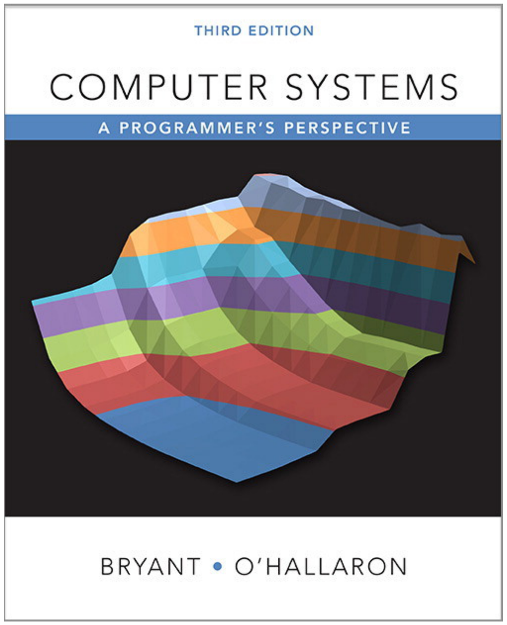
CS 4400 – Computer Systems



Instructor:	Matthew Flatt
TAs:	Ashish Gupta
	Atul Sharma
	John Young
	Monish Gupta
	Taylor Smith

Course Information

`https://www.eng.utah.edu/~cs4400/`

- Prerequisite: CS 3810
- Recommended: CS 3505

Registering for CS 4400 Fall 2018

- There's a waiting list

- Preference given to students who need the course now to satisfy requirements

  e.g., CE student to take ECE 5780 in the Spring

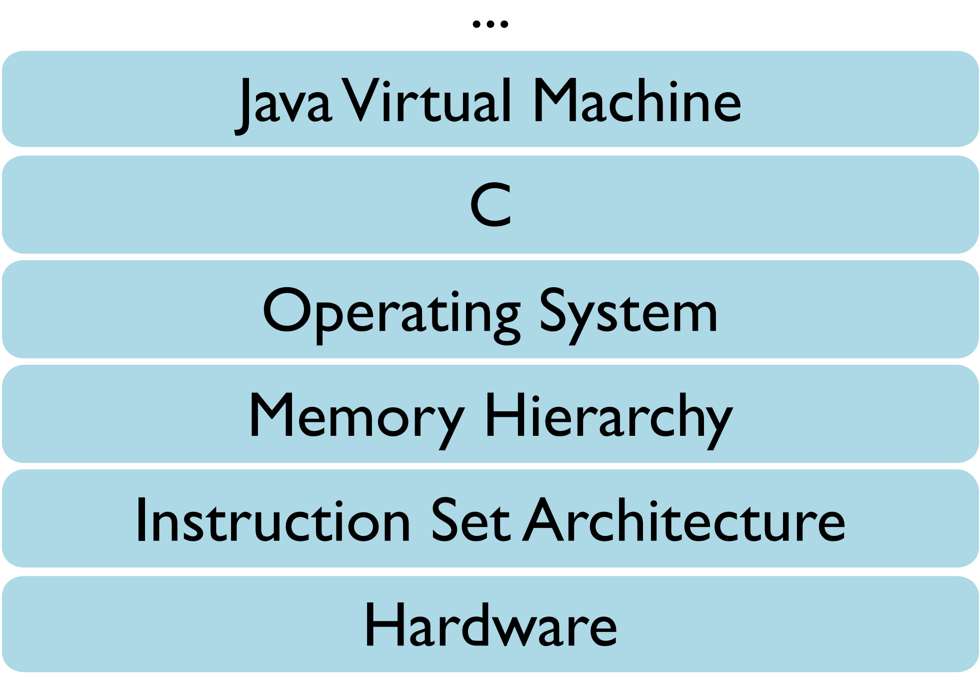
- Waiting list or permission code: e-mail **`tracyv@cs.utah.edu`**

  — CC **`mflatt@cs.utah.edu`**

  --- please include details of need in request

Why CS 4400?

Explore layers of abstraction — especially the lower ones, but above hardware



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Java Virtual Machine

C

Operating System

Memory Hierarchy

Instruction Set Architecture

Hardware

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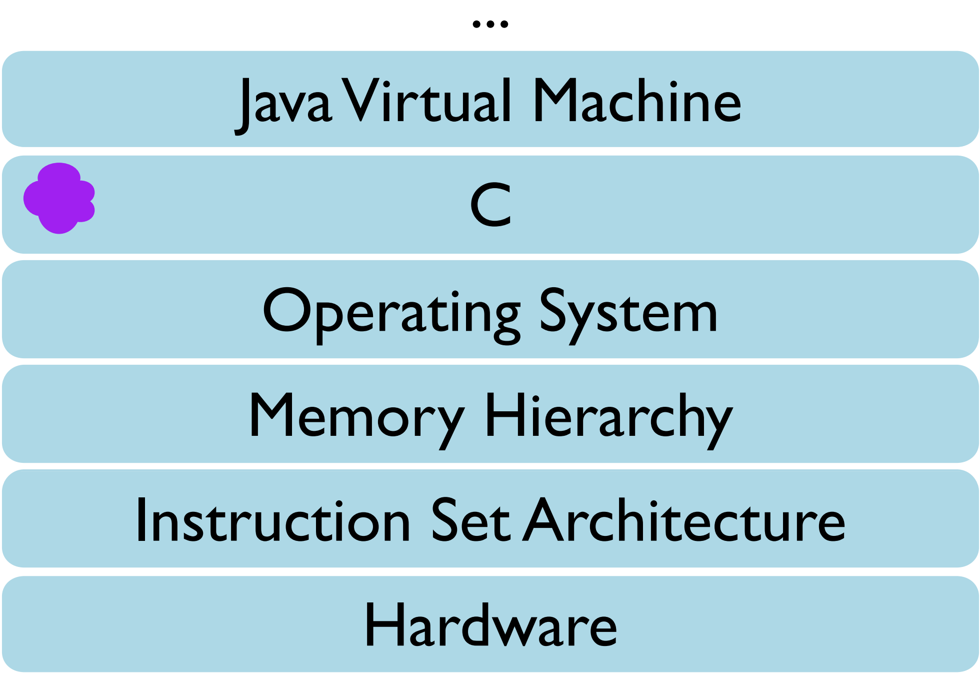

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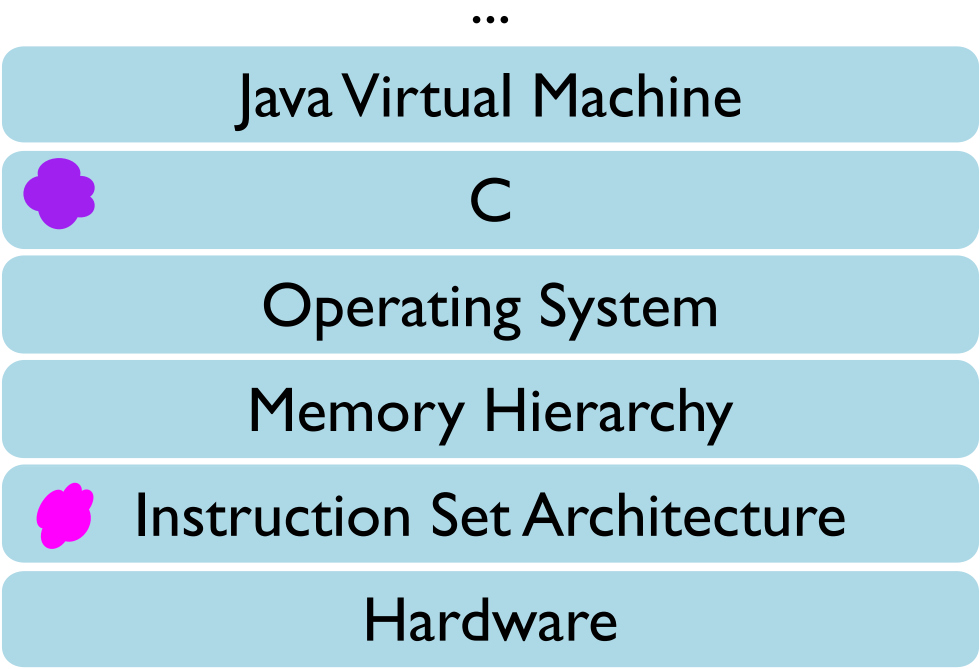

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Course Skills

Unix both technically and culturally

- Processes, file descriptors, sockets
- Shells, **`gcc`**, **`gdb`**

C as a "portable assembly language"

- Exposed data representations
- Unsafe
- Manual memory management

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ANSI C = C89 = C90

default **gcc** on CADE machines

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Seriously!

We'll count C99/C11 homework as wrong

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x86-64 but transferrable to, e.g., ARM

Course Concepts

Representing data, especially numbers

Instruction sets

Optimization

Linking

Processes and signals

Memory allocation

Networking APIs

Concurrency

Useful Outcomes of CS 4400

You will be a more effective programmer

- detecting and fixing bugs more efficiently
- understanding and tuning program performance

You will be comfortable using the terminal and command line

You will have a firm foundation for specialized systems classes and real-word software development

CS 4400 Organization

- Video lectures
- Before-class quiz on videos
- Recitation-style class
- Lab sessions
- Homework assignments

Course Structure: Homework Assignments

match

bomb (disassembly)

performance

linking

shell

malloc

server

2 weeks each, sometimes student-specific

Course Structure: Videos, Classes, and Lab Sessions

Before Monday & Wednesday:

- video lectures posted
- quiz on video due 1 hour before class

Monday & Wesneday:

- class meets for extended examples

Thursday:

- lab session in MEB 3167 (*not* CADE)

Command-Line Arguments

Running Programs at a Command Line

```
$ /bin/cat one.txt two.txt
```

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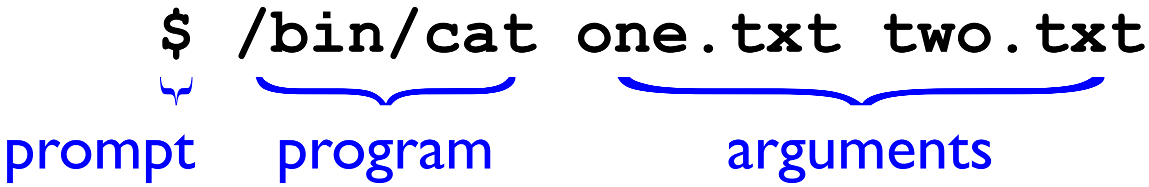

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```

Running Programs at a Command Line

A command line is itself a program known as a ***shell***

The default shell is **`/bin/bash`**

```
$ /bin/echo a   b
```

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$$\texttt{\$ /bin/echo }\underbrace{\texttt{a}}_{\text{argument}}\quad\underbrace{\texttt{b}}_{\text{argument}}$$

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$$\texttt{\$ /bin/echo "}\underbrace{\texttt{a~~b}}_{\text{argument}}\texttt{"}$$

Shell Quoting

Both

"

and

'

are quotes in **`bash`**, but with different rules

More information:

```
man bash
```