



UNIVERSITY OF  
RICHMOND



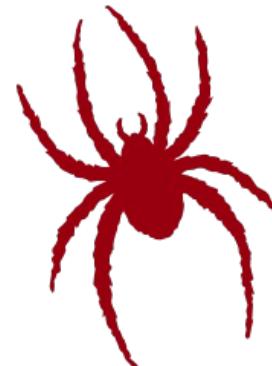
A photograph of several students walking away from the camera on a paved path through a university campus. They are dressed in casual attire, including jeans and backpacks. The path is lined with large pine trees and leads towards a brick building with arched windows and doors. A pink flowering tree is visible in the background. The scene is bathed in warm sunlight, casting long shadows on the grassy areas.

Welcome to CMSC 240!

**CMSC 240 Software Systems Development**  
Fall 2023

# Today

- Introductions
- Course logistics
- Motivation
- Hello C++
- Environment setup
- In-class coding exercise





# Introductions



# Dr. David Balash



May 2023

- Prof. David Balash  
*“Ba-lish”*
- He/Him
- BS in computer engineering Iowa State
- Two-decade career as a software engineer
- MS and PhD in computer science from GW
- Research: Computer S&P

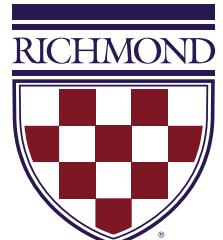


# Dr. David Balash

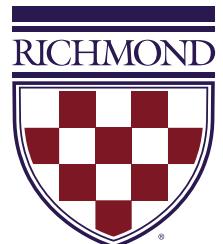


Shenandoah National Park

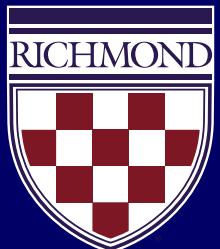
- Things I like
  - Learning
  - Hiking
  - Cycling
  - Guitars
  - Board games
  - Programming
  - Cats



# The Cats: Jake and Elwood

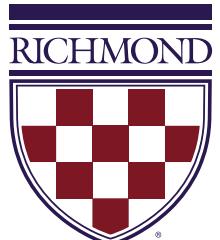


Ask me anything



# Classroom Meet and Greet

1. Introduce yourself to a person near you
  2. Introduce yourself to a different person near you
- Potential conversation topics:
    - What are some of the things that you like?
    - Who are your favorite pets?
    - Why do you want to take this class?



# Student Introductions

- Name
- Pronouns
- Major
- Class year
- Favorite snack food



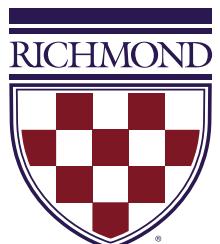


# Course Logistics



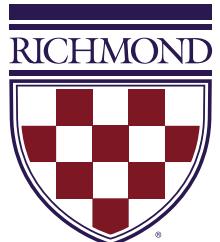
# Classroom Norms

- Questions are always welcome!!
  - Ask them at any time
- “I don’t know” is okay
- Be curious
- Treat peers and instructors with kindness and respect
- Communication is key!
- Seek support when needed



# Where All Class Information Can Be Found

<https://cmsc240-f23.github.io>



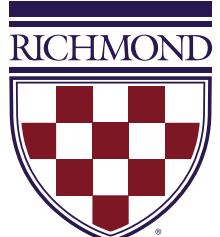
# How to Communicate With Me

- Public or private post on Ed
  - <https://edstem.org>
- After class or in office hours - 223 Jepson Hall
  - Tue 3:00PM - 4:00PM
  - Fri 2:30PM - 4:30PM
  - and by appointment <https://calendly.com/davidbalash>
- Email
  - [david.balash@richmond.edu](mailto:david.balash@richmond.edu)



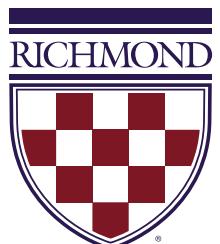
# Course Outline

- **Weeks 1-5** Introduction to C++ programming
  - Syntax, memory management, libraries, file IO
- **Weeks 6-10** Object-oriented programming
  - Abstraction, polymorphism, inheritance, encapsulation
- **Weeks 11-15** Software systems development
  - UML, design patterns, testing, debugging



# Learning Outcomes

- Experience modern C++ programming
- Gain familiarity with Unix/Linux environments
- Understand the software development life cycle
- Practice object-oriented programming and design
- Understand design patterns, reuse, and usability
- Exposure to version control systems
- Demonstrate skill in software testing and debugging



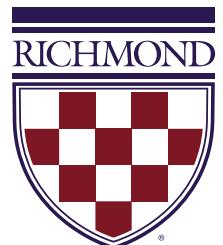
# Lecture

- Tuesdays and Thursdays Jepson G04
- Will usually include in-class exercises
- In-class exercises will be due one week from when they are assigned (except during break)
- Regular attendance is expected
- Students who are sick should not attend class
- Notify me in advance of the absence, if possible



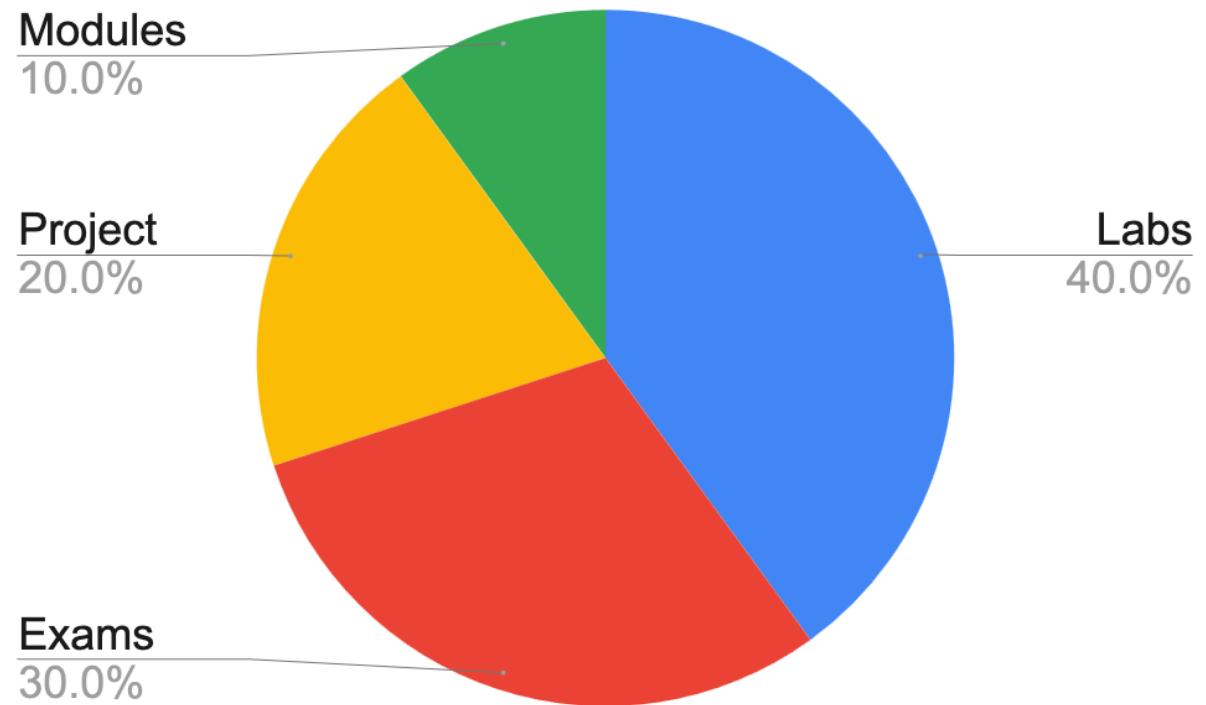
# Labs

- Fridays in Jepson G03
- Lab assignments done individually and in groups
  - but will always be turned in individually
- Lab assignments are typically due at 5:00 pm on the night prior to the next lab (except during break)
- Please ask for help from me or the lab assistant



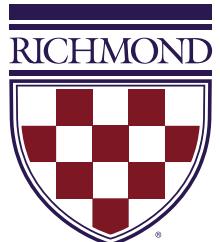
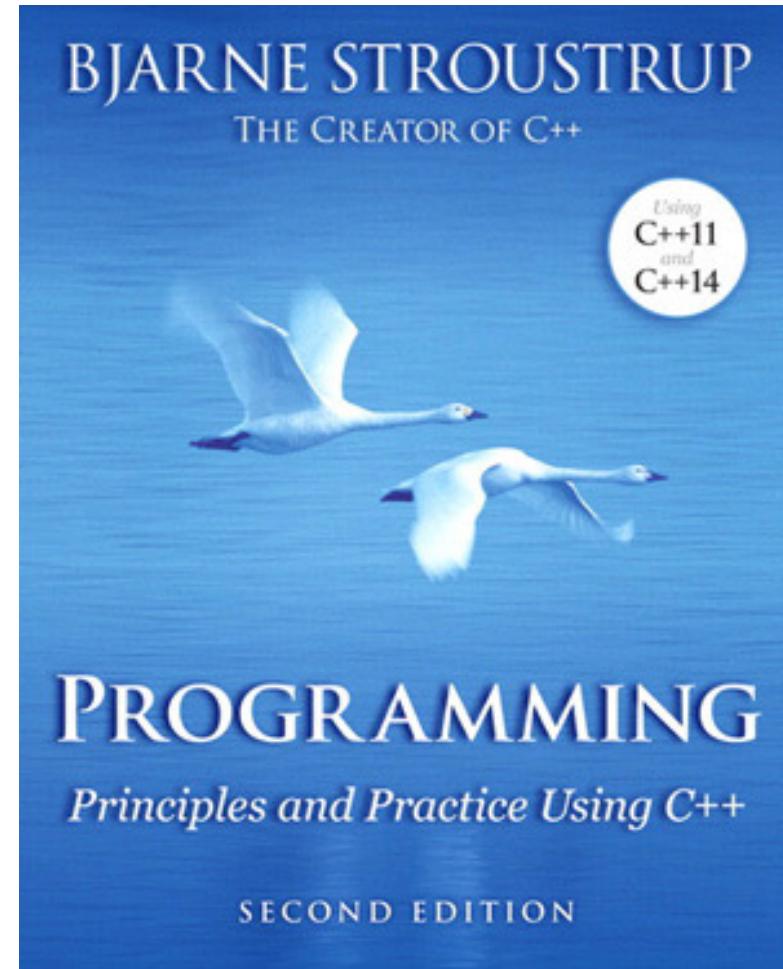
# Coursework and Grading

- Modules (In-class coding exercises)
- Lab assignments
- Programming project
- Midterm exam
- Final exam

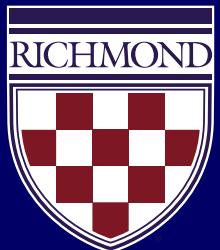


# Textbook

- Free electronically from the UR library
- Reading assignments

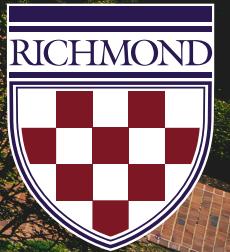


# Ask me questions





Motivation



# C++ is a Very Popular Language

Aug 2023	Aug 2022	Change	Programming Language	Ratings	Change
1	1		 Python	13.33%	-2.30%
2	2		 C	11.41%	-3.35%
3	4	▲	 C++	10.63%	+0.49%
4	3	▼	 Java	10.33%	-2.14%
5	5		 C#	<b>7.04%</b>	<b>+1.64%</b>
6	8	▲	 JavaScript	3.29%	+0.89%
7	6	▼	 Visual Basic	2.63%	-2.26%

TIOBE Index for August 2023

# Many Open-Source Projects

language:C++

Filter by

- Code 76.5M
- Repositories 1M
- Issues 4M
- Pull requests 3M
- Discussions 0
- Users 983k
- More

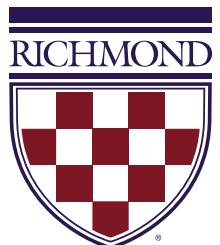
Advanced

- Owner
- Size
- Number of followers
- Number of forks
- Number of stars
- Date created
- Date pushed
- Topic
- License
- Archived

More than 1M results (717 ms) Sort by: Best match ▾ Save ...

- totemstech/neuraln**  
Source code repository for the Book GPU Pro 7  
C++ · ⭐ 274 · Updated on Jun 29, 2015
- wolfgangfengel/GPU-Pro-7**  
Source code repository for the Book GPU Pro 7  
C++ · ⭐ 273 · Updated on May 3, 2016
- YCAMInterlab/ofxTimeline**  
lightweight timeline tools for openFrameworks  
C++ · ⭐ 265 · Updated on Aug 24, 2020
- TooTallNate/node-iOS**  
Native node bindings to iOS functionality (vibrate, acceleromoter, geoservices, etc.)  
C++ · ⭐ 264 · Updated on Aug 5, 2011
- shangjingbo1226/SegPhrase**  
C++ · ⭐ 258 · Updated on Oct 29, 2020

<https://github.com>



# Cool Things Were Built With C++

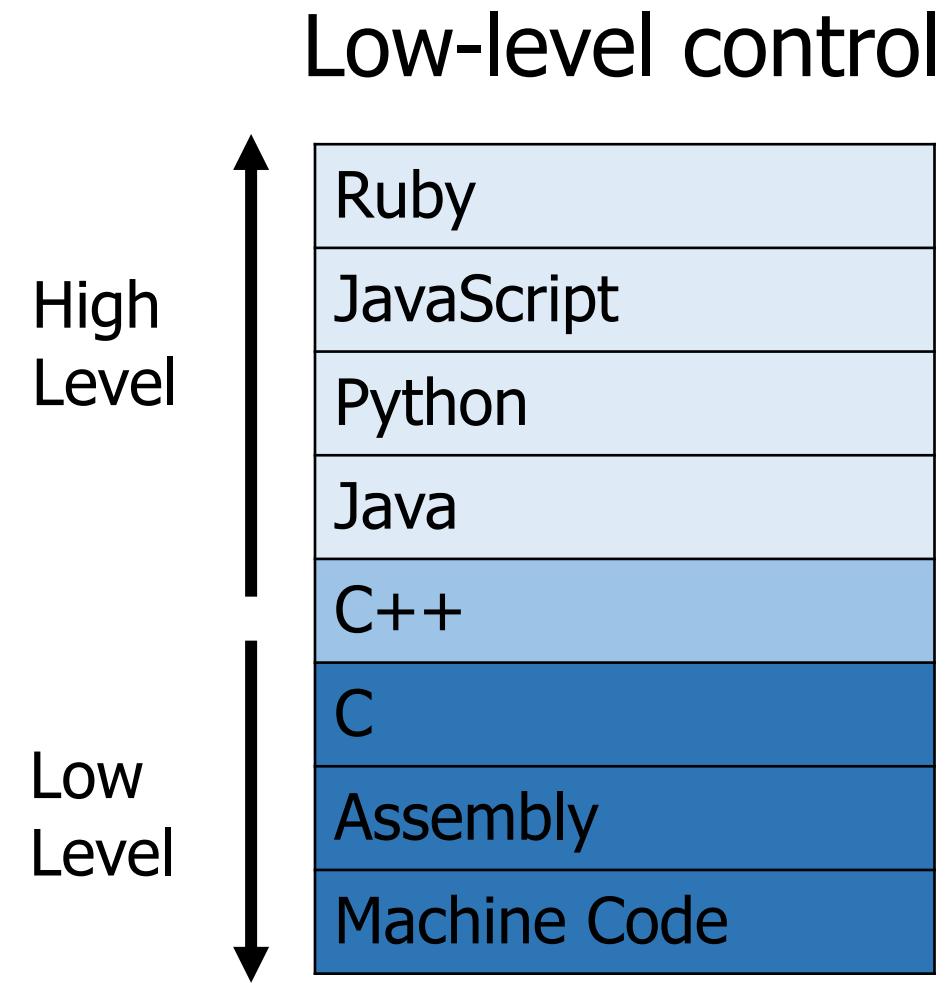
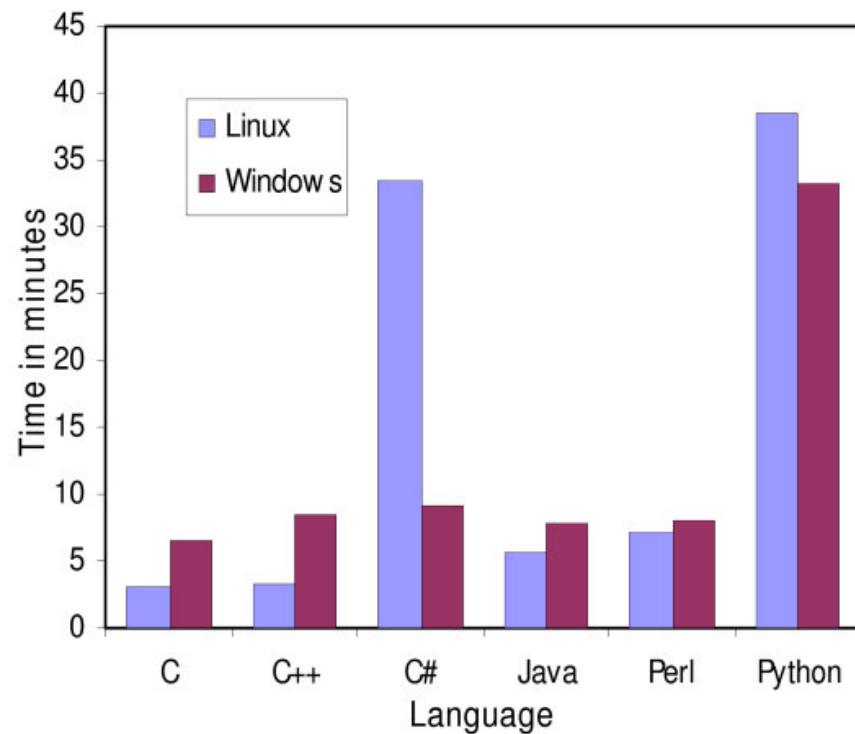


Google



# What Makes C++ Great?

Speed: It's Fast!

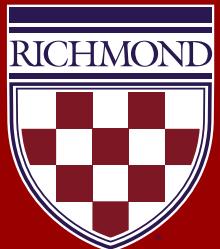


# Foundational Software Development Skills

- Object-oriented design
- Software development life cycle
- Design patterns and code reuse
- Version control systems
- Testing and debugging



# What motivates you?





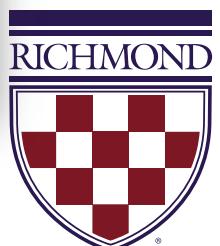
A wide-angle aerial photograph of a university campus. In the center is a tall, ornate red brick tower with multiple spires and arched windows. To its left is a large white building with a gabled roof. The campus is surrounded by a variety of trees, including several large evergreens and some with bright yellow leaves. In the foreground, there are paved walkways and paths where several people are walking. The sky is clear and blue.

Hello C++



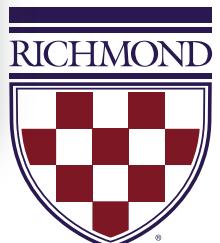
# Writing Your First C++ Program

```
→ // This program outputs the message "Hello, World!"  
→ #include <iostream>  
→ using namespace std;  
  
→ int main()  
→ {  
→     cout << "Hello, World!" << endl;  
→     return 0;  
→ }
```



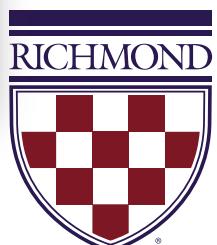
# Writing Your First C++ Program

```
// This program outputs the message "Hello, World!"  
#include <iostream>  
// Without using namespace std  
  
int main()  
{  
    std::cout << "Hello, World!" << std::endl;  
    return 0;  
}
```



# Writing Your First C++ Program

```
// This program outputs the message "Hello, World!"  
#include <cstdio>  
  
int main()  
{  
    printf("Hello, World!\n.");  
    // ^ a C function  
    return 0;  
}
```



# Compile & Execute Your Program

```
g++ hello.cpp -o hello
```

The C++ compiler

The source code file name

Using the `-o` option allows you to name the executable file

```
./hello
```

indicates that the executable resides in the current directory



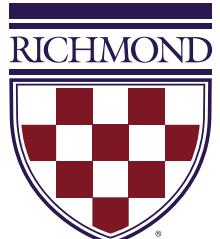
An aerial photograph of a university campus featuring a prominent red brick Gothic-style tower. The campus is surrounded by lush green trees and manicured lawns. Several paved paths and walkways are visible, with a few people walking on them. The sky is clear and blue.

# Environment Setup



# Development Environment

- All work will be compiled, run, tested and graded on the computer science Linux machines:
  - cs01 – cs06.richmond.edu
- GitHub classroom for all assignments
  1. Accept the assignment
  2. Clone repository using VSCode with remote-ssh
  3. Make updates to the code and README.md file
  4. Add (Stage), Commit, and Sync changes



# Development Environment

1. Open a terminal
2. ssh your\_UR\_netid@cs01.richmond.edu  
For example: my netid is dbalash@cs01.richmond.edu
3. Follow instructions:
  - <https://cmsc240-f23.github.io/guides/vscode-ssh>



An aerial photograph of a university campus. In the center is a tall, ornate brick tower with multiple spires and arched windows. To its left is a large, light-colored building with a gabled roof. The campus is surrounded by a variety of trees, including several large evergreens and some with bright yellow spring foliage. A paved walkway leads towards the tower from the bottom left. Several people are walking along the paths. The sky is clear and blue.

# In-Class Coding Exercise

