Discussion Session Week 1

Command Line

A quick note before we start on scripting

- Comments
  - Comment your code even if no one else is going to read it
  - **Trust me on this**

- Comment style in C++
  - // for a single line comment
  - /* for a multi-line (block) comment */

- Make sure that your comments are meaningful
  - A comment that just explains exactly what the code is doing is bad
  - Higher-level comments that explain the purpose of a line of code is better

- On the other hand…
  - If you have to comment every line of code to understand that's going on, you probably need to re-evaluate your code
  - Comments should never dominate your code

Command Line

- Different OS distributions will have different command line interfaces
  - Windows uses one set of commands
  - Linux uses another

- Programs designed to be run entirely on the command line are commonly known as “Shell Scripts”
  - bash (bourne again shell)
  - zsh (zshell)
  - etc.

- Common commands
  - “dir” and “ls -l”
  - “copy” and “cp”
  - “del” and “rm”
  - etc...

Standard

- Vast majority of software developers and companies will use Linux or some sort of linux system
- Get used to shell scripting
  - bash for Windows
  - zsh for Mac
- There are tons of commands
  - <u>You will not always remember them all</u>
  - Get used to navigating documentation
  - However, there are several key commands that you should remember (more on this later)

Before we get into bash, some background

- When we work with bash we need to be familiar with the structure of Linux systems as there are multiple keywords that will tell you a lot about what’s going on

- Treat this section as the backbone of your bash knowledge

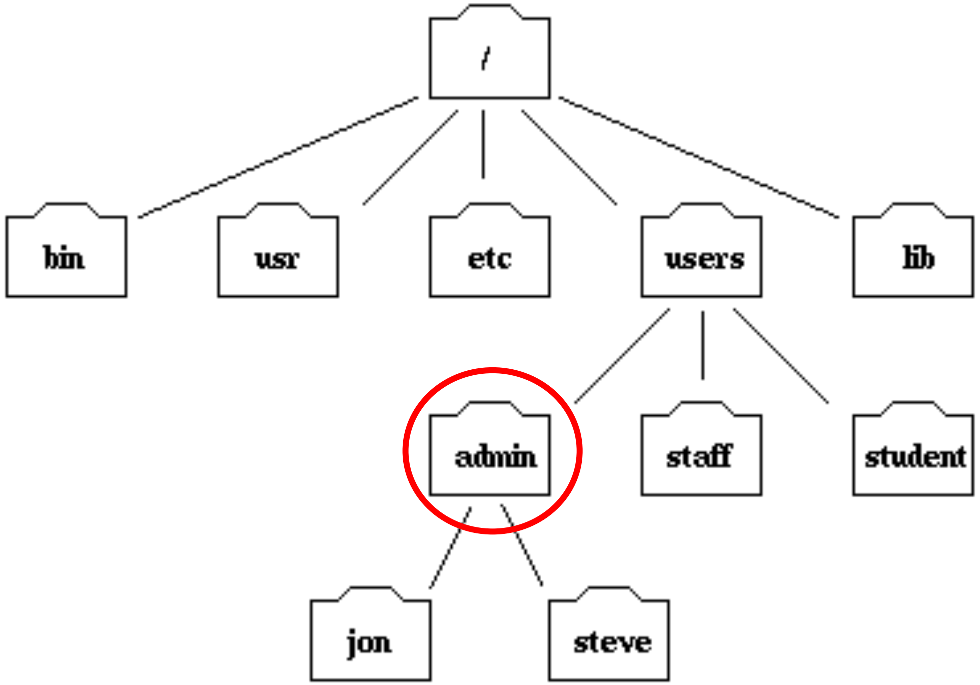
Linux File System

- The Linux file system can be viewed as a **tree** like structure
- In order, the system is made up of
  - Directories,
  - Subdirectories
  - files
- For the purposes of this class, almost all work is done in the path **~/**
- **~** is the **home directory**

File System Overview

“Current Working Directory” (CWD/ CD)

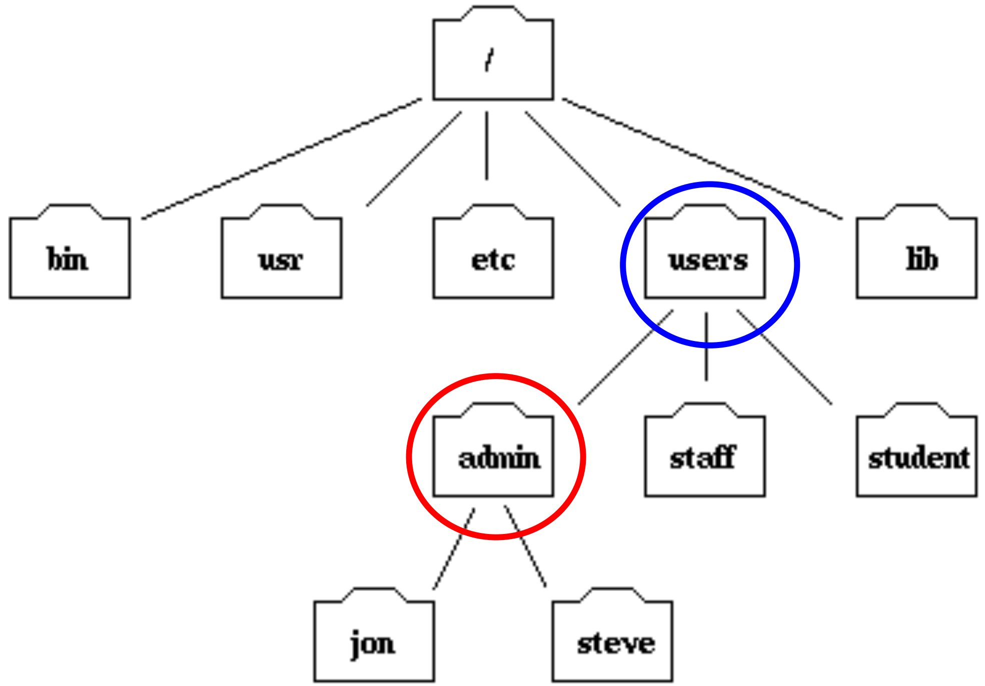
Denoted as “.”



File System Overview

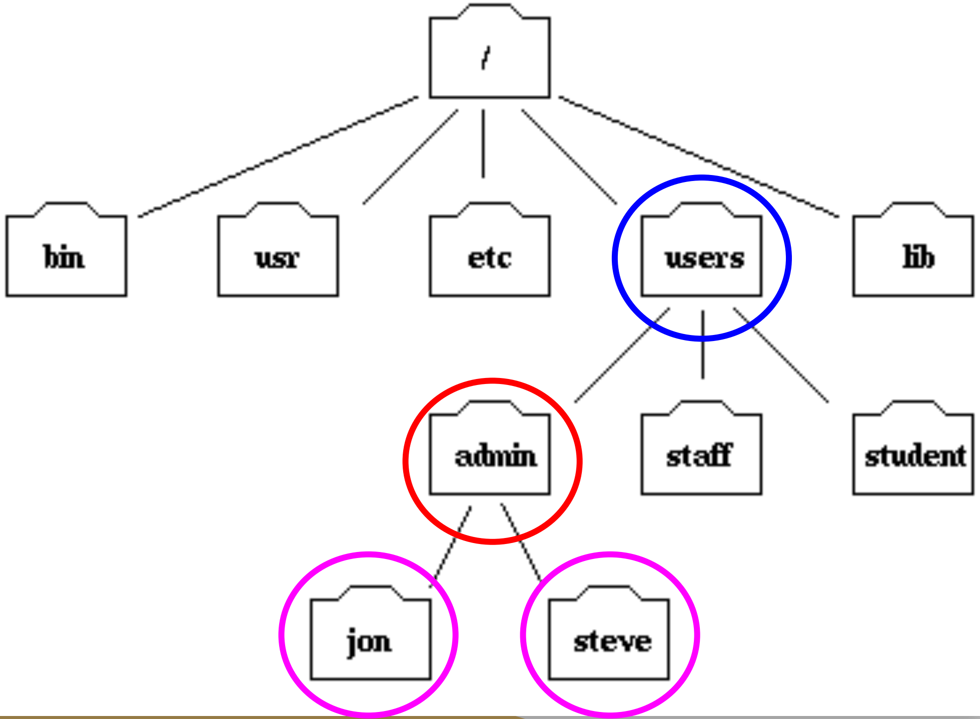
“Parent Directory”

Denoted as “..”



File System Overview

“Child Directory/Subdirectory”



Other Jargon

- Commands
    - What you write on the command line to perform actions
- Options
    - Add-ons to commands that change behavior of commands
- Operators
    - Symbols such as +, -, >>, <<, |, &&, that perform specific actions

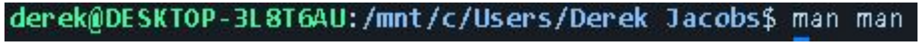
Commands/Operators

man	
echo	
ls	
pwd	
cd	
cat	(and other readers)
mkdir	
rm, cp, mv	
touch	
grep	
|	(Pronounced “Pipe”)
&&	(Pronounced “And”)
||	(Pronounced “Or”)
>>	(Pronounced “Redirect”)

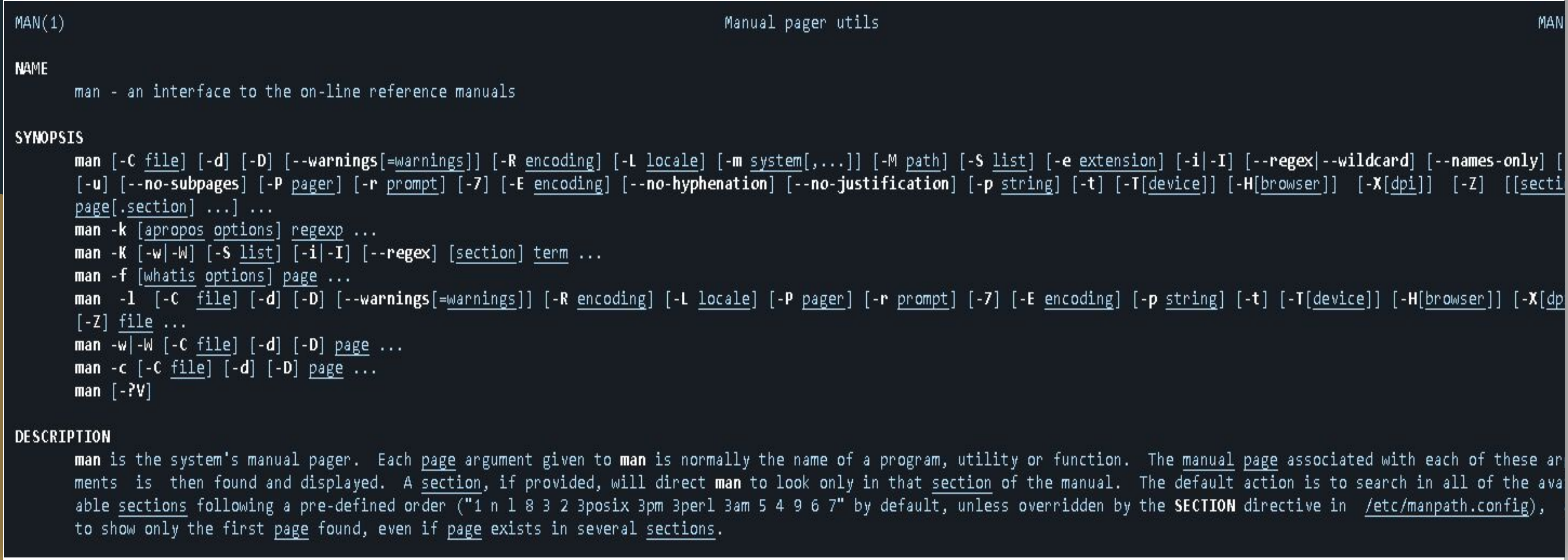
man

Displays the manual page for a given command

Usage: man {command}



```
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs$ man man
```



```
MAN(1)                                    Manual pager utils                                              MAN

NAME
       man - an interface to the on-line reference manuals

SYNOPSIS
       man [-C file] [-d] [-D] [--warnings[=warnings]] [-R encoding] [-L locale] [-m system[,...]] [-M path] [-S list] [-e extension] [-i|-I] [--regex|--wildcard] [--names-only] [
       [-u] [--no-subpages] [-P pager] [-r prompt] [-7] [-E encoding] [--no-hyphenation] [--no-justification] [-p string] [-t] [-T[device]] [-H[browser]]  [-X[dpi]]  [-Z]  [[secti
       page[.section] ...] ...
       man -k [apropos options] regexp ...
       man -K [-w|-W] [-S list] [-i|-I] [--regex] [section] term ...
       man -f [whatis options] page ...
       man  -l  [-C  file] [-d] [-D] [--warnings[=warnings]] [-R encoding] [-L locale] [-P pager] [-r prompt] [-7] [-E encoding] [-p string] [-t] [-T[device]] [-H[browser]] [-X[dp
       [-Z] file ...
       man -w|-W [-C file] [-d] [-D] page ...
       man -c [-C file] [-d] [-D] page ...
       man [-?V]

DESCRIPTION
       man is the system's manual pager.  Each page argument given to man is normally the name of a program, utility or function.  The manual page associated with each of these ar
       ments  is  then found and displayed.  A section, if provided, will direct man to look only in that section of the manual.  The default action is to search in all of the ava
       able sections following a pre-defined order ("1 n l 8 3 2 3posix 3pm 3perl 3am 5 4 9 6 7" by default, unless overridden by the SECTION directive in  /etc/manpath.config),
       to show only the first page found, even if page exists in several sections.
```

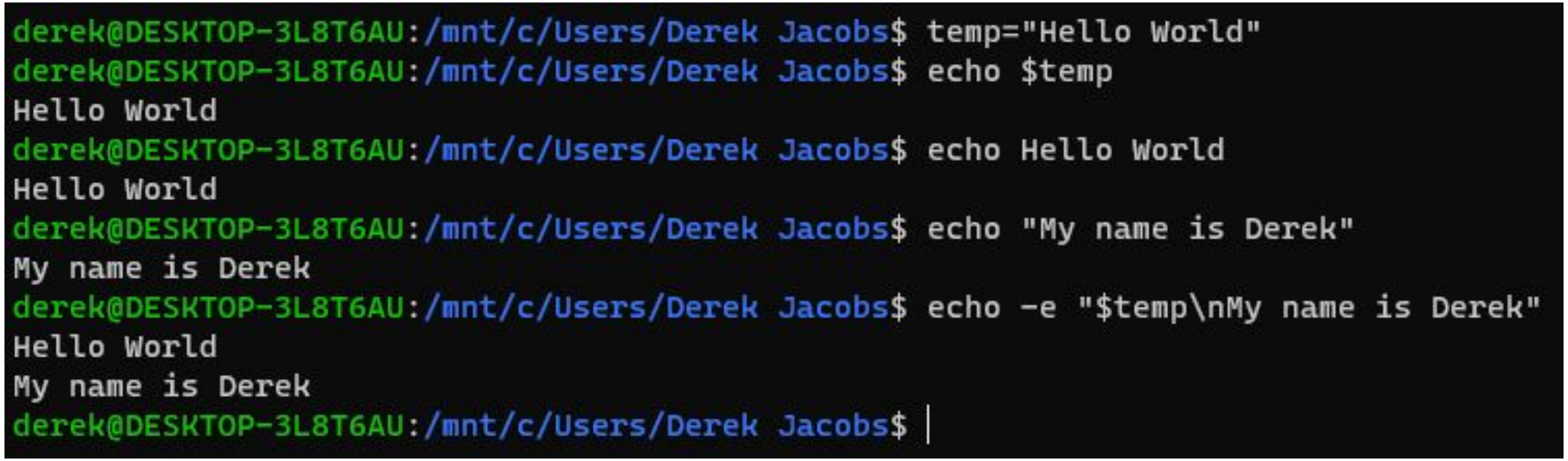
When in doubt, look it up

StackExchange

stackoverflow

echo

Prints out a variable/string

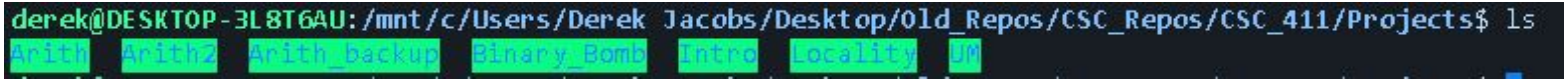


```
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs$ temp="Hello World"
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs$ echo $temp
Hello World
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs$ echo Hello World
Hello World
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs$ echo "My name is Derek"
My name is Derek
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs$ echo -e "$temp\nMy name is Derek"
Hello World
My name is Derek
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs$
```

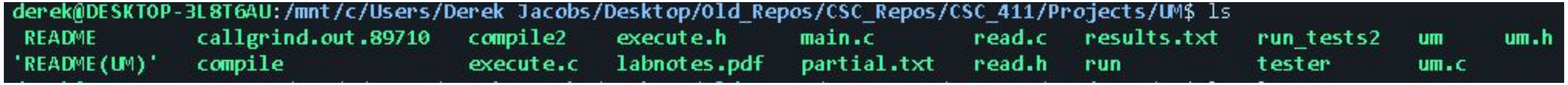
ls

Used to list files and subdirectories in the current working directory

Particularly useful if you're like me and constantly forget what you named something



```
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/Old_Repos/CSC_Repos/CSC_411/Projects$ ls
Arith  Arith2  Arith_backup  Binary_Bomb  Intro  Locality  UM
```



```
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/Old_Repos/CSC_Repos/CSC_411/Projects/UM$ ls
 README       callgrind.out.89710   compile2    execute.h      main.c        read.c   results.txt   run_tests2   um     um.h
'README(UM)'  compile               execute.c   labnotes.pdf   partial.txt   read.h   run           tester       um.c
```

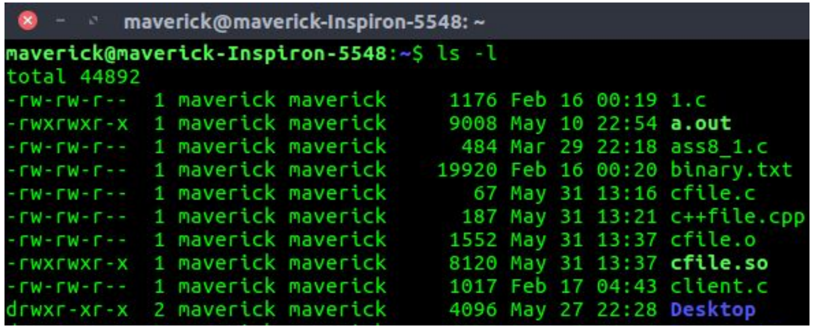
Useful ls options

-l

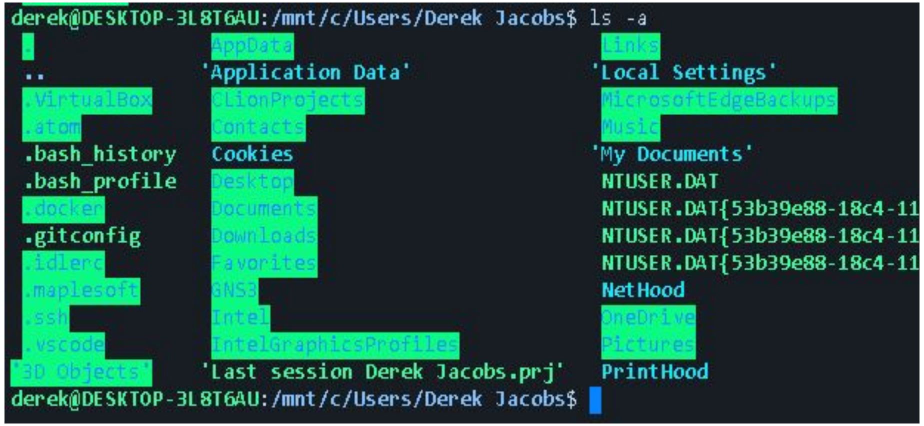
Lists in “long format”

-a

Lists all files, even hidden ones



```
maverick@maverick-Inspiron-5548: ~
maverick@maverick-Inspiron-5548:~$ ls -l
total 44892
-rw-rw-r--  1 maverick maverick     1176 Feb 16 00:19 1.c
-rwxrwxr-x  1 maverick maverick     9008 May 10 22:54 a.out
-rw-rw-r--  1 maverick maverick      484 Mar 29 22:18 ass8_1.c
-rw-rw-r--  1 maverick maverick    19920 Feb 16 00:20 binary.txt
-rw-rw-r--  1 maverick maverick       67 May 31 13:16 cfile.c
-rw-rw-r--  1 maverick maverick      187 May 31 13:21 c++file.cpp
-rw-rw-r--  1 maverick maverick     1552 May 31 13:37 cfile.o
-rwxrwxr-x  1 maverick maverick     8120 May 31 13:37 cfile.so
-rw-rw-r--  1 maverick maverick     1017 Feb 17 04:43 client.c
drwxr-xr-x  2 maverick maverick     4096 May 27 22:28 Desktop
```



```
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs$ ls -a
 .                 AppData                               Links
 ..               'Application Data'                    'Local Settings'
 .VirtualBox       CLionProjects                         MicrosoftEdgeBackups
 .atom             Contacts                              Music
 .bash_history     Cookies                              'My Documents'
 .bash_profile     Desktop                               NTUSER.DAT
 .docker           Documents                             NTUSER.DAT{53b39e88-18c4-11
 .gitconfig        Downloads                             NTUSER.DAT{53b39e88-18c4-11
 .idlerc           Favorites                             NTUSER.DAT{53b39e88-18c4-11
 .maplesoft        GNS3                                  NetHood
 .ssh              Intel                                 OneDrive
 .vscode           IntelGraphicsProfiles                 Pictures
'3D Objects'      'Last session Derek Jacobs.prj'        PrintHood
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs$
```

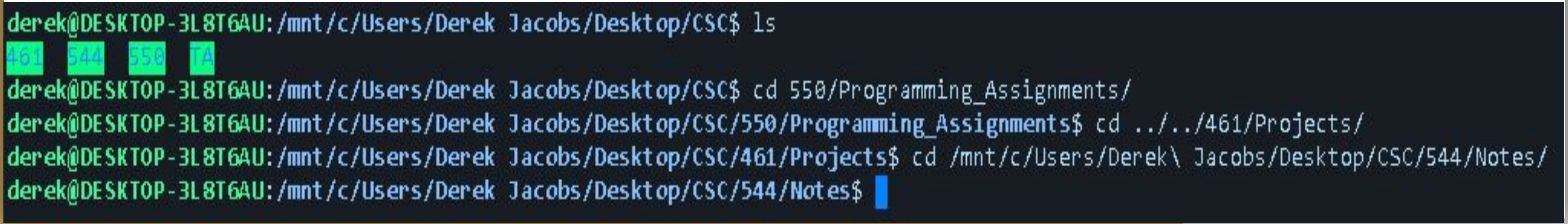
pwd/cd

pwd:

- Prints the current working directory

cd:

- Used to change the current working directory
- Can use either a relative path or an absolute path
  - Relative: From current working directory to the desired directory.
  - Absolute: From the root directory, follows the tree branches up to the desired directory.



```
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/CSC$ ls
461  544  550  TA
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/CSC$ cd 550/Programming_Assignments/
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/CSC/550/Programming_Assignments$ cd ../../461/Projects/
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/CSC/461/Projects$ cd /mnt/c/Users/Derek\ Jacobs/Desktop/CSC/544/Notes/
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/CSC/544/Notes$
```

Exercise 1 (5 Min)

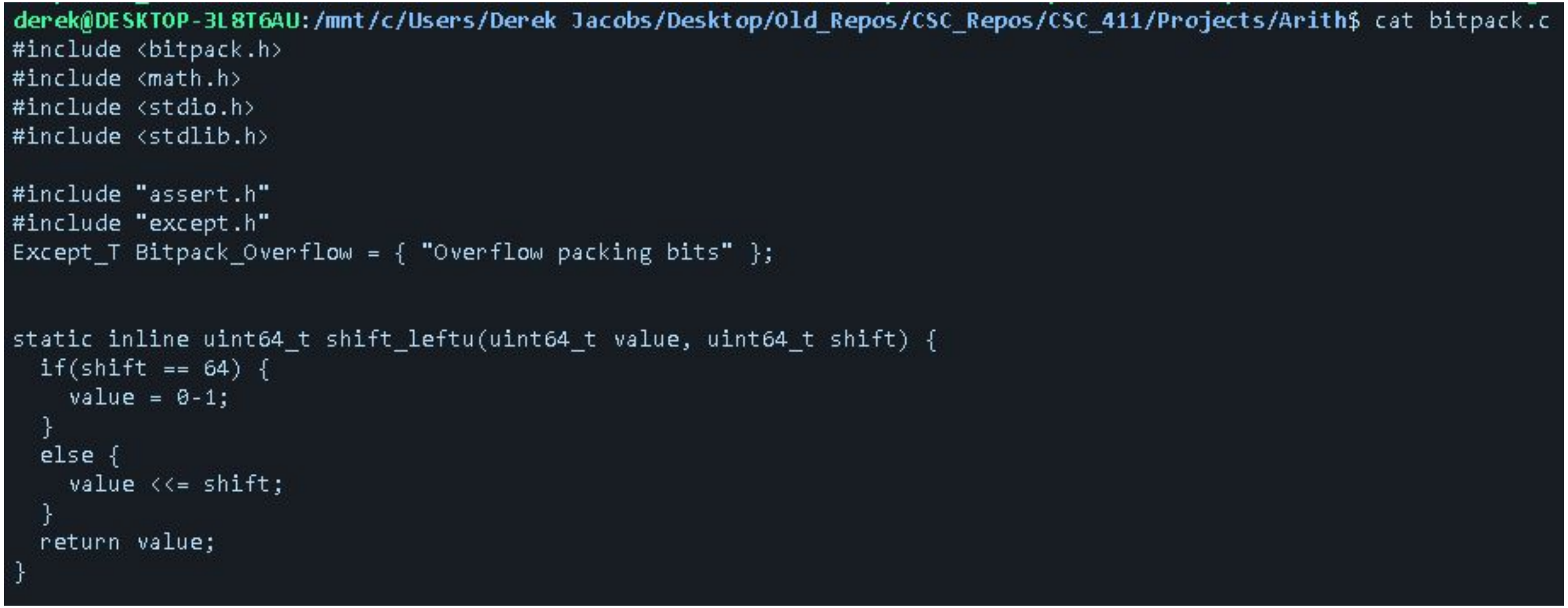
Provide a sequence of commands to

a) Print your current working directory
b) Print all files (including hidden ones) of your current working directory in long, human readable format
    i) Hint: Use ‘man’
c) Change directory to a directory of your choice
d) Change back to your original path using a relative path

File Readers

- Cat, more, less
    - Used to print out the contents of files
    - The difference lies in how it’s printed out

File Readers example



```
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/Old_Repos/CSC_Repos/CSC_411/Projects/Arith$ cat bitpack.c
#include <bitpack.h>
#include <math.h>
#include <stdio.h>
#include <stdlib.h>

#include "assert.h"
#include "except.h"
Except_T Bitpack_Overflow = { "Overflow packing bits" };


static inline uint64_t shift_leftu(uint64_t value, uint64_t shift) {
  if(shift == 64) {
    value = 0-1;
  }
  else {
    value <<= shift;
  }
  return value;
}
```

rm, cp, mv

- mv
  - Used to move files or rename them

```
mv ./file1  ../file1
```

- cp
  - Used to copy files or directories

- rm
  - Used to delete existing files or directories

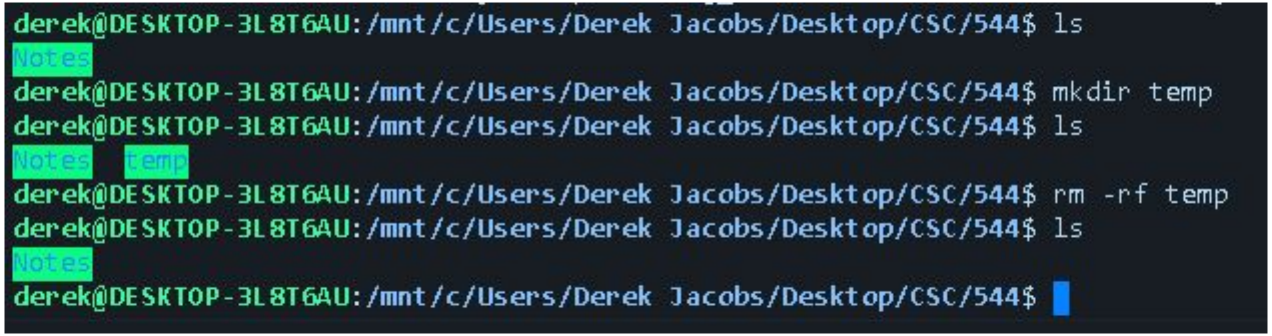
Useful Options

-r Recursively delete contents of subdirectories

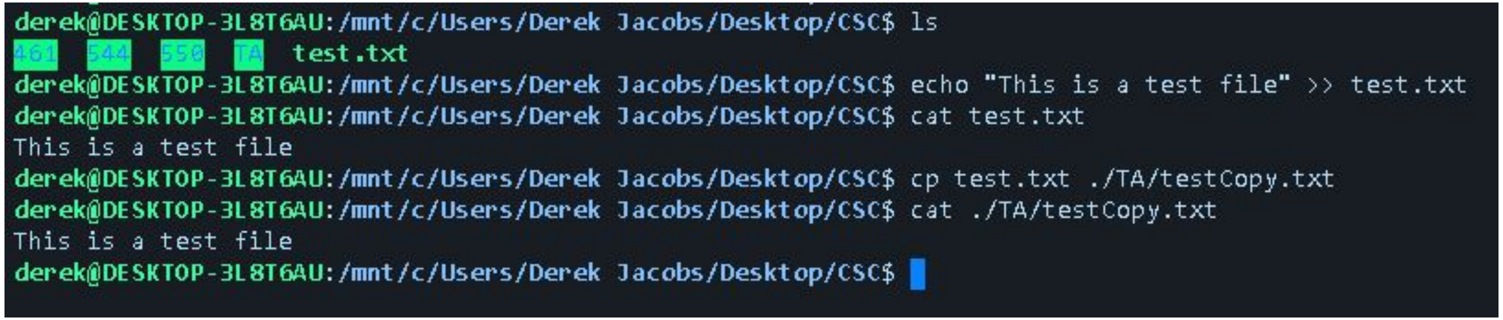
-f Force deletion

mkdir

Creates a new directory



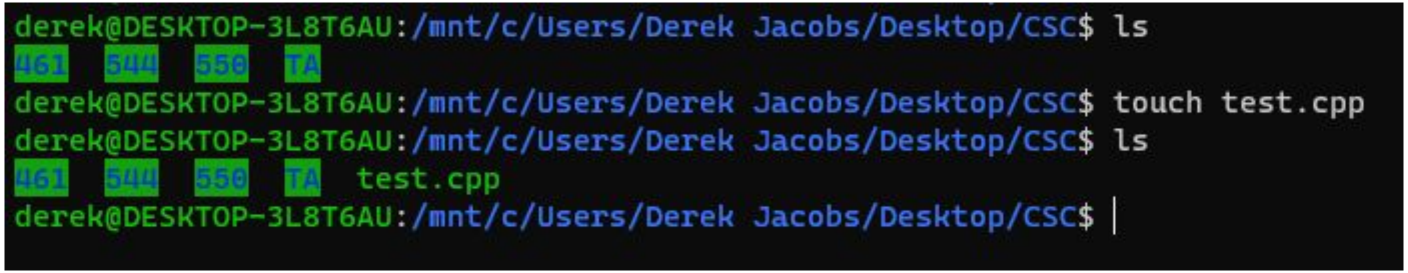
```
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/CSC/544$ ls
Notes
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/CSC/544$ mkdir temp
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/CSC/544$ ls
Notes   temp
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/CSC/544$ rm -rf temp
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/CSC/544$ ls
Notes
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/CSC/544$
```



```
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/CSC$ ls
461  544  550  TA  test.txt
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/CSC$ echo "This is a test file" >> test.txt
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/CSC$ cat test.txt
This is a test file
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/CSC$ cp test.txt ./TA/testCopy.txt
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/CSC$ cat ./TA/testCopy.txt
This is a test file
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/CSC$
```

touch

Used to create files



```
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/CSC$ ls
461  544  550  TA
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/CSC$ touch test.cpp
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/CSC$ ls
461  544  550  TA  test.cpp
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/CSC$
```

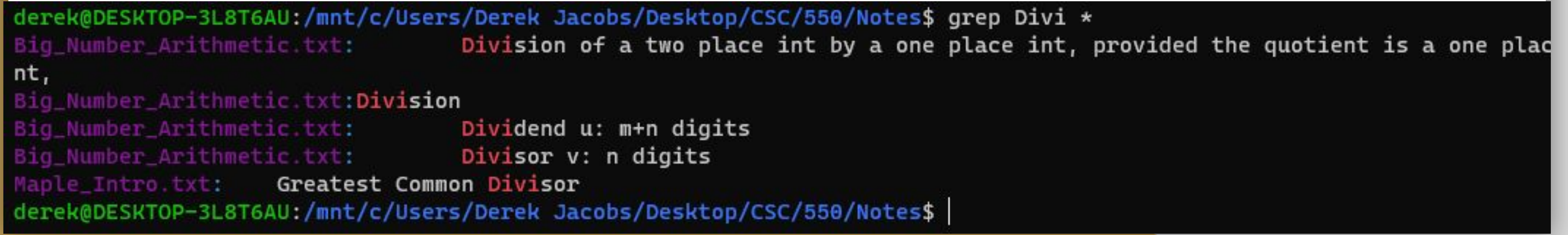
grep

Used to search for a phrase or word

Usage: grep {searchTerm} searchFile/Directory

<u>Not available for mac command lines</u>

- zsh has just about all of the tools you'd ever need, but if you really want grep or other linux tools, you can look into "homebrew"
- A word of warning: I do not have a mac and cannot help if you do this and things go south



```
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/CSC/550/Notes$ grep Divi *
Big_Number_Arithmetic.txt:        Division of a two place int by a one place int, provided the quotient is a one plac
nt,
Big_Number_Arithmetic.txt:Division
Big_Number_Arithmetic.txt:        Dividend u: m+n digits
Big_Number_Arithmetic.txt:        Divisor v: n digits
Maple_Intro.txt:     Greatest Common Divisor
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/CSC/550/Notes$ 
```

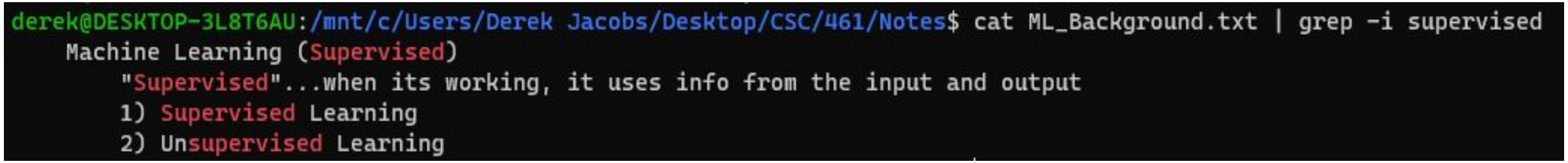
Exercise 2 (10 Min)

Provide a sequence of commands to

a) Create a directory called “Exercise_2” and cd into that directory
b) Create a file called “bashIntro.txt”
    i) Add the following string to the file
        1) “I am learning bash!”
c) Output the contents of bashIntro.txt
d) Make 3 copies of bashIntro.txt, named “copy1.txt”, “copy2.txt”, and “copy3.txt”
e) Output a list of files containing the string “I am learning bash!”
    i) You’ll need to use man again

| (Pipe)

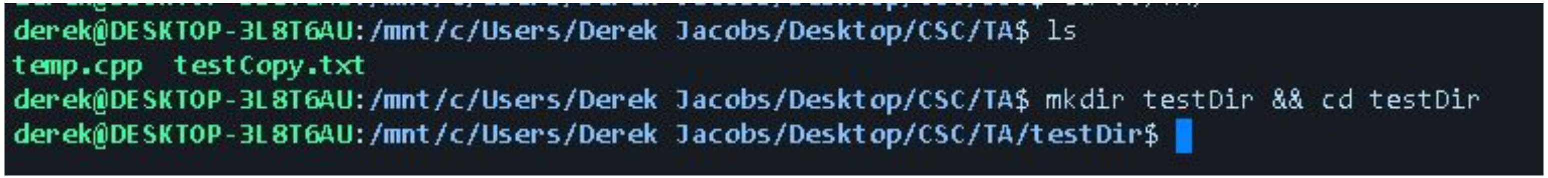
Used to redirect output of one command to the input of another



```
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/CSC/461/Notes$ cat ML_Background.txt | grep -i supervised
    Machine Learning (Supervised)
        "Supervised"...when its working, it uses info from the input and output
        1) Supervised Learning
        2) Unsupervised Learning
```

&& (And)

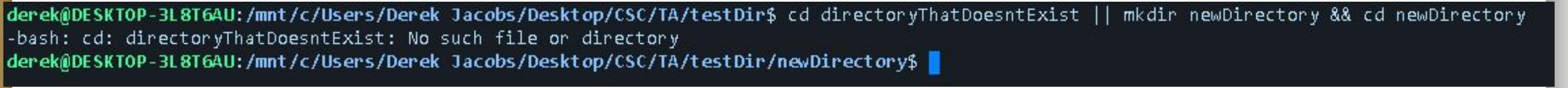
Used to execute commands sequentially (if the left hand side succeeds)



```
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/CSC/TA$ ls
temp.cpp  testCopy.txt
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/CSC/TA$ mkdir testDir && cd testDir
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/CSC/TA/testDir$
```

|| (Or)

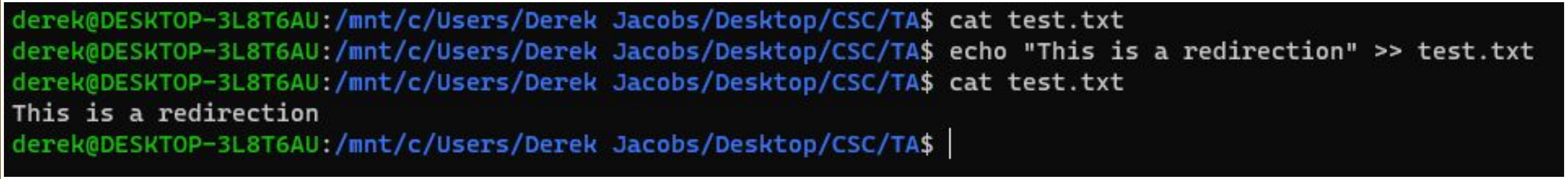
Used to complete commands sequentially regardless of success status



```
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/CSC/TA/testDir$ cd directoryThatDoesntExist || mkdir newDirectory && cd newDirectory
-bash: cd: directoryThatDoesntExist: No such file or directory
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/CSC/TA/testDir/newDirectory$
```

>>, << (Redirect)

Used for other manipulation of command outputs



```
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/CSC/TA$ cat test.txt
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/CSC/TA$ echo "This is a redirection" >> test.txt
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/CSC/TA$ cat test.txt
This is a redirection
derek@DESKTOP-3L8T6AU:/mnt/c/Users/Derek Jacobs/Desktop/CSC/TA$
```

Scripting

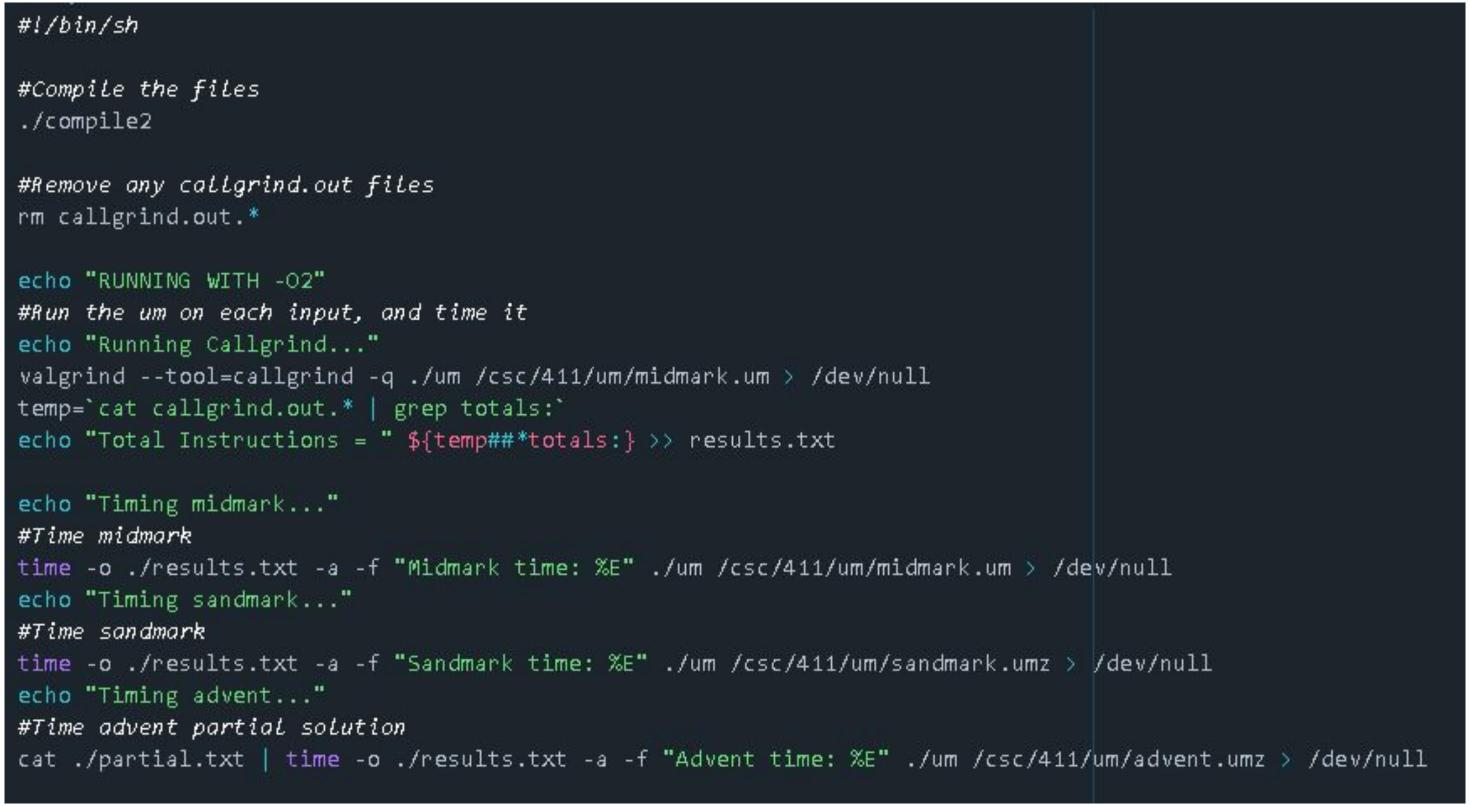
Scripts

- Sequences of commands that are executed from start to finish
- Commands may fail, but the script will not stop

Running a script:

- bash {scriptName}

Sample script



```
#!/bin/sh

#Compile the files
./compile2

#Remove any callgrind.out files
rm callgrind.out.*

echo "RUNNING WITH -O2"
#Run the um on each input, and time it
echo "Running Callgrind..."
valgrind --tool=callgrind -q ./um /csc/411/um/midmark.um > /dev/null
temp=`cat callgrind.out.* | grep totals:`
echo "Total Instructions = " ${temp##*totals:} >> results.txt

echo "Timing midmark..."
#Time midmark
time -o ./results.txt -a -f "Midmark time: %E" ./um /csc/411/um/midmark.um > /dev/null
echo "Timing sandmark..."
#Time sandmark
time -o ./results.txt -a -f "Sandmark time: %E" ./um /csc/411/um/sandmark.umz > /dev/null
echo "Timing advent..."
#Time advent partial solution
cat ./partial.txt | time -o ./results.txt -a -f "Advent time: %E" ./um /csc/411/um/advent.umz > /dev/null
```