
- This is just like Python, for those of you who know it already.
- Bad code? you may only realize it when (and if) the script reaches that line
- The script starts at the top of the file.
- Execution continues down until the bottom (or `exit` called).
 - Broken statement? It still keeps executing the subsequent lines.

Text Editors

Nano, and VIM vs Emacs

- There is a great and ancient war among the *NIXfolk ... long has it raged, and ever shall it burn.
- To use VIM, or to use emacs?
- I will (try to) teach both.
 - But the easiest editor is nano
- **NANO:** the OG notepad
- **VIM:** *mode*-based editor
- **EMACS:** *hotkey*-based editor

Your friend Nano

Edit files like it's 1989

nano file

```
GNU nano 2.9.8                                markdown source/04 Find and scripting.md
[/info]
# Text Editors
## Nano, and VIM vs Emacs
- There is a great and ancient war among the *NIXfolk ... long has it raged, and ever shall it burn.
- To use VIM, or to use emacs?
- I will (try to) teach both.
  - But the easiest editor is nano
  - **NANO:** the OG notepad
  - **VIM:** *mode*-based editor
  - **EMACS:** *hotkey*-based editor
## Your friend Nano
[cmd=('nano')] Edit files like it's 1989]
[/cmd]
![[Nano Screenshot](img/04_nano_screenshot.png)]
## What is VIM?
- VIM is a powerful "lightweight" text editor.
- VIM actually stands for "Vi IMporoved".
  - 'vi' is the predecessor, and mostly works the same.
  - If you end up on a system that does not have 'vim', I would be shocked if 'vi' was not there.
- VIM can be installed on pretty much every OS these days.
- Allows you to edit things quickly ...
  - ...after the initial learning curve.
^G Get Help      ^O Write Out    ^W Where Is     ^K Cut Text     ^T To Spell     ^U Undo         ^M Mark Text    ^] To Bracket   ^_ Previous
^X Exit          ^R Read File    ^N Replace      ^U Uncut Text   ^C Cur Pos     ^E Redo         ^G Copy Text    ^W WhereIs Next ^_ Next
```

Figure 1: Nano Screenshot

What is VIM?

Edit files like it's 1976. or 1991.

```
vim file
```

- VIM is a powerful “lightweight” text editor.
- VIM actually stands for “Vi IMporoved”.
 - **vi** is the predecessor, and mostly works the same.
 - If you end up on a system that does not have **vim**, try **vi**.
 - if no **vi**, try **nano**
- VIM can be installed on pretty much every OS these days.
- Allows you to edit things *quickly*...
 - ...after the initial learning curve.

The 3 Main Modes of VIM

- Normal Mode:
 - Launching pad to issue commands or go into other modes.
 - Can view the text, but not edit it directly (only through commands).
 - Return to normal mode *from other modes*: press **ESCAPE**
- Visual Mode:
 - Used to highlight text and perform block operations.
 - Enter visual mode *from normal mode*: press **v**
 - Visual Line: **shift+v**
 - Visual Block: **ctrl+v**
 - Explanation: try them out, move your cursor around...you'll see it.
- Insert Mode:
 - Used to type text into the buffer (file).
 - Like any regular text-editor you've seen before.
 - Enter *from normal mode*: press **i**

Moving Around VIM

- Most of the time, you can scroll with your mouse / trackpad.
- You can also use your arrow keys.
- VIM shortcuts exist to avoid moving your hands at all. Use
 - **h** to go left.
 - **j** to go down.
 - **k** to go up.
 - **l** to go right.
- Hardcore VIM folk usually map left caps-lock to be **ESCAPE**.
 - Goal: avoid moving your wrists at all costs. Arrows are so far!
 - I don't do this. I also don't use VIM.

Useful Commands

:help	help menu, e.g. specify :help v
:u	undo
:q	exit
:q!	exit without saving
:e [filename]	open a different file
:syntax [on/off]	enable / disable syntax highlighting
:set number	turn line numbering on
:set nonumber	turn numbering off (e.g. to copy paste)
:set spell	turn spell checking on
:set nospell	turn spell checking off
:sp	split screen horizontally
:vsp	split screen vertically
<ctrl+w> <w>	rotate between split regions
:w	save file
:wq	save file and exit
<shift>+<z><z>	alias for :wq (hold shift and hit z twice)

WOW How about no. let's see Emacs

- Basic editing works like notepad (except no mouse)
- No switching between modes to edit/search/save/etc.
- Emacs can also be installed on pretty much every OS.
- Allows you to edit things *moderately* quickly...
 - ...and keeps getting faster as you learn it

Emacs modes

An editor, also from 1976.

emacs file

- Based on file and action type
 - Java file detected? IDE mode engaged!
 - Plain file detected? Basic edit mode engaged!
 - LaTeX file detected? TeXstudio mode!
- Shortcuts and actions *mostly* independent of mode
 - But modes hide a lot of power...
 - Sometimes accused of being a whole OS.

Moving around and basic editing:

- move by character? Use the arrow keys!
- move by word? Hold control and use the left/right arrow keys!
- move by paragraph? Hold control and use the up/down arrow keys!
- Saving: hold CTRL, press X then S (all while holding control)
- Closing: hold CTRL, press X then C (all while holding control)
- Convention: C-x means “hold control, press x”
 - C-x C-s means “press x and s, all while holding control”
- These editors predate “normal” shortcuts!

Useful Shortcuts

C-x C-f	Open a file for editing
C-x C-s	Save the current file
C-x C-c	exit
C-x b	change to a different open file
C-space (arrow key)	Start highlighting (marking) a region
C-w	Cut the code in the highlighted region
Alt-w	Copy the code in the highlighted region
C-g	Quit (cancel command, “escape”)
C-y	paste
C-s	search (find)
Escape-x	Enter a command by name (C-g to quit)
C-x k	close a file (it will ask) (emas stays open)
Escape- $\$$	spellcheck the word under the cursor
Escape-x ispell	spellcheck the highlighted region
Escape-x help	Get just a lot of help information
Escape-x <tab>	List ALL THINGS EMACS CAN DO

What editor to choose?

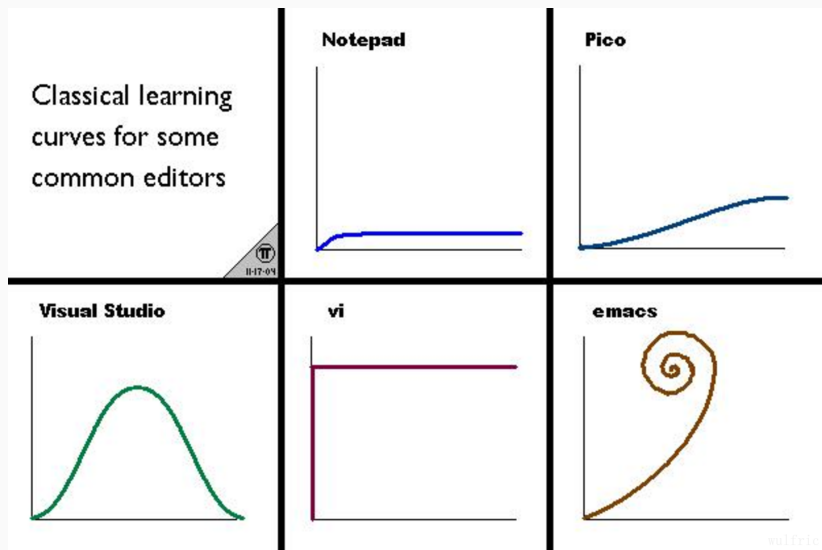


Figure 2: Editor Learning Curves

Let's Git Started

What is **git**?

- **git** is a *decentralized* version control system.
- Like “historic versions” for DropBox/OneDrive
- Except far more advanced, and more streamlined
- It enables you to save changes as you go to your code.
 - As you make these changes, if at any point in time you discover your code is “broken”, you can *revert* back in time!
 - Of course, if you haven’t been “saving” frequently, you have less to work with.
 - Mantra: *commit* early and often.
- Can also *share* your code with friends!!
 - Can work on same version, or...
 - can “go back in time” to latest working one!
 - You will have trouble – we all do.

The Official Man Entry

The Stupid Content Tracker

```
git [--version] [--help] [-C <path>] [-c <name>=<value>]
    [--exec-path[=<path>]] [--html-path] [--man-path]
    [--info-path] [-p|--paginate|--no-pager]
    [--no-replace-objects] [--bare] [--git-dir=<path>]
    [--work-tree=<path>] [--namespace=<name>]
    <command> [<args>]
```

- Do **not** expect to learn **git** once and be done.
- You will learn it steadily, over time. The sooner you start, the better off you will be in your development career.
- **Git is not just for CS Majors.**
 - It is for *anybody* working with **any** code.

git Terminology

- The tracked folder is called a *repository* (*repo*)
- You **git init** . to create repository “here”
- To *track* a file in a repository, you **git add <filename>**
- The act of “saving” is *commit*, and needs a message
 - to commit all tracked files,
git commit -a -m 'your message here'
- To copy a repository, you **git clone** it
- To work with friends, you need to
 - **git clone** their (or a common) repository
 - **git pull /other/repo/path** their changes
- if you edited the same file, you get a *conflict*
 - if you have uncommitted changes, you can't pull

Teaser: Example Scenario

- Suppose you (**A**), and your best friend **B** are working in the same repo.
- You **init** the repository and make a **commit**; your friend then **clones** from you
- **A** and **B** both edit the same file and **commit** the edits
- **A pulls**, and discovers the conflict! You resolve it, but..
- **B pulls**, and discovers another one!
- Basically, **git** can get complicated quickly. Nothing replaces actual communication!

Demo Time! Everybody!

```
git clone /course/cs2043/demos/git-demo cd git-demo
```

```
git pull /course/cs2043/demos/git-demo
```

```
nano demo-file
```

```
git commit -a -m 'mucking with the demo'
```

```
git pull /course/cs2043/demos/git-demo
```

References

- [1] Stephen McDowell, Bruno Abrahao, Hussam Abu-Libdeh, Nicolas Savva, David Slater, and others over the years. “Previous Cornell CS 2043 Course Slides”.