(Finish going over syllabus/syllabus slides first)

About 1320

TOC

- What to Expect
- How I Will Code
- GUIs/Omega/Virtual Machine
- Sample Programs

WHAT TO EXPECT

Goals of the Course

1. More advanced exposure to the C programming language
2. Using the Linux operating system
3. Exposure to basic data structures
4. Exposure to simple algorithms

What to Expect

- This class is called **Intermediate Programming**
  - It is **not** called C programming
    - We could have used any programming language
  - We will focus on intermediate programming concepts
    - This class is not just 1310 part two
    - Expect to solve more advanced problems
    - Expect to solve problems mathematically and then implement them in code

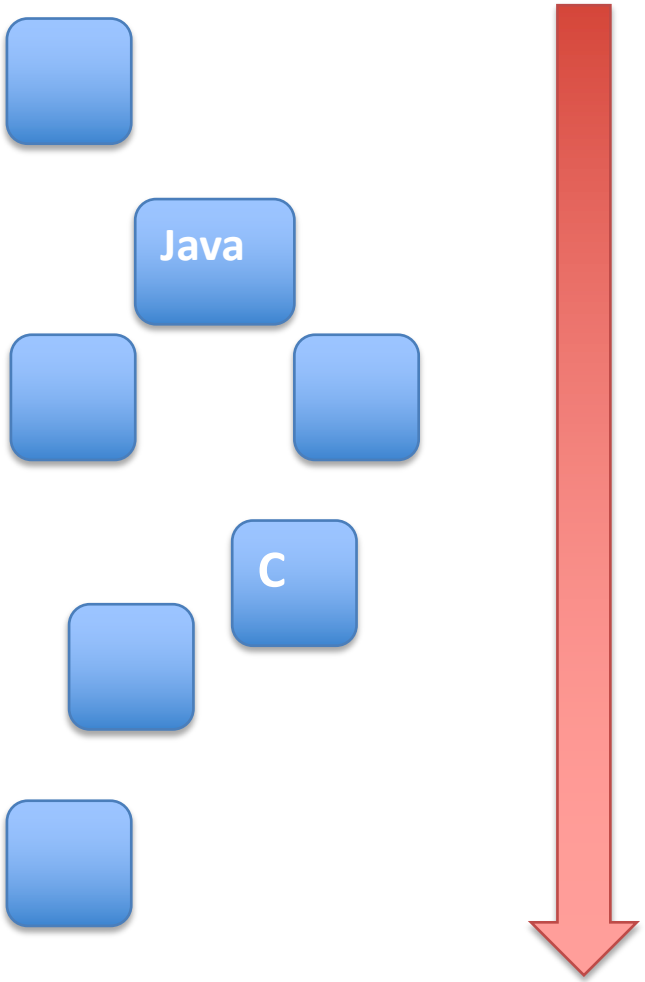
What to Expect

- The material taught in this class assumes some basic background knowledge on programming
  - It is NOT directed towards a total beginner in programming
- You are expected to have an understanding of topics like: loops, variable types, operators, if statements, arrays, file IO and basic problem solving.
  - Please review these concepts if you are not comfortable with them

What to Expect

- We will also focus more on how the computer actually works
  - C is a lower level language (see next slide), so we can actually take into consideration how the computer works
  - We did not pay much attention to this in 1310

Lower Level Languages



Higher Level Languages

-Easier to code for humans
-We can focus more on the real world problem
-NOT as much focus on the inner workings of the computer

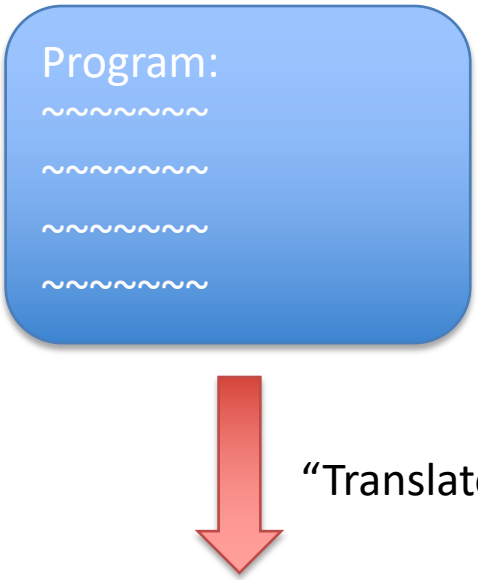
Lower Level Languages

-General rule of thumb: The more "lower level" a language is, the more we have to consider how the computer actually functions (in addition to our problem we are solving)

Machine Language **(what the computer actually executes)**

Higher Level Languages

- The program you create (in C or Java) might only have a few lines, but might have hundreds of actual instructions being executed by the computer after turning it into machine language



Machine language:

~~~ ~~~ ~~~ ~~~ ~~~ ~~~ ~~~~
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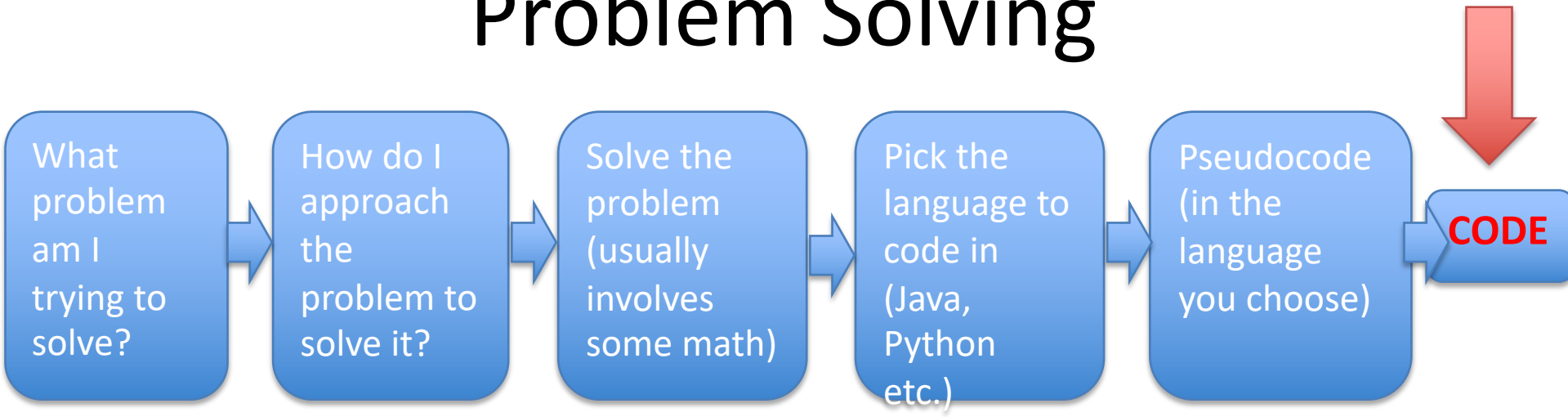
(Actually executed instructions)

Problem Solving



-In 1310, the problems we solved were simpler

-In 1320, the problems we will be solving will be more advanced and mathematical

In 1310, we did not pay as much attention to how the computer actually works

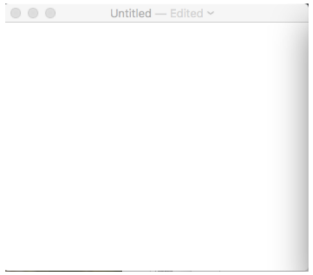
In this course, using the C language (a lower level language), **we will take into consideration more detail about the inner workings of the computer.**

HOW I WILL CODE THIS SEMESTER

Setting Up

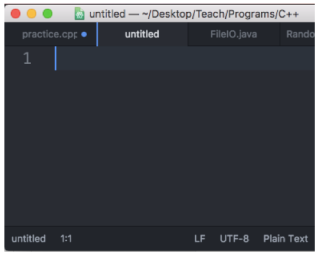
- You will see me sometimes using an IDE (Netbeans) and sometimes using an editor
  - Remember an IDE is just a workspace we used for our code (in 1310 you may have used Codeblocks)
  - You are welcome to use an IDE (like Netbeans Codeblocks or Visual Studio for example) or an editor
  - Coding without an IDE may also help you understand more about your code and the computer

A standard text editor. You can type anything you want here, including code. NO HELP AT ALL TYPING UP CODE. Save it with the .c extension (so the computer knows it is a C program). There are diff types, like Notepad or VIM.



Notepad

This editor is specialized in writing code. It is still an editor, but just has a little help when writing code. For example, it will turn variable different colors. There are diff types, like Atom or Notepad++. I use Atom. You should also save it with the .c extension.



Atom

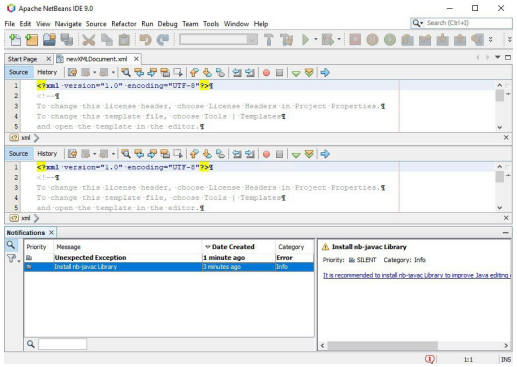
gcc compiler

You need to download this program yourself. You need to compile your code to run it.

Executable code

You can run this executable now
Using gcc, the default name will be a.out
You can also name it whatever you want

An IDE is a whole environment to type up your code. You usually just hit a run button and it runs the code for you without you having to manually do anything else. Sometimes, you may need to additionally download a compiler or other things.



IDE (Codeblocks, Netbeans)

GUIS/OMEGA/VIRTUAL MACHINE

Omega/Virtual Machine

- Please look at the additional material on Canvas (pdf, recordings) for Omega and virtual machine
- I will start next class assuming you have gone over the material
- In today's class, I will just be going over the concepts

GUIs/Omega/Virtual Machine

- What is a GUI?
- What is Omega?
- What is the Virtual Machine?

NOTE: This will be a lot of info-don't worry if you don't catch everything in just one lecture!

What is a GUI?

What is Omega?

What is the Virtual Machine?

Navigating Your Computer

- You are most likely used to using your computer with a GUI (Graphical User Interface)
  - We can use our mouse to click around
  - It is about interfacing with your computer visually
  - It looks like this:

Windows Desktop (GUI)

Mac Desktop (GUI)

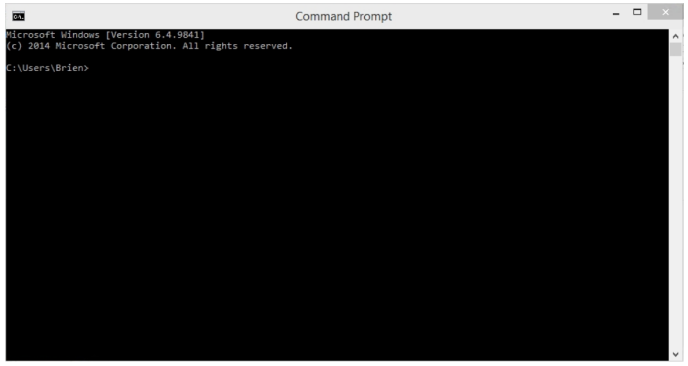
(you may also be using another OS like Linux)

Navigating Your Computer

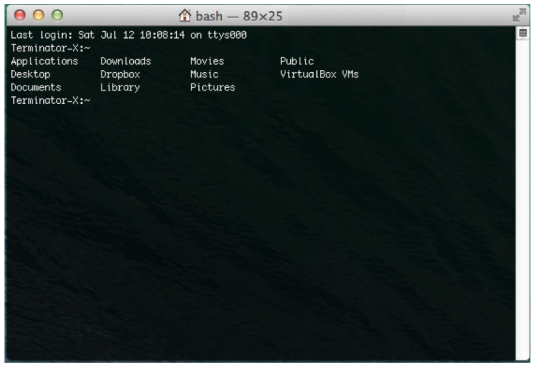
- If you want, you can navigate your computer without a GUI
  - GUIs are just for our convenience-it makes it easier to navigate as a human
  - It makes the experience more enjoyable and intuitive
- You can do the same things on your computer without a GUI that you can with a GUI
  - Open folders (with a GUI-double clicking on a folder icon, without a GUI using the command line)
  - Open programs (with a GUI-double clicking on a program icon, without a GUI using the command line)
  - Etc.

Windows Desktop (GUI)

Mac Desktop (GUI)

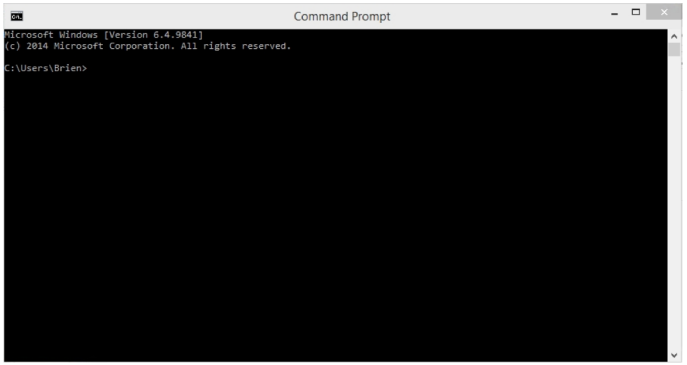


You can use **Command Prompt** on Windows to navigate your computer



You can use **Terminal** on Mac to navigate your computer

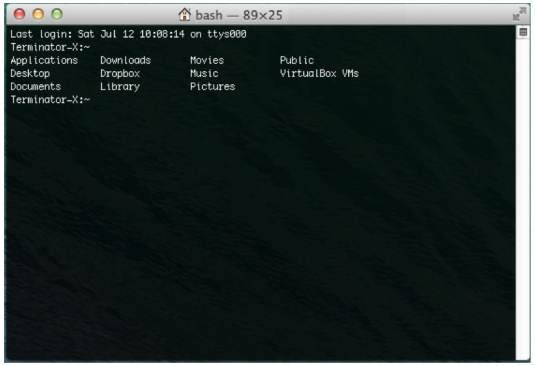
When using these (non-GUI), you will have to type all commands-you cannot use a mouse



You can use **Command Prompt** on Windows to navigate your computer

For example, if you want to see all the the files in a folder (using a GUI, you can double click a folder and see everything inside) you can just type the **dir** command.

*YOU CAN GOOGLE COMMANDS TO USE TO NAVIGATE YOUR COMPUTER USING **COMMAND PROMPT** ON WINDOWS*



You can use **Terminal** on Mac to navigate your computer

For example, if you want to see all the the files in a folder (using a GUI, you can double click a folder and see everything inside) you can just type the **ls** command.

*YOU CAN GOOGLE COMMANDS TO USE TO NAVIGATE YOUR COMPUTER USING **TERMINAL** ON MAC*

What is a GUI?

What is Omega?

What is the Virtual Machine?

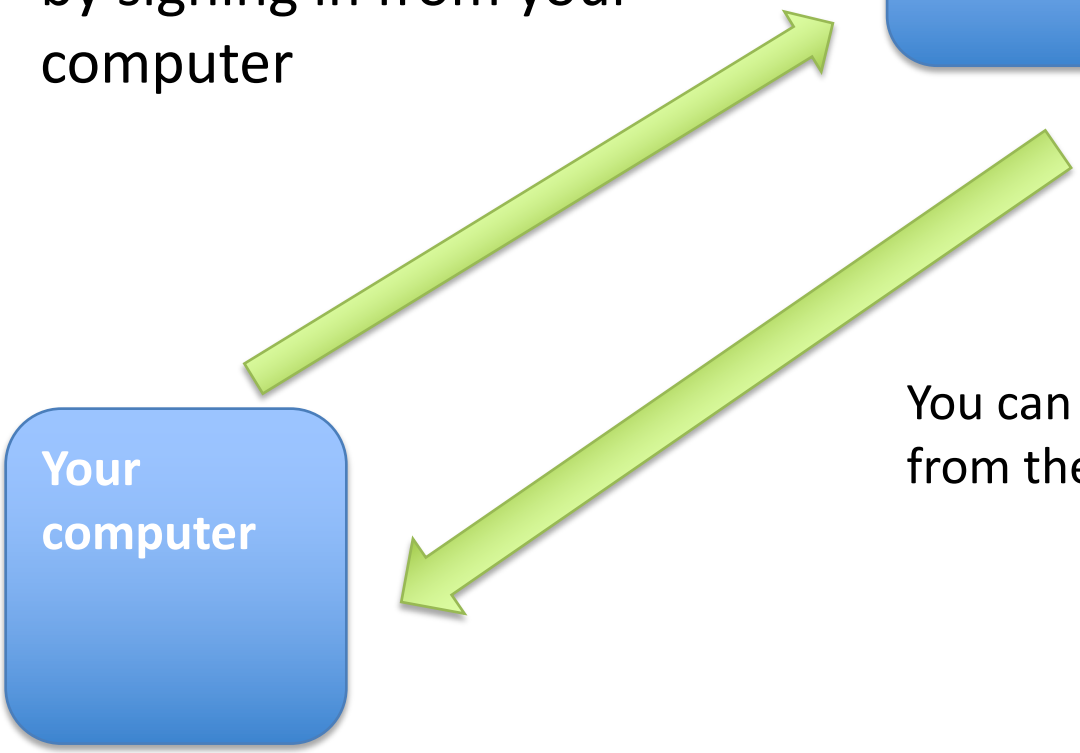
What is Omega? What is the virtual machine?

- You will see me using the Omega server and virtual machine during the semester
  - You might be familiar with Omega and/or the virtual machine from 1310
    - Don’t worry if you are not, we will see it in class!
    - You can think of the Omega server as another computer that you connect to with your computer
      - It does NOT have a GUI, meaning the only way we can interact with it is through the command line (just like I showed you on your own computer without a GUI)
    - You can think of the virtual machine as running another computer within your computer

What is Omega?

Once you are signed in, you can think of yourself as on the Omega server (not just your computer)

You can access the server by signing in from your computer



You can also send files and take files from the Omega server.

What is Omega?

- You can create programs directly on the Omega server using an editor
  - An editor is like Notepad on your computer
    - The same way we could create a Java/C program simply using Notepad (instead of using an IDE), we can do the same thing on an editor on Omega
      - I will show you an example of this
  - I like to use an editor on Omega called VIM
- You do NOT have to create programs on Omega
  - You can send them over from another machine
  - We will discuss this

What is Omega?

- Useful links about Omega (you can also just google: uta omega)

https://www.uta.edu/oit/cs/web/OmegaUtaEdu-webPage.php

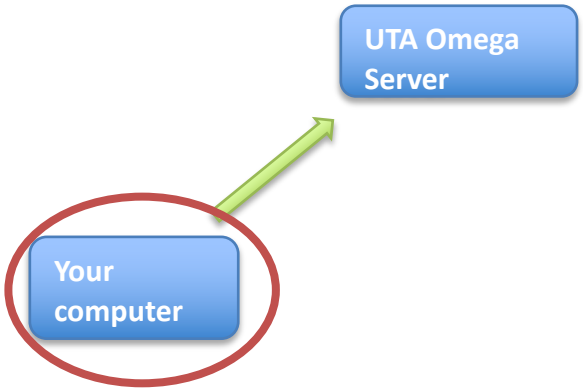
http://www.uta.edu/studentorgs/lug/files/uta_omega.pdf

https://www.uta.edu/oit/cs/files/sftp/putty/putty.php

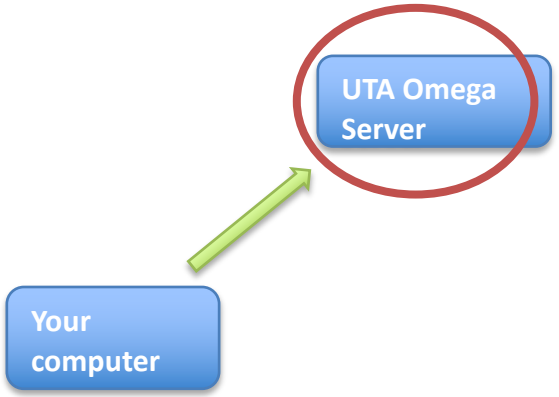
Accessing Omega

- You access the Omega server by signing in
  - On a Mac, you can use terminal
  - On a PC, if you have Windows 10 you can use the command prompt
    - If you don't have Windows 10, you can download something called PuTTy: https://www.uta.edu/oit/cs/files/sftp/putty/putty.php
  - YOU MUST USE A VPN TO ACCESS OMEGA OFF CAMPUS (see bottom of following link)
    - https://www.uta.edu/oit/cs/files/sftp/index.php
    - Contact OIT if you have issues setting this up

Connecting to Omega



1. You log into Omega from your computer either using Terminal (Mac), Command Prompt (Windows 10) or PuTTy.



2. Once you are logged into Omega (either in Terminal, Command Prompt or PuTTy), you can start navigating Omega using text commands. The Omega server does not have a GUI so you would navigate using text commands (same idea I showed you on the slide about navigating your own computer without a GUI).

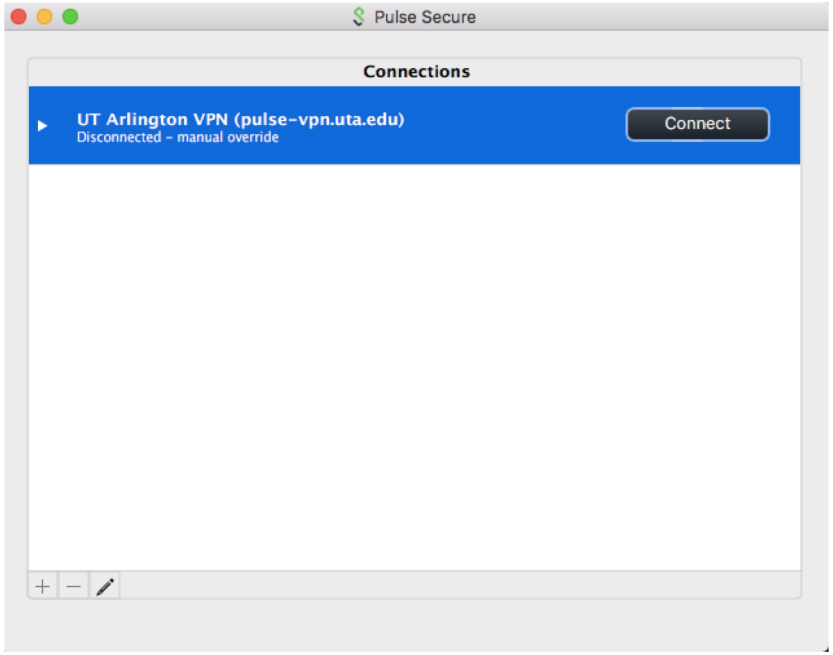
Connecting to Omega

- Remember you are connecting to Omega because:
  - Your HW programs should run on Omega (if they don’t run on the VM)
  - You are also learning about the Linux operating systems (Omega uses this)
  - You are also learning about navigating using a command line prompt (without a GUI)

Connecting to Omega

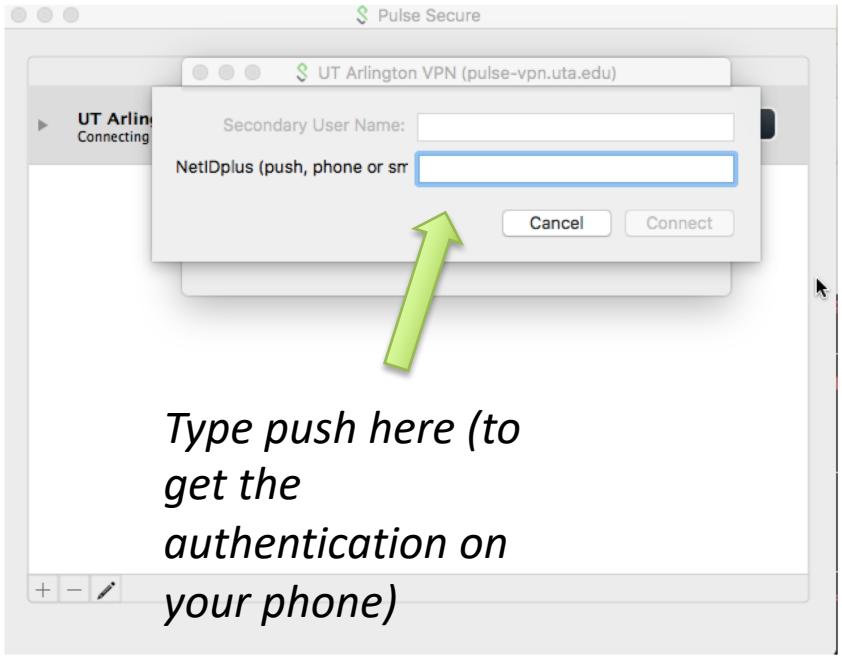
- The university now requires you to use a VPN to connect to Omega from off-campus
- Contact OIT for more info if you have trouble setting this up
- You will need to download DUO on your phone for authentication
  - I will show you on my phone

1



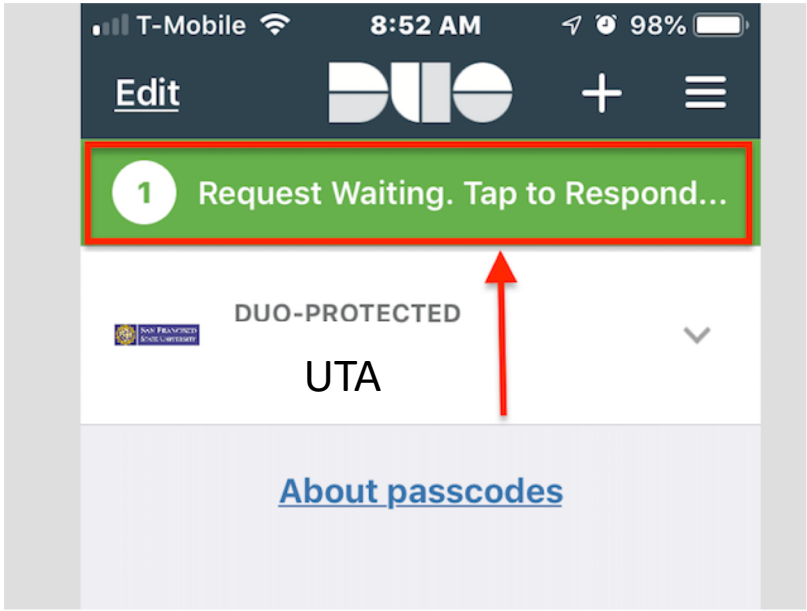
Once you get PulseSecure (contact OIT if you have trouble with this), start here

2



Type push here (to get the authentication on your phone)

On your phone:



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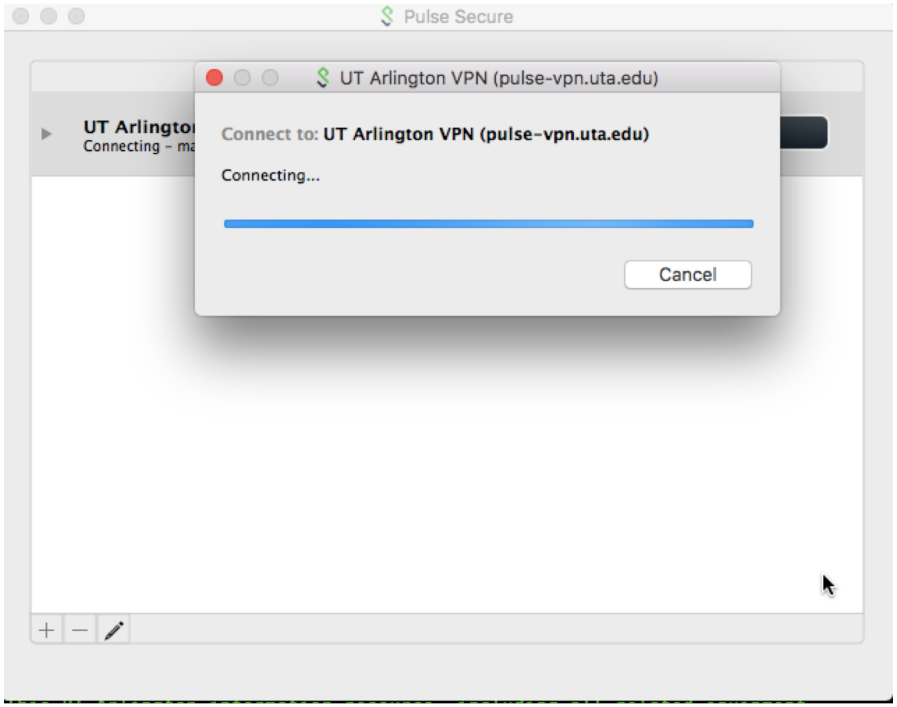


4

Post Sign-In Notification

The University of Texas at Arlington VPN Service - See http://www.uta.edu/vpn for options available for this service.

All unauthorized use is prohibited and misuse is subject to criminal prosecution. Usage may be subject to security testing and monitoring. There is no expectation of privacy except as otherwise provided by applicable [illegible]acy law

Decline Proceed

Accessing Omega

- Once you are signed in to Omega, you can enter commands to navigate around
  - There is no GUI
  - We use text the whole time
    - We do not use our mouse to move around
- All students should be able to sign in using: ssh your_net_ID@omega.uta.edu
  - You will see me do this today
- You then enter your password (the same one you use for email)

Navigating on Omega

- OMEGA DOES NOT HAVE A GUI!
- As I just mentioned, we can interface on our computers with or without a GUI
- On Omega, we don’t have that choice
  - Just think of Omega as a computer with only one way to interface-no GUI
  - It will be text based
  - I will discuss further in the next section

Omega Info

- Note that when you are on Omega:
  - You are essentially on another computer
  - Files that you make on Omega EXIST ON OMEGA not your computer
  - Files you make on your computer EXIST on your computer, NOT OMEGA
- When you are in Omega, you can use commands to navigate like cd, ls, rm etc.
  - It's the same idea as when you were on computer navigating without a GUI-Omega does not have a GUI so you use text to navigate
  - You can look up commands to use on Omega
    - Omega uses the Linux operating system, you can look up Linux commands to navigate
- You can also open an editor to write a program
  - I use vim, but there are others like emacs nano etc.

Omega Info

- You can send files to Omega
  - Instead of writing programs on Omega (I do it on an editor named vim), you can write them on your computer and send them to Omega
    - For example, if you choose to use an IDE like Codeblocks or code in Notepad on your own computer, you can send the code to Omega and run it
    - Note that I use an editor called Atom
- You can also send files to your computer from Omega
  - If you write a program on vim on Omega, you can send it back to your computer
- I will talk about file transfers in a future lecture

What is a GUI?

What is Omega?

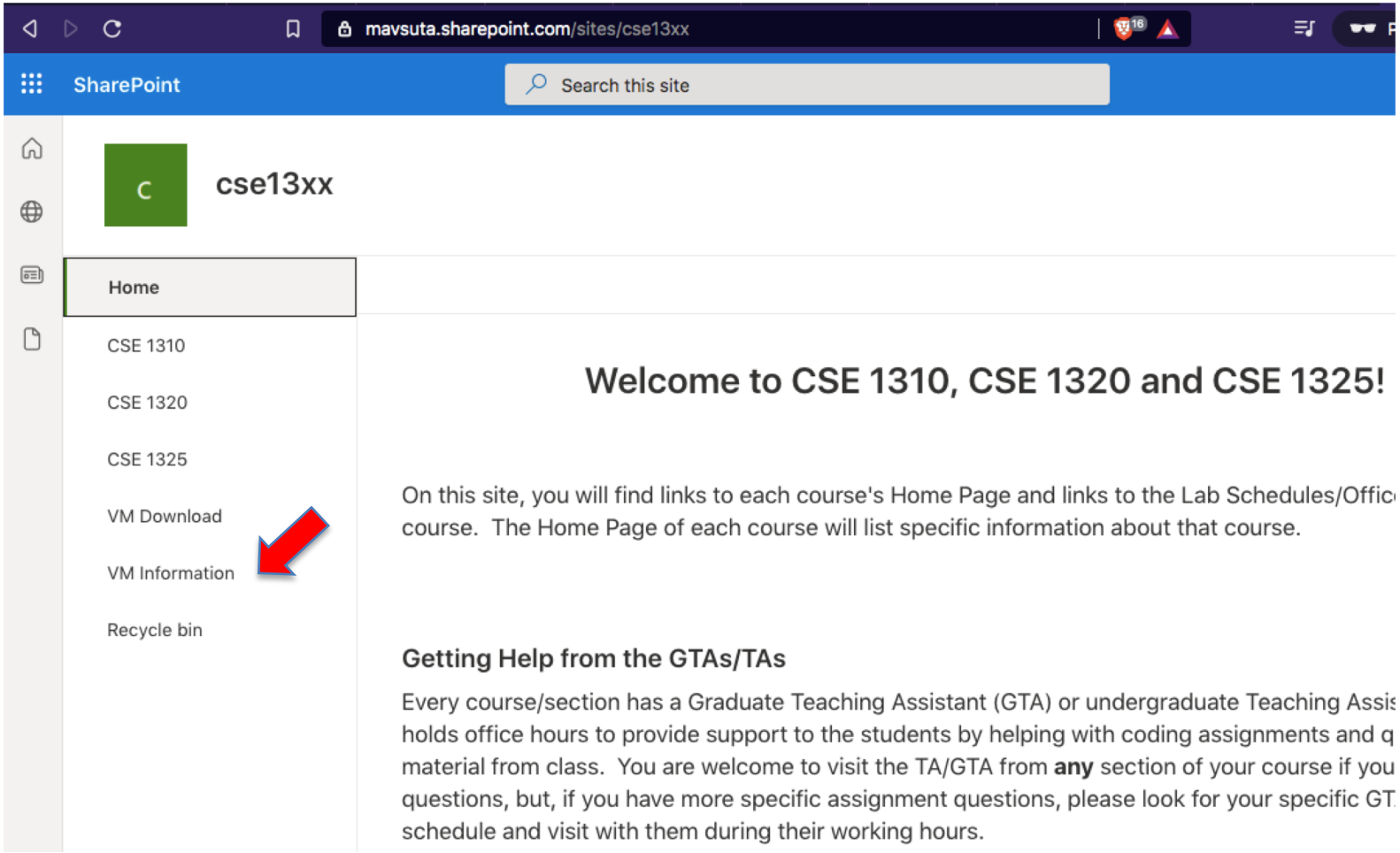
What is the Virtual Machine?

Virtual Machine

- You can think of this as running a computer within another computer
- We will use something called VirtualBox to allow this to happen
  - We can run multiple operating systems on one computer
  - Normally, our computers only use one operating system
  - We will be using a virtual machine created by one of the 1325 professors
    - It uses the Linux operating system
    - It has a GUI
    - We will be able to interact with it using both the command line (no GUI) and the GUI interface (just like you can do with your own computers)

This is a Mac computer running Windows 8

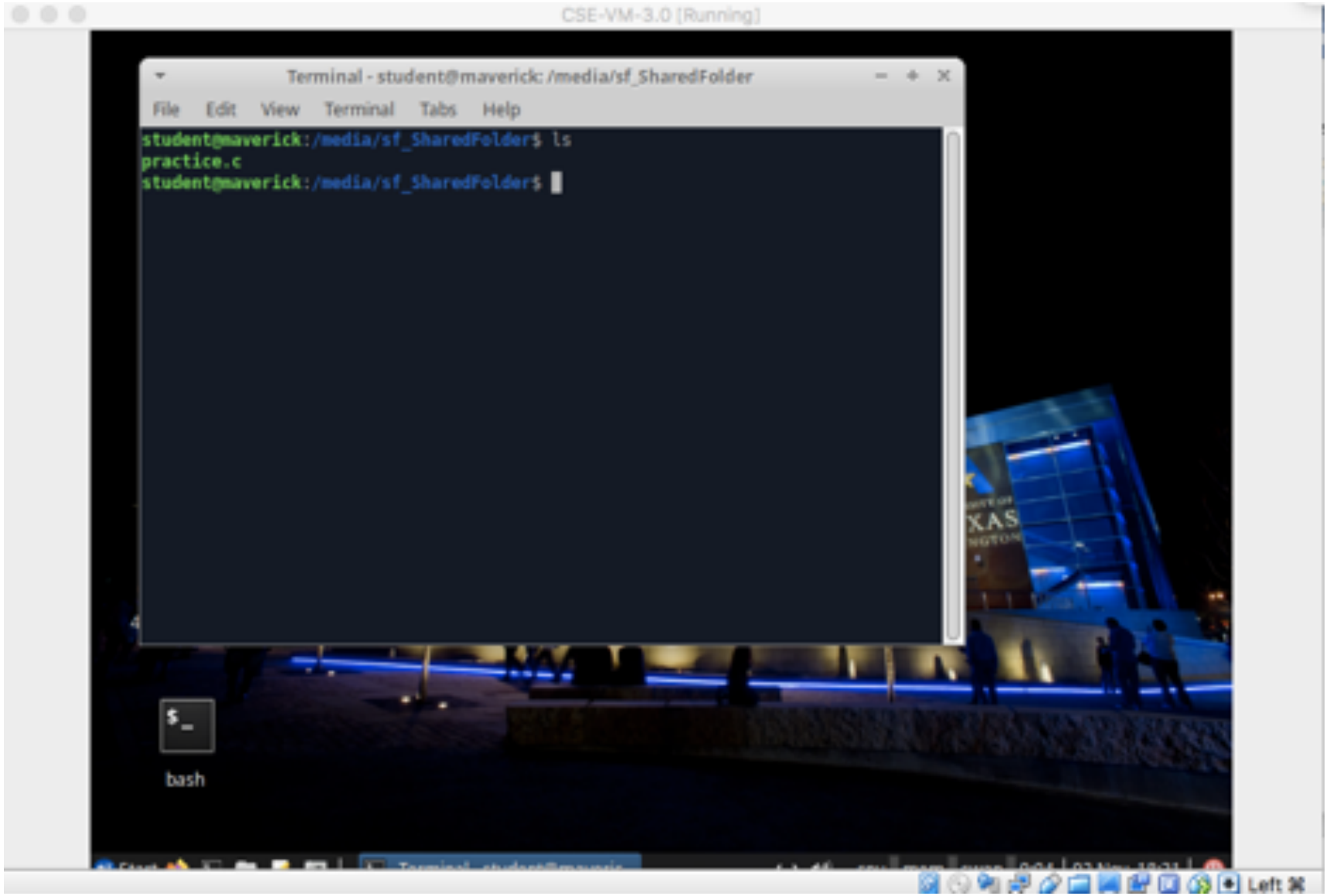
use the 13xx website to get information on downloading and creating a shared folder:
https://mavsuta.sharepoint.com/sites/cse13xx



When you have your VM set up (following the instructions on the website), you can access it in the Virtual Box like this (note that you can have multiple virtual machines and so you would have multiple items on the left side):

- Remember that you can treat it JUST like a normal computer
- For example, you can use the internet or download programs

When you run the VM, it should look something like this (it may be slightly different):



Virtual Machine

- All assignments submitted should run on either Omega or the virtual machine (given below)
  - The compiler on Omega is VERY OLD-it is a good idea to go ahead and start using the virtual machine
  - Make sure to specify in your README where to run it

FINAL NOTE

- PLEASE CHECK THE ADDITIONAL MATERIAL FOR OMEGA AND THE VM ON CANVAS
  - Also, as mentioned for the VM, there is info on it on the website given
  - I will start next class assuming you have gone over this material

- I know this may initially seem like a lot of info- don’t worry we will be seeing examples throughout the semester

SAMPLE PROGRAMS

Before We Code

- I will be writing VERY simple programs today
- I'm focusing today more on non-GUI interfacing with your computer/Omega
    - REMEMBER:
        - WHAT WE CREATE ON OMEGA IS ONLY ON OMEGA
        - WHAT WE CREATE ON OUR COMPUTERS IS ONLY ON OUR COMPUTERS
- You will also see me use some commands to navigate around Omega (and the non-GUI version of my computer)
    - I will not be using my mouse to click around (non-GUI)
        - Instead, I will be using commands like:
            - ls (list everything in a directory)
            - cd (change directory)
            - rm (remove a file)

Sample Programs

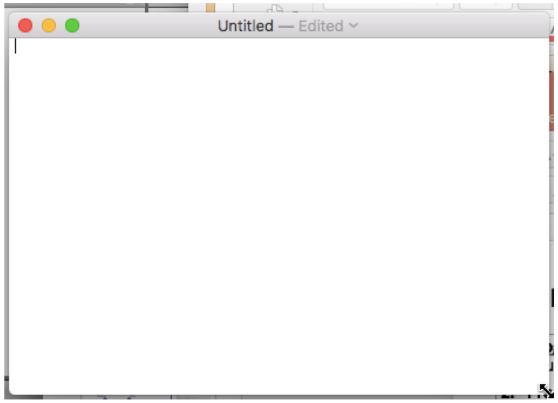
- I will make a program on my computer using Notepad (an editor)
  - I will compile it using gcc (a compiler) on my computer (I downloaded it)
    - If you already have an IDE, you may possibly already have gcc or some compiler downloaded
- I will make a program on Atom (an editor)
  - I will compile it using gcc on my computer
- I will make a program on VIM (an editor) on Omega
  - I will compile it using gcc on Omega (Omega already has gcc downloaded on it)
  - If you have a mac, you can also use VIM there

Sample Programs

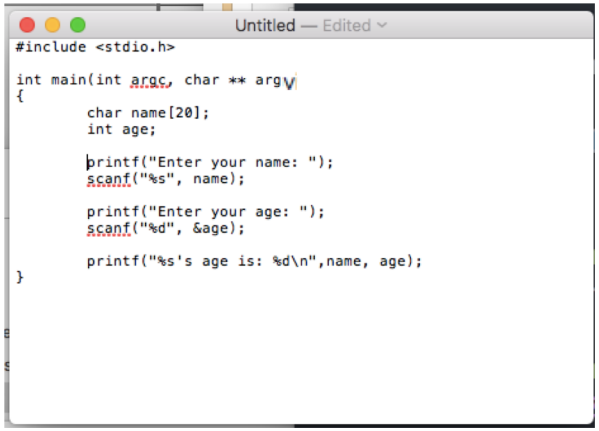
1. **<u>Program on Notepad:</u>** Create a program that allows you to type in your name and age. You should then print it to screen.
    - Note: You can choose to open the program in Atom later on
2. **<u>Program on Atom:</u>** Create a program that allows you to enter a word then print out the first letter.
3. **<u>Program on Omega:</u>** Create a program that allows a user to type in three words.

Today I will be doing very simple programs

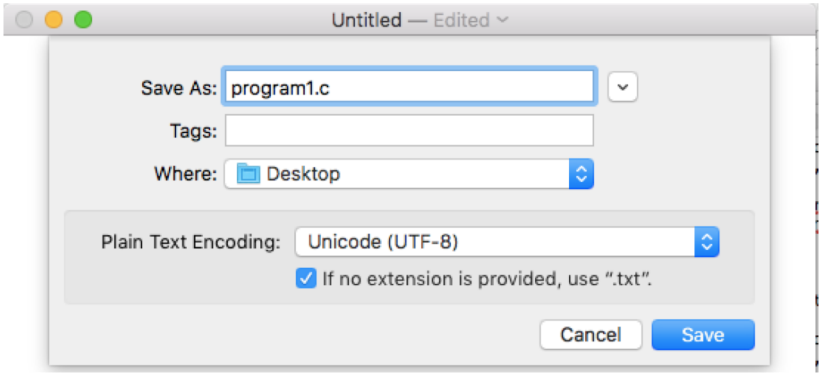
Program 1 (on Notepad/Textedit on Mac):



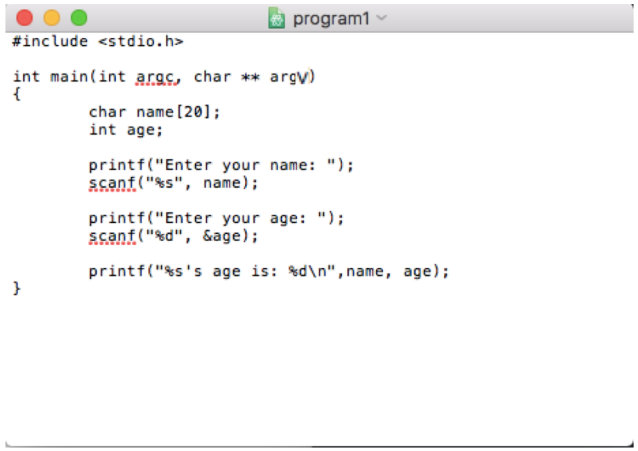
1. Open up Notepad (make sure it is not a rich text file).



2. Type up code on Notepad.



3.Save your code with a .c extension (since it's a C program). Notice I saved it on my Desktop (so I will compile it on my Desktop).



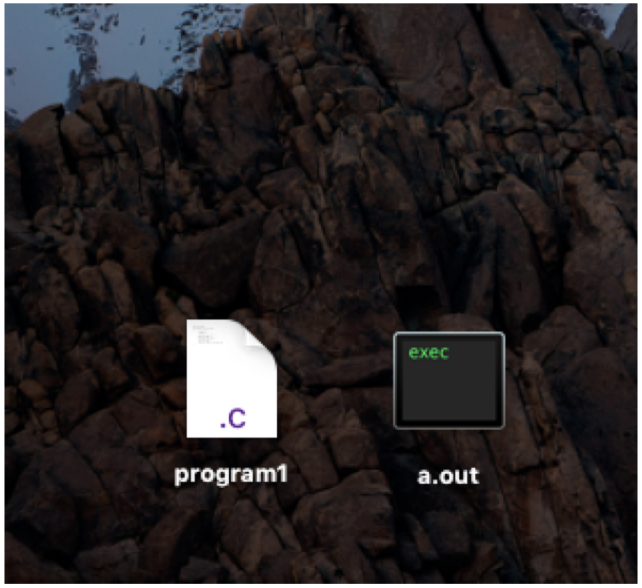
4. Your code is now saved as a C program. Notice that it does not look any different from before you saved it.

Notes: in Windows, you may need to save your file type as All Files (not .txt)

```
~/Desktop — -bash
(base) Computers-MacBook-Air:Desktop computer$ gcc program1.c
(base) Computers-MacBook-Air:Desktop computer$ ./a.out
Enter your name: Fad
Enter your age: 99
Fad's age is: 99
(base) Computers-MacBook-Air:Desktop computer$
```

5. Compile the program using gcc. If you have an error, it will show up (see next slide). There is no error here so nothing shows up here.

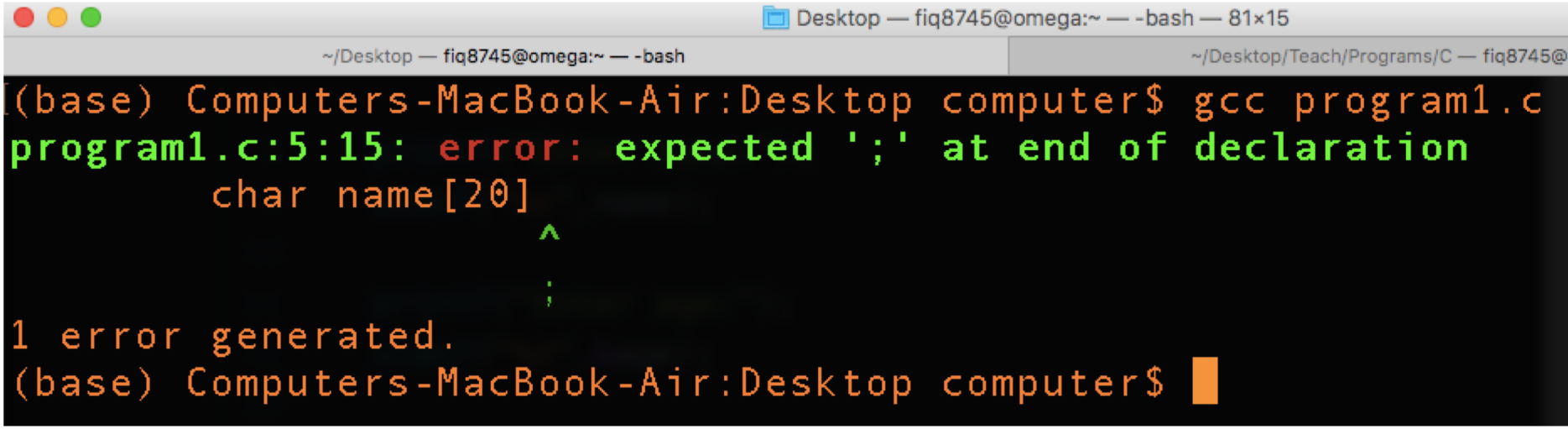
Note: on Windows, you may need to execute a.exe (instead of a.out)



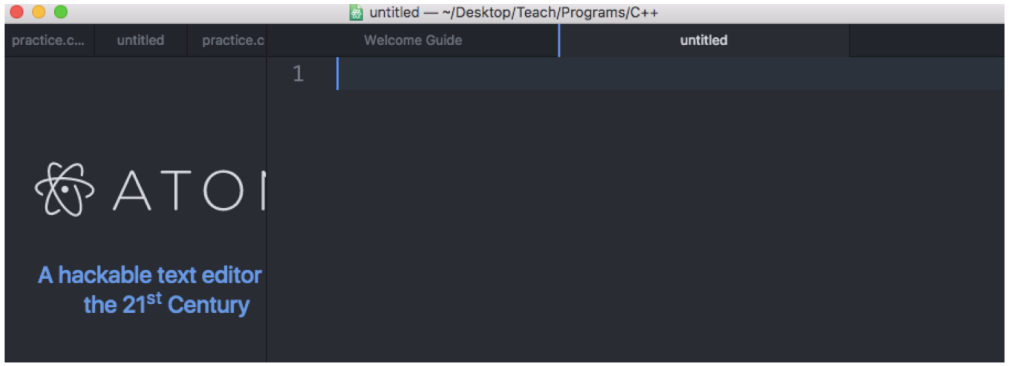
On my actual desktop

NOTE: YOU CAN ALSO OPEN THIS FILE WITH OTHER EDITORS, LIKE VIM AND ATOM (NOT JUST THE EDITOR YOU MADE IT IN!!!

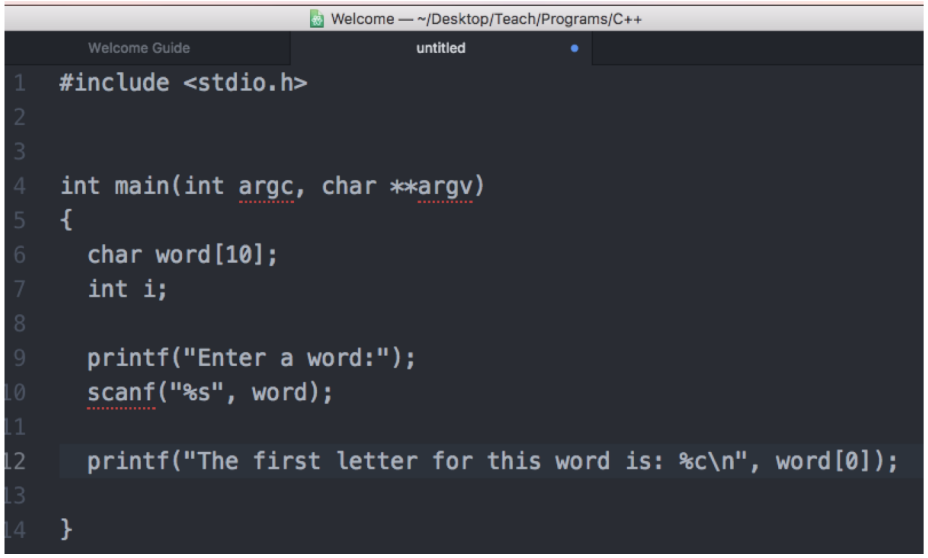
NOTE: When you compile, if you have an error you will see something like the following (this is for all the examples including Omega)



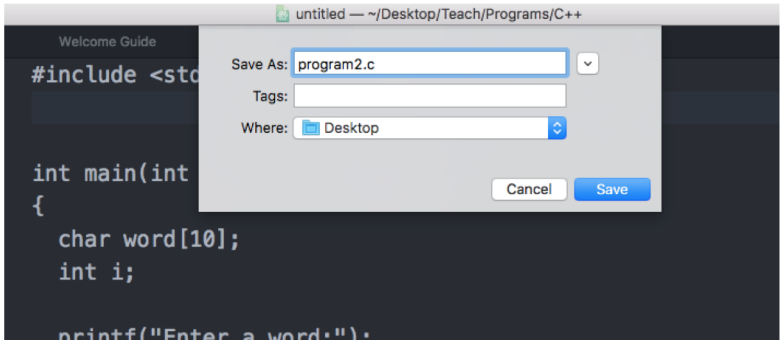
Program 2 (on Atom):



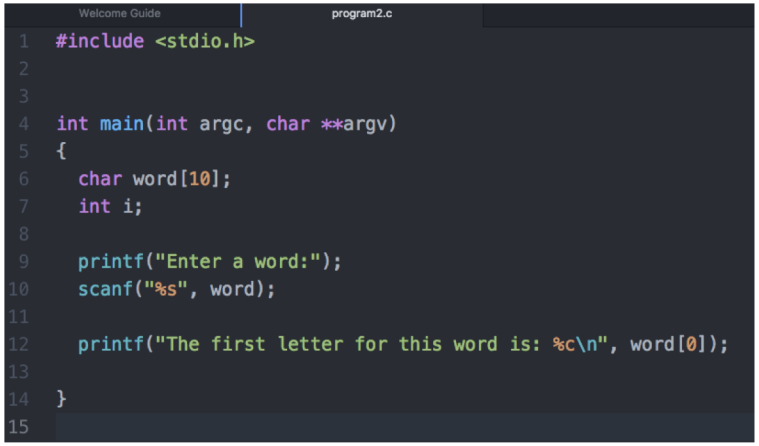
1. Open a new file on Atom.



2. Type up code in Atom. Notice the code looks the same (same colors).



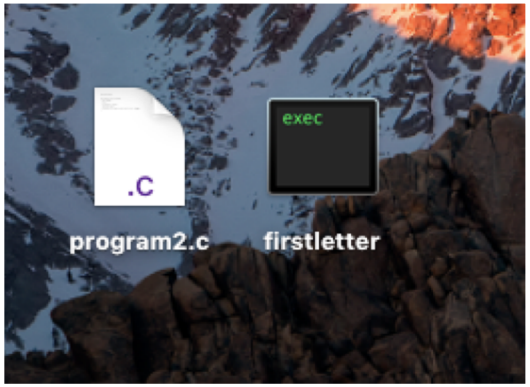
3. Save the code with a .c extension (like we did in Notepad).



4. Notice now the colors have changed. The Atom editor recognizes this is a C program and makes the code more readable. Note that you could save the file as c program before and have the colored text.

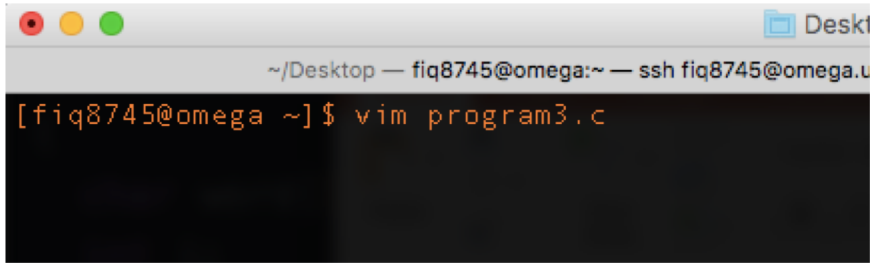
```
~/Desktop — -bash
(base) Computers-MacBook-Air:Desktop computer$ gcc -o firstletter program2.c
(base) Computers-MacBook-Air:Desktop computer$ ./a.out
Enter your name: ^C
(base) Computers-MacBook-Air:Desktop computer$ ./firstletter
Enter a word:word
The first letter for this word is: w
(base) Computers-MacBook-Air:Desktop computer$
```

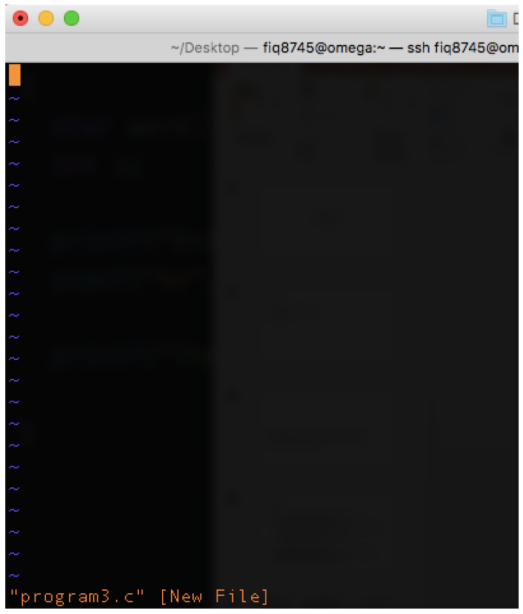
5. Compile using gcc. Notice I am changing the name from the default of *a.out* to *firstletter*. *Note for lines 2 and 3: I tried to run a.out, but since my new program is named firstletter, it runs the previous program (since a.out is the name of the last executable). I enter control-C to exit the program (line 3) and then run firstletter (line 4).*



On my actual desktop

Program 3 (on VIM on Omega):

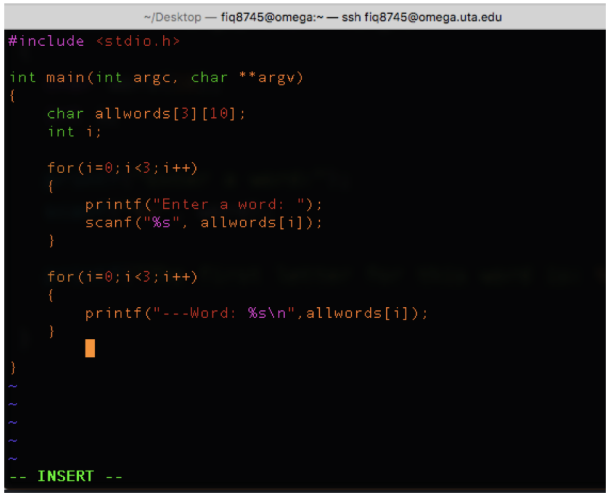




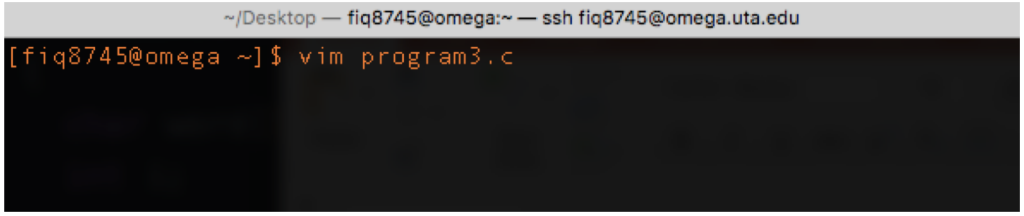
1. Open a file on vim on Omega. We have no GUI on Omega, so the way we do this is giving the editor name and the name of the file we want. An empty file will be opened. If you give a filename that already exists that can be opened by an editor (a text file or program for example), this command will just open that file (not give you a new file).

I GAVE SOME INFO ON USING VIM ON THE FIRST DAY OF CLASS-CHECK THOSE SLIDES FOR MORE INFO. You can also look up vim commands online.

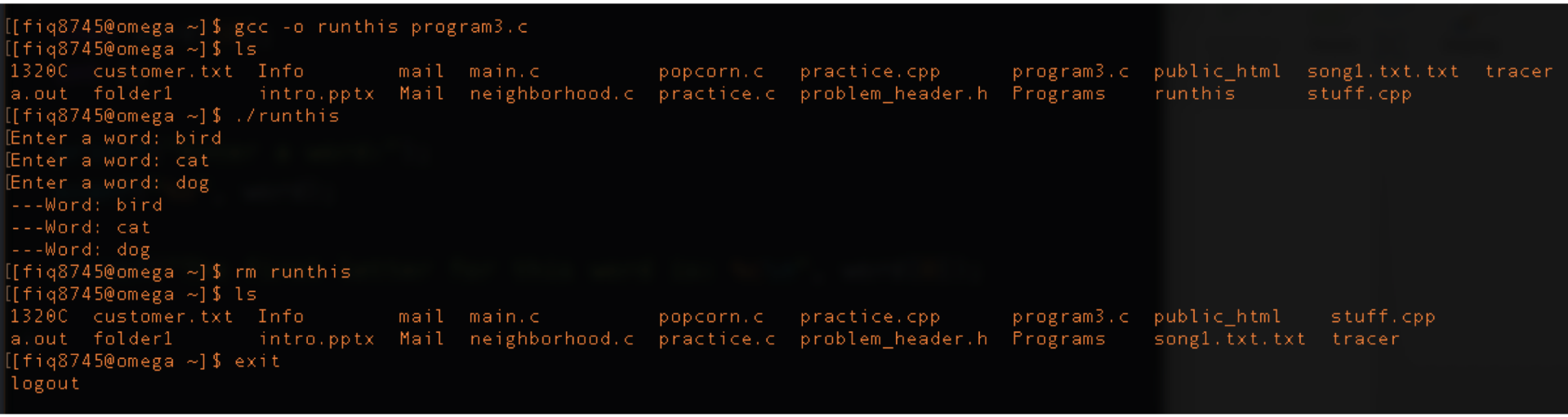
Program 3 (on VIM on Omega):



2. Type up the code.



3. When you exit, you go back this screen.



4. Compile the program.
Note: rm will remove the given file