CS112 – Java Programming

Spring 2024

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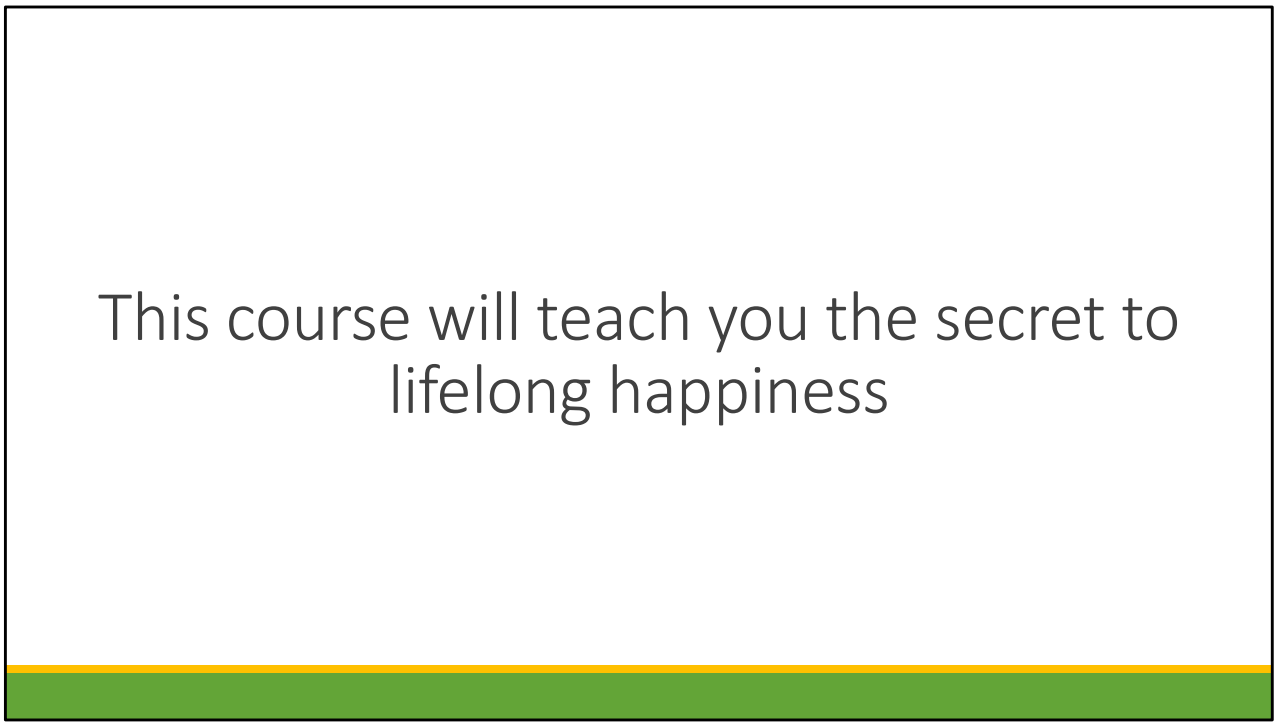
UNIVERSITY OF SAN FRANCISCO

Ph.D. EECS UCB. 30 years in tech—TV. 4th semester teaching at USF, really enjoy it.

This is the computer I used for my first college computer science course as a freshman. DEC VAX 11/750. It was shared by 600 undergraduates. Four years later, everyone had a personal computer.

Why are you taking this course?

Required for major, want the major
Want to learn about computer programming because like it
Want to learn what I like, figure CS could be it
Heard prof is really good
SHOW OF HANDS!



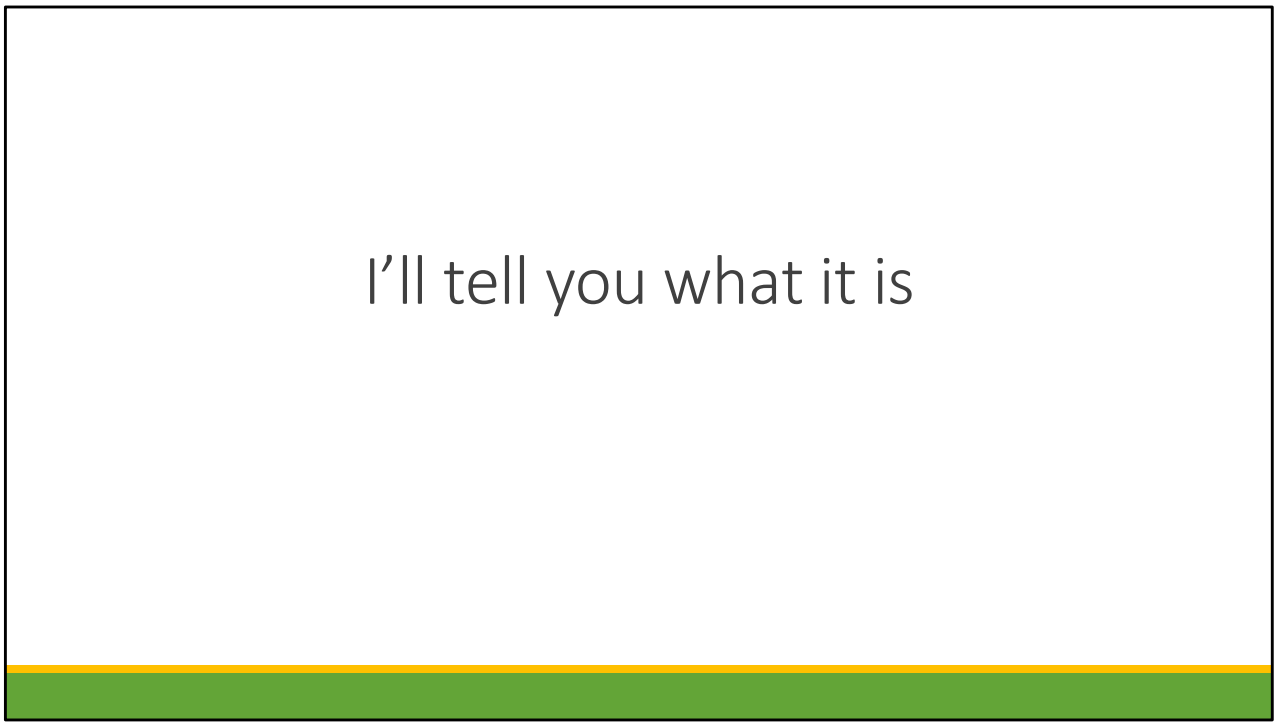
I'm not joking, entirely

Money

…is not it

(LINK)

Surveys show happiness plateaus after salary of about $80k/year



Anybody want to cover your ears?

It is...

...working really hard at something you care about and succeeding at it

YOU WILL WORK HARD IN THIS CLASS. 12 hours per week, all in. TALK THRU THIS!
IF YOU WORK HARD, AND GET HELP WHEN YOU NEED TO, YOU WILL SUCCEED.
++++++++++++++++++
I spent 10 years in college. I currently have 3 kids in college. I know a lot about college.
The lessons probably sound simple and boring but…

- Start assignments early. Every 1:45 class will have ~1 hr lec + 45 minutes to present/start HW, which I call "labs"
- Get help! I am a very informal guy. The TA's are great. Come talk w us
- A college student's most precious resource is TIME. PLAN YOUR TIME! WEEKLY PLAN. Use it efficiently
- Get >= 6 hours of sleep per night. Try. I learned this as a junior. Once as a soph, I woke up at 8am Monday and went to bed at 11pm on Wednesday. I was almost hit by a bus walking against a red light I didn't notice. I had computer lab from midnite to 5am

Down to business

The USF Computer Science sequence is becoming:

- CS 110, CS 111 (CS 186), CS 112
- You need Java programming experience to succeed in this class

This course will cover…

Programming in Java
Software design, especially Object Oriented design
Debugging
Intro to SW testing concepts
Data types and data structures
Recursion
Brief intro to graphics

Administrative topics (1 of 3)

Syllabus online in Canvas. It is subject to change

Office hours:

- 11:30am – 12:30pm in person Mon/Wed, outside Harney 148
- 3:00 – 3:45pm Mon/Wed, outside Harney 148
- 12-1:30pm Thurs, via Zoom
- Or by appt
- I am an informal guy—just shoot me a note saying "Can we talk 5 minutes on Friday?"

TA's: Chandana Srinivas and Andrew Liu

Textbook: *Java Software Solutions* by Lewis and Loftus (8th or 9th edition)

Course **communication tools**: email, Piazza, GitHub. *Not* Canvas, please

You will not do well unless you attend classes regularly.

Other book: learning.oreilly.com "Head First Java 3rd edition". Free! (Also "Head First Git")

Administrative topics (2 of 3)

Course components:

- Labs (homework): 20% of final grade
- Quizzes: 15%
- Two big projects: 25% total
- Midterm: 15%
- Final: 25%

I will **curve the course grade**

Grades for SW depend both on correctness of code and clean professional coding style

- I will give guidelines

Attendance not mandatory but *strongly encouraged*

Late-day policy for late homeworks, projects. **No make-ups** for missed tests, quizzes, in-class labs

- Talk with me about exceptions i.e. with doctor's note

Curving: will not enforce Gaussian distribution. Will adjust grade thresholds so reasonable number of students get A's, B's, and C's. Will "publish the curve" approx. weekly after the first few assignments.
Quizzes each only about 1% of grade.
LATE homework/projects: share policy! 10 "credit days".

Administrative topics (3 of 3)

Flipped Lectures…

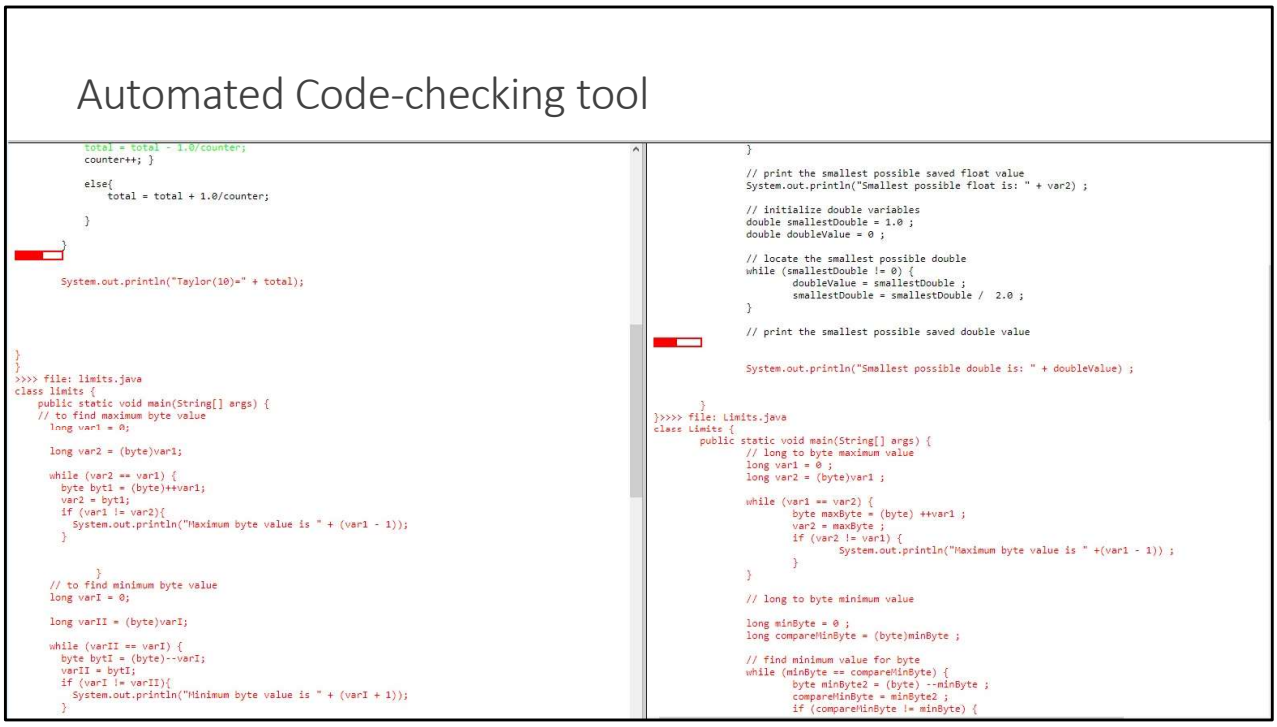
Honor Code – zero tolerance for cheating

- Zero for assignment
- Every incident is reported to the University's Academic Integrity Committee
- Second incident causes automatic "F" for the course. Only appeal is to the Academic Integrity Committee

Scott and “C” in O-chem
Monica and "C-" in O-chem
If found guilty of cheating, your college transcript will say "Suspended for Honor Code violation" for the rest of your life
#1 issue among USF CS faculty. I think I am pretty successful at dissuading my students

- All exams and quizzes are paper and pencil
- I use an online system with every HW and proj that looks for similar code. Takes me 5 seconds. Pretty effective
- I give students a ton of help. Don’t cheat—come to me for help! BUT DON’T START LATE!

Automated Code-checking tool



```
            total = total - 1.0/counter;
            counter++; }

            else{
                total = total + 1.0/counter;

            }

        }

        System.out.println("Taylor(10)=" + total);




}
}
>>>> file: limits.java
class limits {
    public static void main(String[] args) {
    // to find maximum byte value
      long var1 = 0;

      long var2 = (byte)var1;

      while (var2 == var1) {
        byte byt1 = (byte)++var1;
        var2 = byt1;
        if (var1 != var2){
          System.out.println("Maximum byte value is " + (var1 - 1));
        }


            }
      // to find minimum byte value
      long varI = 0;

      long varII = (byte)varI;

      while (varII == varI) {
        byte bytI = (byte)--varI;
        varII = bytI;
        if (varI != varII){
          System.out.println("Minimum byte value is " + (varI + 1));
        }
```

```
            }

            // print the smallest possible saved float value
            System.out.println("Smallest possible float is: " + var2) ;

            // initialize double variables
            double smallestDouble = 1.0 ;
            double doubleValue = 0 ;

            // locate the smallest possible double
            while (smallestDouble != 0) {
                    doubleValue = smallestDouble ;
                    smallestDouble = smallestDouble /  2.0 ;
            }

            // print the smallest possible saved double value


            System.out.println("Smallest possible double is: " + doubleValue) ;


        }
}>>>> file: Limits.java
class Limits {
        public static void main(String[] args) {
                // long to byte maximum value
                long var1 = 0 ;
                long var2 = (byte)var1 ;

                while (var1 == var2) {
                        byte maxByte = (byte) ++var1 ;
                        var2 = maxByte ;
                        if (var2 != var1) {
                                System.out.println("Maximum byte value is " +(var1 - 1)) ;
                        }
                }

                // long to byte minimum value

                long minByte = 0 ;
                long compareMinByte = (byte)minByte ;

                // find minimum value for byte
                while (minByte == compareMinByte) {
                        byte minByte2 = (byte) --minByte ;
                        compareMinByte = minByte2 ;
                        if (compareMinByte != minByte) {
```

I run this automatically as part of auto grading. I look at results

This is not a first-level course

Quiz #1! Due Monday Sept 29th at start of class

- The course will teach you everything you need
- But the CS 111 review material will be covered VERY quickly

GIVE QUIZ NOW!

Some questions about your bg. I will NOT use these at all during this class…
Some programming questions that I think you should be able to solve. If not, consider CS186, or talk w me.

Guts of a computer

Computer Guts

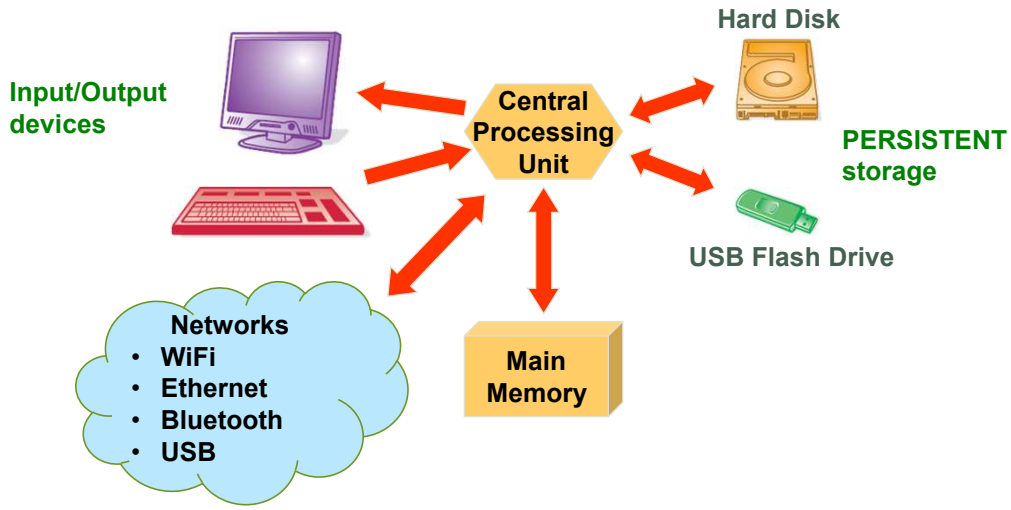
What can you name?

My laptop is quite old:
- 8 GB memory
- 480 GB disk capacity
- Intel i3-2370M CPU (released January 2012)
- Windows 10 “21H2” version
- 1366x768 display

CPU, RAM, Nonvolatile storage, keyboard, display, mouse.
Motherboard, power supply, fan, WiFi radio, USB ports, audio port, HDMI port

MacOS, Windows, Linux. Others: Android, VxWorks

Primary components of a computer



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OPEN UP THE BROKEN COMPUTER!

Show FULLSCREEN video using VLC

Quick discussion on networks

WiFi, Ethernet

Bluetooth, USB

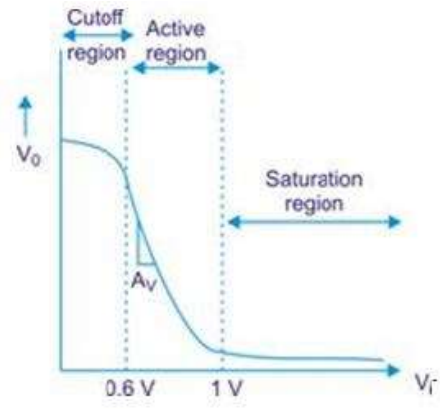
Wired and wireless
1) IP protocol. Connect computers to other computers mostly. Email, WWW, file transfer, file sharing, etc
2) Connect a computer to I/O devices: keyboards, mouse, printer, headphones, nonvolatile storage. Screen clicker!
USB also supplies electrical power. My bicycle lights recharge via USB

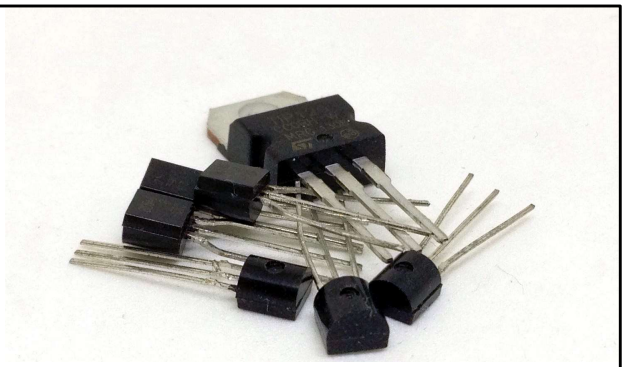
Why ever use wired? Faster. More scalable. More secure

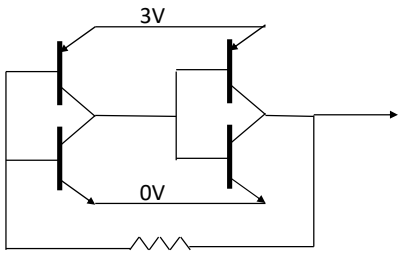
Computer Memory

Built of transistors

A small “circuit” stores one of two states







SHOW CIRCUIT BREADBOARD via VLC

“State” = (0V, 3V) or (“low”, “high”) or (“0”, “1”)

Bit Permutations

1 bit	2 bits	3 bits	4 bits	
0	00	000	0000	1000
1	01	001	0001	1001
	10	010	0010	1010
	11	011	0011	1011
		100	0100	1100
		101	0101	1101
		110	0110	1110
		111	0111	1111

A bit (binary digit) is something that can take one of two values

Each additional bit doubles the number of possible permutations

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Previous circuit stores one bit.
COMPUTERS USE BINARY BECAUSE OF HOW TRANSISTORS BEHAVE
WHAT IS RANGE OF POSSIBLE VALUES WE CAN STORE WITH 8 BITS?

Computer Memory

From software view, computer memory acts like dictionary or look-up table

Address	Value
0000	0000 1111
0001	1111 1100
…	
1000	0011 0101
1001	0000 0000
1002	0000 0000
…	

Traditionally computer memory structured so that each address maps to 8 bits = 1 byte

Computer Variables

We assign meanings (interpretations) to values: could be integers, floating point numbers, text strings, colors, etc.

Most computer languages let us use names rather than numerical addresses

Most computer languages let us group several addresses together, so a value can include more than 8 bits

Addresses	Name	Interpretation	Values
100-115	petName	"Paul's Gray Cat"	80, 97, 117, 108, 39, 115, 32, … 116, 0
1000-1002	petColor	GRAY	20, 20, 20
1004-1007	sodaPrice	$1.25	00, 01, 02, 05
1008-1015	PI	3.1415926	87, 225, 11, 0, 0, 113, 24, 77
1016-1031	worldPopulation	7999545000	63, 11, 24, 31, …, 0
…			

Central Processing Unit

Also built of transistors, more complicated circuits than memory

Functions of CPU: name some?

1) Read and write memory values
   - Read/write to other devices e.g. keyboard, mouse, disk, WiFi, USB, etc
2) Interpret some memory values as INSTRUCTIONS and execute those INSTRUCTIONS
3) System maintenance: keep track of time, temperature, etc

CPU Instructions

Math: ADD, SUB, MULT, DIV

Logic: AND, OR, NOT, COMPARE

Program execution: JUMP to new instruction, CONDITIONAL jump

Data: LOAD, STORE

These instructions and their operands are stored as values in memory. CPU interprets the values as instructions. A program represented with these numerical values is called "machine code". Program from my CS-55 course:

- 005003
- 105004
- 051013
- 105023
- 005033 …

Interpret some memory values as a sequence of INSTRUCTIONS, and perform those instructions

HUMAN BEINGS DO NOT LIKE READING OR WRITING MACHINE CODE.

Types of CPUs

- Intel & AMD: x86 (from old chip names e.g. 80286)
- Apple: M1
- ARM, Motorola, RISC-V, etc

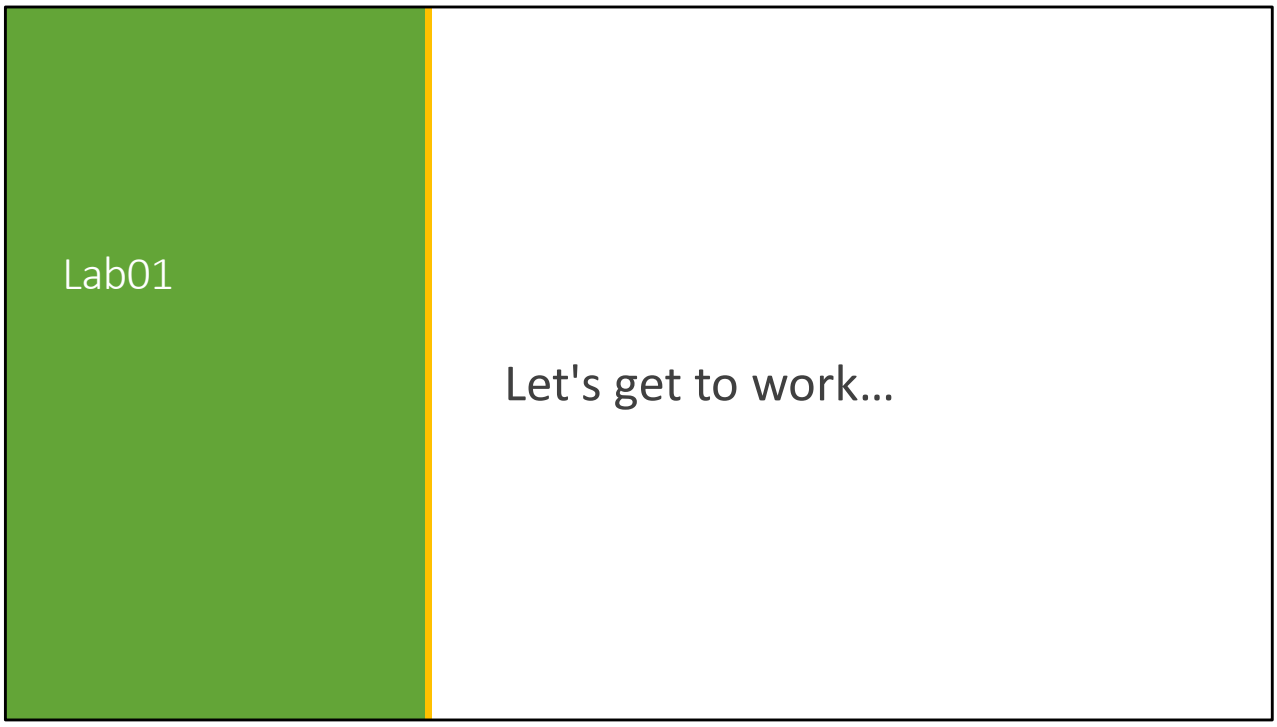
All have different machine languages. Software compiled for one type will not run on another type (must recompile).

JAVA is one solution for need to run same program on many different types of computers

Reading

Java Software Solutions

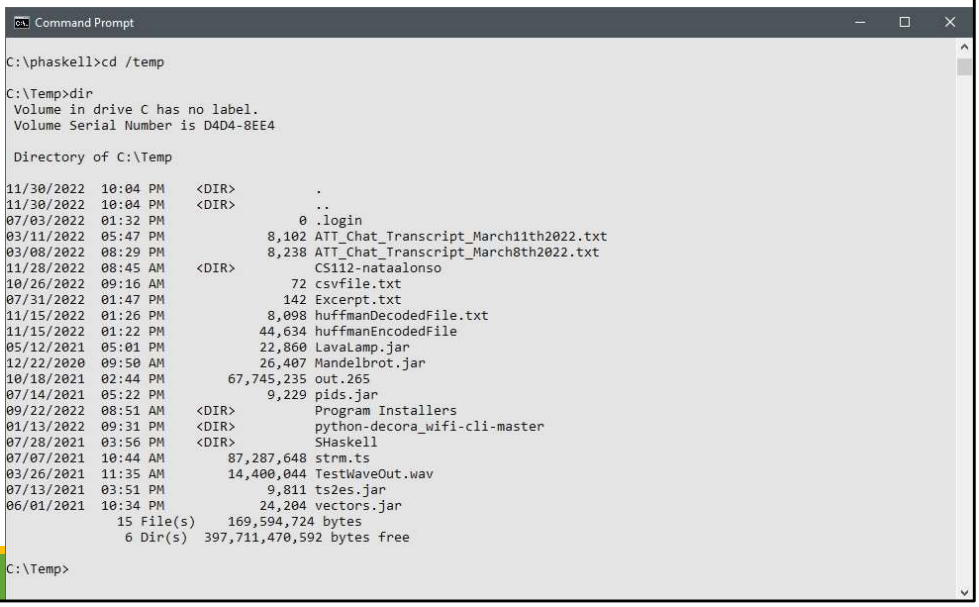
- For today: sections 1.1, 1.2, 1.3
- For next time: sections 1.4-1.6, 2.1-2.3



THIS IS A REAL, GRADED LAB FOR THE COURSE. Mostly installing and setting up sw.
We are here to help you all succeed with this one—lots of help. Don't be shy about asking.

Command Window

This week's lab documentation has a "how-to" guide for using a command window



Show it off! Windows vs Mac

Lots of commands we will use in this class will be via cmd window, not graphical SW!
This week is a great time to get 15 minutes of practice!

Lab01

Goals:

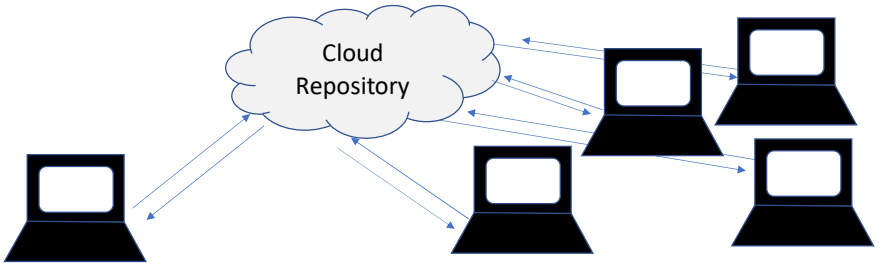
- Install and set up software that you will use to fetch course materials and turn in course assignments: Git and GitHub
- Start to become familiar with these tools
- Submit a few documents:
  - Confirm your success with Git and GitHub
  - Help me **learn your names**: some info and photo
  - LMK if this is a problem

Git and GitHub

GitHub is a cloud based “repository” of files, like Google Docs, but for software source code

Throughout the course I will distribute files to you by uploading them to GitHub and telling you to download them

You will submit assignments by uploading them to GitHub before assignment deadlines. The TA’s and I will retrieve them and grade them (and enter grades in Canvas)



Lab01

Take a break whenever you need to

Then please retrieve Lab01 instructions from
https://www.cs.usfca.edu/~phaskell/CS112/Lab01.pdf

All documentation for this course:

- All following Lab assignments
- Project assignments
- Lecture notes
- Reading assignments
- Etc

will be distributed via GitHub (not Canvas)

LOOK AT GITHUB PAGE FOR COURSEINFO. SEE README.md FILE!