

Introduction and a dash of *nix

Lecture 1

Overview

1. Staff Introductions
2. Class Overview
3. Unix intro
4. Command line: what and why?

Staff Introductions

IA: Arav Agarwal

- CS-Eng and DS-Eng
- Interests include adversarial machine learning and reinforcement learning
- Hobbies include reading, coffee-making, and gaming (namely roguelikes)

IA: Sowgandhi Bhattu

- CS-Eng
- Interests include data analysis and web development
- Virtually interned at TD Ameritrade
- Fun fact: playing guitar since age 6

Instructor: Brandon Nguyen

- PhD Student under Prof. Scott Mahlke
- Undergrad at UT Austin in ECE
 - Primary focus: Computer architecture and embedded systems
 - Secondary focus: Digital signal processing
 - (spent my first two years as a BME doing premed...)
- Weirdo who enjoys classes like 427, [2345]70, [34]73, 482, 583
 - Interests include computer architecture, compilers, and systems software

Other stuff about me

- Modern and historical fencing (HEMA)
 - Shoutout to [University of Michigan Fencing Club](#)
- Slight addiction to Genshin Impact
- Trying to learn Vietnam's pre-romanization writing system
 - Turns out knowing classical Chinese is a prerequisite

Course Overview

What is this class

- This class is for *anyone* wanting to become more effective at using their computer for development work
- This isn't necessarily a "tools" class
 - Tools come and go: does anyone remember COBOL and CVS?
- Each workplace will have its own tools and workflows
- The ultimate goal of this class is to help you learn to pick up, learn, and use new tools to solve problems
- The tools you learn along the way are the icing on the cake
- That being said, we will be focusing on Unix/Unix-like systems and shells in this class
 - Windows Command Prompt is not suitable for this class
 - Windows Subsystem for Linux (WSL) is suitable, however

Expectations

- Have a basic understanding of program control flow
 - e.g. if statements, loops, functions
- Have experience expressing your solutions in program statements
- Have some experience with a C or C++ or similar language
 - Let me know if you need help with the language itself
- Work is intended to be done alone
 - It can help to point each other to useful resources you find
 - Your code should be your own

Expectations

Technology

- Have a computer that runs Windows, mac OS, or Linux that you can install software on
- Chromebooks are welcome if they have Linux Beta (Crostini)
- Ubuntu 20.04 is going to be the reference environment for class
 - Most Linux distributions will have similar behavior for things in this class, so don't fret if you're on 18.04 or Debian or whatever (btw i use arch)
- While most things can be done on mac OS, some tools have different behavior between Linux and mac OS
- Information will come out soon for getting access to an Ubuntu 20.04 environment
 - The release of M1 Macs has rocked the landscape and assumptions I can make...

Course structure

Weekly lecture

- Attendance optional
- I will do live demos, mistakes can happen
 - Recovering from mistakes is always a learning opportunity
- Fill out a survey within a week of recording publication for extra credit
- There may be additional extra credit opportunities
- Feel free to "raise your hand" in Zoom or ask in chat
- I may record some supplementary lectures about certain smaller topics

Weekly "basic" assignment

- Guided light assignments to familiarize you with tools and what you can do with them
- Directly related to material covered in lecture

Advanced component

- Less guidance than basic assignments
- May touch on some things not covered in lecture
- Provides practical experience in perusing documentation and applying what you know
- Can be fulfilled by doing 4 "advanced" assignments for full credit
 - Submitted online just like basic assignments
- Can also be fulfilled by doing a project
 - Checked out at an office hour
- Example projects:
 - Personal website
 - Picking up another language
 - Web scraping and data analysis
 - More to come...

Grading

- Two major grade categories: **Basic** and **Advanced**
- Basic has 60 total points
- Advanced has 40 total points
- Final score is the sum of these categories
 - There is no averaging: you just add numbers
 - Lecture extra credit is added on top
 - You can see how letter grades get assigned in the [syllabus](#)

Basic

- There will be 12 basic assignments worth 6 points each
- That means you only need to do 10 to get all 60 points
- The other 2 assignments serve as a buffer for you to miss/skip
- Points past 60 are worth 50%: an 11th assignment would only be worth 3 points
- If you do all 12 assignments:
 - $12 * 6 = 72 \rightarrow 60 + 12/2 = 66$

Advanced

- There will be 12 advanced assignments worth 10 points each
- That means you only need to do 4 to get all 40 points
- You can also do a project for a total of 40 points
 - You can submit a partially completed project for partial credit
- Similarly, points past 40 are worth 50%: an 11th assignment would only be worth 5 points
- If you do all 12 assignments and the project...
 - $12 * 10 + 40 = 160 \rightarrow 40 + 120/2 = 100$: no need to do basic assignments 😊

Any questions before we
continue onto material?

Intro to *nix and the command line

First off, a poll

- Who has used a *nix environment?
- Who has Linux on their computer?
- Who has some sort of *nix on their computer?

What is *nix?

- "*nix" refers to a group of operating systems either derived from or inspired by the original AT&T Unix from Bell Labs
 - GNU/Linux is a "Unix-like"
 - mac OS is an actual Unix derivative
 - *nix systems follow similar principles and provide similar (software) interfaces
- Unix and its derivatives have entrenched themselves in academia and industry
 - The many tools developed to run on *nix systems are mature and are here to stay
 - General *nix literacy will help you since you have a pretty good likelihood to be developing on a *nix system
- This does not mean that *nix systems are inherently better than other operating systems like Windows
 - Windows also has its own set of tools
 - Some *nix tools have been ported to Windows
 - Windows now has WSL(2) that serves as a Linux living inside Windows

What is a command line?

- The "command line" is a type of interface where *you provide a line of text* that the interpreting software can interpret into commands to perform
 - This interpreting software is known as a "shell"
 - There are also "graphical shells" i.e. the GUIs of Windows and mac OS
 - These take an input like a mouse click on a shortcut and interprets it as a command to launch the appropriate application

Why the command line?

- Before we had graphical displays we printers and teletypes (TTYs)
 - `printf()` literally meant to print
- We then moved onto video **terminals**
 - These were a combination display and keyboard, except they could only display text and symbols
 - Nowadays we don't have actual video terminal devices, but we have "virtual terminals" and "terminal emulators" to act like them (e.g. mac OS Terminal, iTerm 2, Command Prompt)
- Unix and the many tools for it were developed during these times
- Text serves as a long lasting, reliable interface that is very easy to automate
 - Count the number of GUI changes to Windows, mac OS, Android, and iOS over the years
 - How would you automate a GUI?
 - It probably would be more work than writing some commands to be run

Command line basics

- We will focus on the *nix command line shell in this class
- (From now on, when I say "shell" by itself I mean command line shell)
- Shells follows very similar basic syntax no matter what shell (bash, zsh, csh, etc.) you use
- Shells provide you an interface to interact with the system via its directories (folders) and files
 - You can navigate through directories
 - You can modify files
 - You can launch applications
- Most shells feature some sort of *tab completion*, where hitting the Tab key will make the shell try to finish a partially typed word

Command structure

```
$ <command> <argument 1> <argument 2> <argument 3>
^      ^      ^      ^
|      |      |      |
|-- programs are provided these to
        interpret (remember argc and argv[]?)
|      |      |
|-- words separated by whitespace
|      |
|-- certain things are actual programs, certain things
        are handled by the shell ("built-ins")
|
|-- this is called a "prompt" and can take many forms
```

*nix and the filesystem

- As a spoiler for a future lecture, *nix exposes everything as a file
- Navigating through directories (folders) and interacting with files is a fundamental task
- We address and locate files via "paths"
- Each running program (including the shell) has a "current working directory"
- `/` enters/separates directories
- `.` refers to the current directory
- `..` refers to the "parent" directory (the directory that contains the current directory)

*nix and the filesystem

Types of paths:

- Absolute: starts with `/`
 - We call `/` the "root directory"; the starting point of the filesystem
 - `/home/brandon/Music/deemo-saika-rabpit.flac`
- Relative: starts from current or parent directory
 - `./dir1/dir2`
 - `../.. /some-dir`
 - Implicitly starts from the current directory if the path doesn't start with `/`, `.`, or `..`:
`dir1/dir2`

Critical commands

- **man**: "manual pages": gives info on programs
- **pwd**: "print working directory": tells you your current directory
- **ls**: "list": lists the contents of a directory
- **cd**: "change directory": changes your current directory
- **mv**: "move": moves files to another directory or another filename
- **touch**: creates an empty file if one doesn't exist (otherwise updates its timestamp)

Playing with output

- You can pipe output from command to another command with a pipe (|)
- You can save output from a command with a "redirection" (>)
- You can retrieve input for a command with another "redirection" (<)
- More to come in a future lecture ...

Intro to automation

- You can save a list of commands into a file
- This is known as a "script"
- You can now run this script whenever you want by invoking the filename as an argument for your shell of choice
 - `$ bash myscriptfile`
- If the file is marked as executable, you can directly invoke it as a program
 - `$./myscriptfile`
 - Note you have to specify it as an explicit path (i.e. has a `/` present)
 - We'll discuss the specifics of this in a future lecture

Demo

- This lecture was only a taste of the command line
- We will go more into depth on week 3
 - More about *nix
 - Control flow
 - Functions
- Next week will be Git 😊

Any further questions?