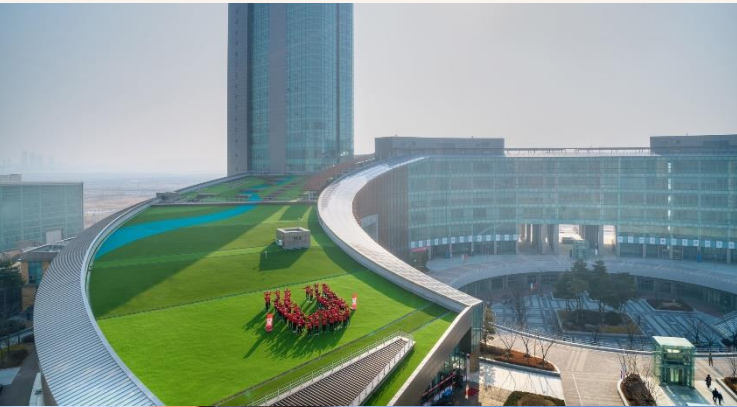




THE UNIVERSITY OF UTAH
ASIA CAMPUS
SOUTH KOREA

Habtamu Minassie Aychew, PhD
Department of Electrical and Computer Engineering



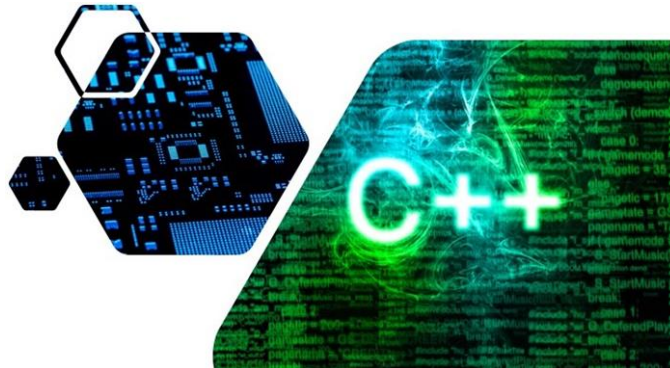
Department of Electrical and Computer Engineering
Spring 2022

Course Title: Accelerated Object Oriented Programming
Course Number: CS 1420

Instructor: Habtamu Minassie Aycheh, PhD
Email: habtamu.aycheh@utah.edu
Office : U759
TA: Seoin Kim

Course Objective

- This course provides the basics of computer programming using C++.
 - Computational problem solving techniques
 - How to write powerful and elegant C++ code



Syllabus

Week	Day	Date	Topic
1	Mon	21/02/2022	Introduction to Programming
	Wed	23/02/2022	Basics of C++
2	Mon	28/02/2022	Reading Day
	Wed	02/03/2022	Program Flow Control –Conditionals
3	Mon	07/03/2022	Iterative Control Statements - Loops
	Wed	09/03/2022	Presidential Election day
4	Mon	14/03/2022	Functions
	Wed	16/03/2022	
5	Mon	21/03/2022	Recursions
	Wed	23/03/2022	Array and Vector
6	Mon	28/03/2022	
	Wed	30/03/2022	Spring Recess
7	Mon	04/04/2022	Pointers
	Wed	06/04/2022	
8	Mon	11/04/2022	Classes and Objects
	Wed	13/04/2022	

Mid Term Exam

Week	Day	Date	Topic
9	Mon	18/04/2022	Encapsulation
	Wed	20/04/2022	
10	Mon	25/04/2022	Inheritance
	Wed	27/04/2022	
11	Mon	02/05/2022	Templates in C++
	Wed	04/05/2022	
12	Mon	09/05/2022	Buddha's Birthday
	Wed	11/05/2022	C++'s Standard Library
13	Mon	16/05/2022	
	Wed	18/05/2022	<ul style="list-style-type: none"> STL Containers STL Iterators STL Algorithms
14	Mon	23/05/2022	Input and Output Streams in C++
	Wed	25/05/2022	
15	Mon	30/05/2022	Local Election Day
	Wed	01/06/2022	
16	Mon	06/06/2022	Memorial Day
	Wed	08/06/2020	

Final Exam

Class Logistics

■ Class

- Time: Monday & Wednesday: 9:00am – 10:20am
- Location: U301

■ Lab

- Time: Wednesday: 10:30am – 11:20am
- Location: U507(LAB)

■ Office Hour

- By appointment

■ Course materials

- Uploaded to Canvas: <https://utah.instructure.com>
 - Please check canvas for lecture slides before class
 - quizzes, assignments, etc..

■ GitHub: <https://github.com/habtamuMin/cs1420>

Evaluation

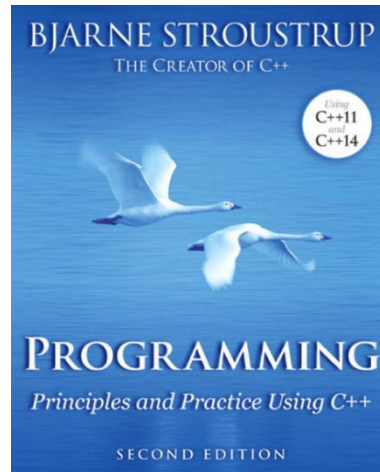
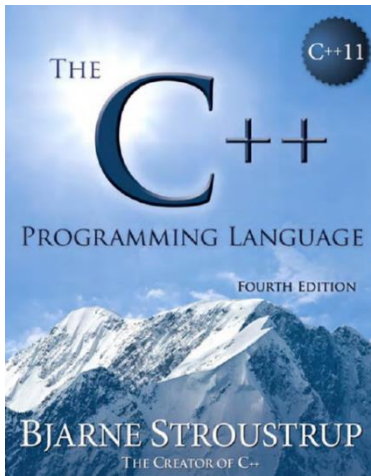
- Class participation: 10%
- Quiz : 10%
- Programming Assignments(PAs) : 40%
- Mid test : 20%
- Final test: 20%

Academic integrity

- You have to be honest in all your academic course work
- Violation will be recorded in your transcript
 - <https://regulations.utah.edu/academics/6-400.php>
- Submit assignment by the deadline
- Attend classes and lab sessions to successfully complete the course. Note that labs are designed to help you get hands-on-practice!

References

- Not Mandatory to buy any textbook
- Useful C++ references



Programming requires “practice”
not just reading!

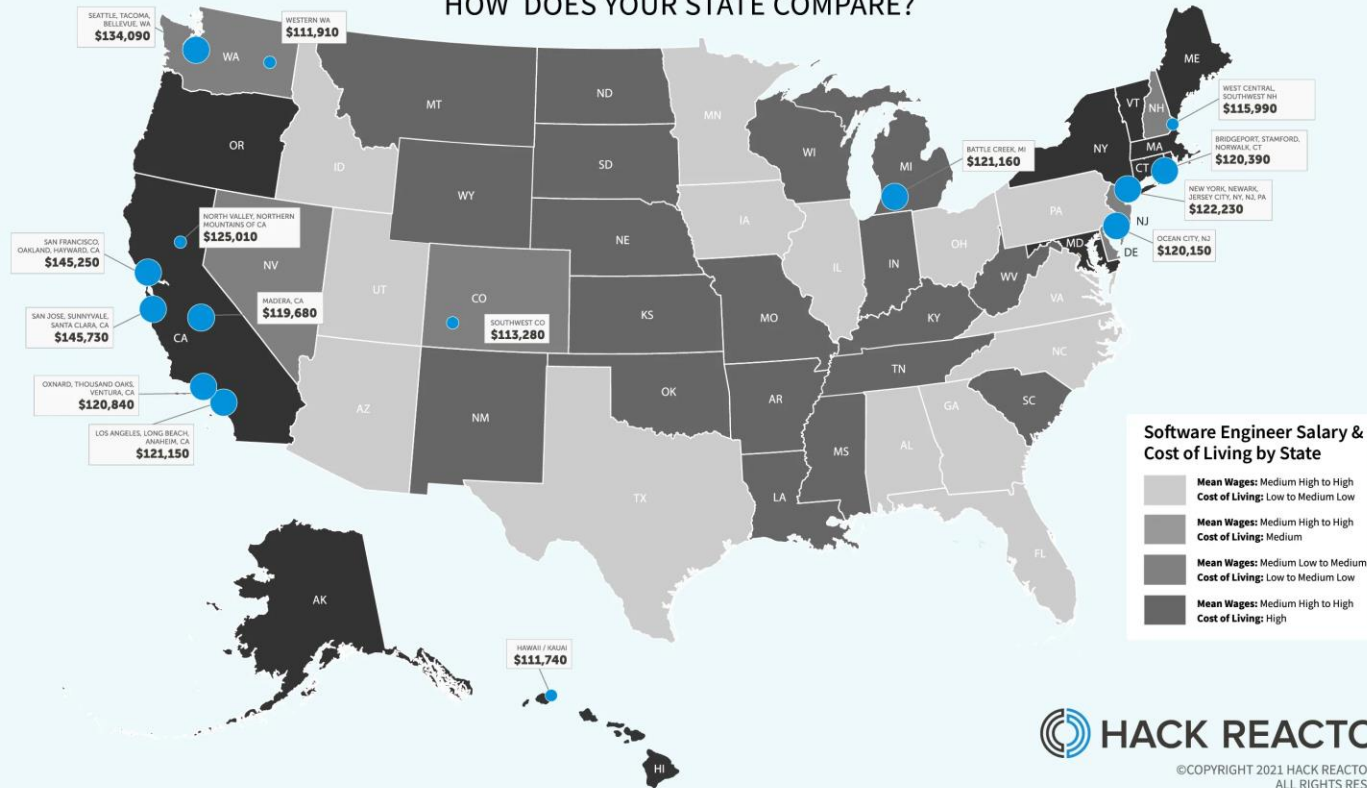


- ❑ Cpp reference: <https://en.cppreference.com/w/>
- ❑ CppCon: <https://www.youtube.com/user/CppCon>

How To Think Like a Computer Scientist C++ Edition

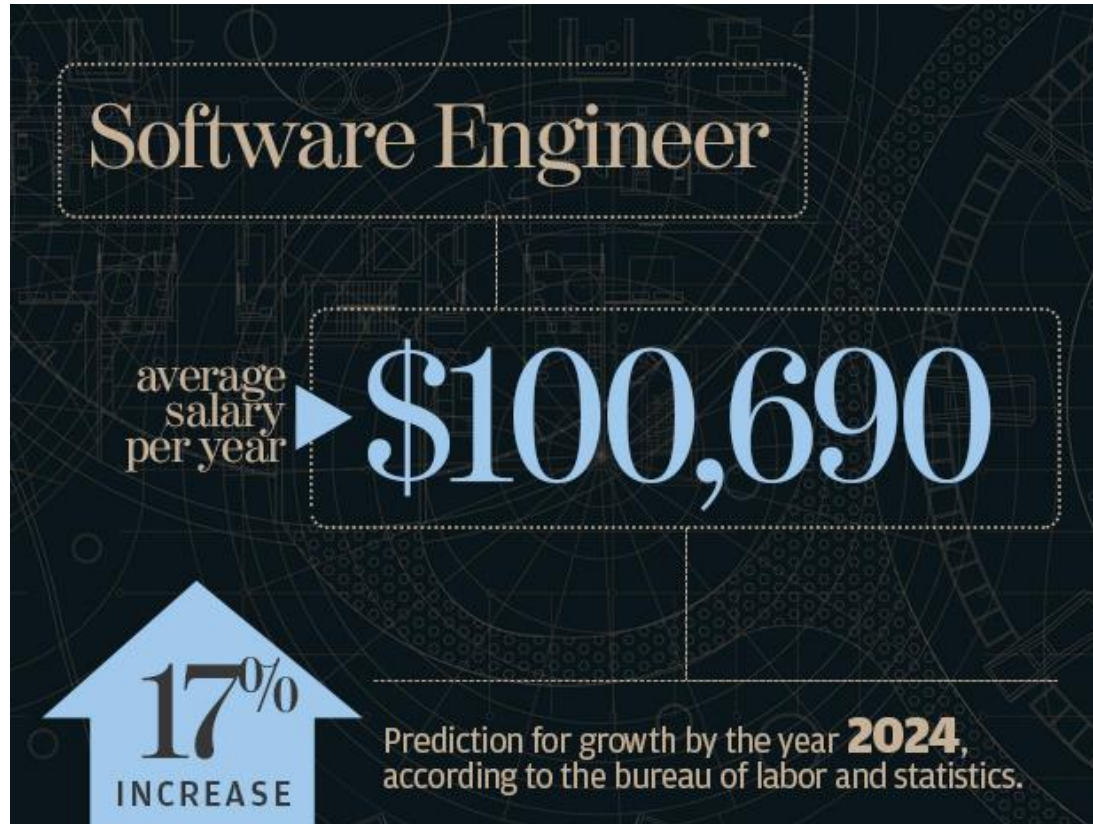
- ❑ <https://runestone.academy/ns/books/published/thinkcpp/index.html>

Motivations



<https://www.hackreactor.com/blog/software-engineer-salary-review-2021-how-does-your-state-compare>

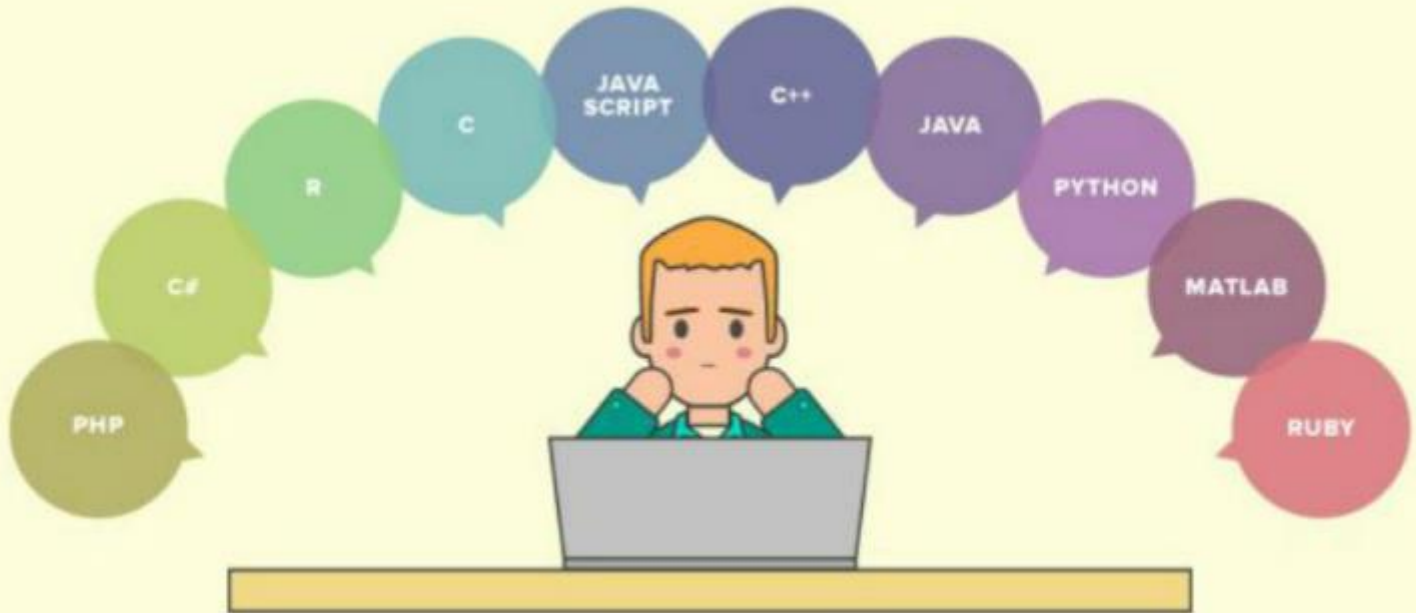
Software Engineer Jobs are Growing!



<https://www.freewarebase.net/2019/08/software-security-engineer-salary.html>

An Often Asked Question

**WHAT
PROGRAMMING
LANGUAGE
SHOULD I
LEARN?**



What is “good” programming language?

- As you all know, there are many different programming languages and many different views on which languages are “good”
- Some languages focus on making programs run fast
- Some languages focus on making easy to write code
- Some languages focus on performing a single task extremely well
- ✓ **Learning “how computers think” and “how you talk to computers through a language” is more important**
 - ❖ **Computational problem solving methods**
 - ❖ **Ideas and concepts**

Example 1: Find a power of a number : a^n

- ❑ Input: a, n ($1 < a, n < 2147483647$)
- ❑ Output: $x = a^n$
 - $a=3, n=4, x=3^4=81$
 - $a=2, n=5, x=2^5=32$
- Naïve method
 - ❑ $2^{16} = 2*2*2*2*2*2*...*2$ total 15 calculations
- Can we do better?

A better way

$$2^{16} = 2^8 * 2^8$$

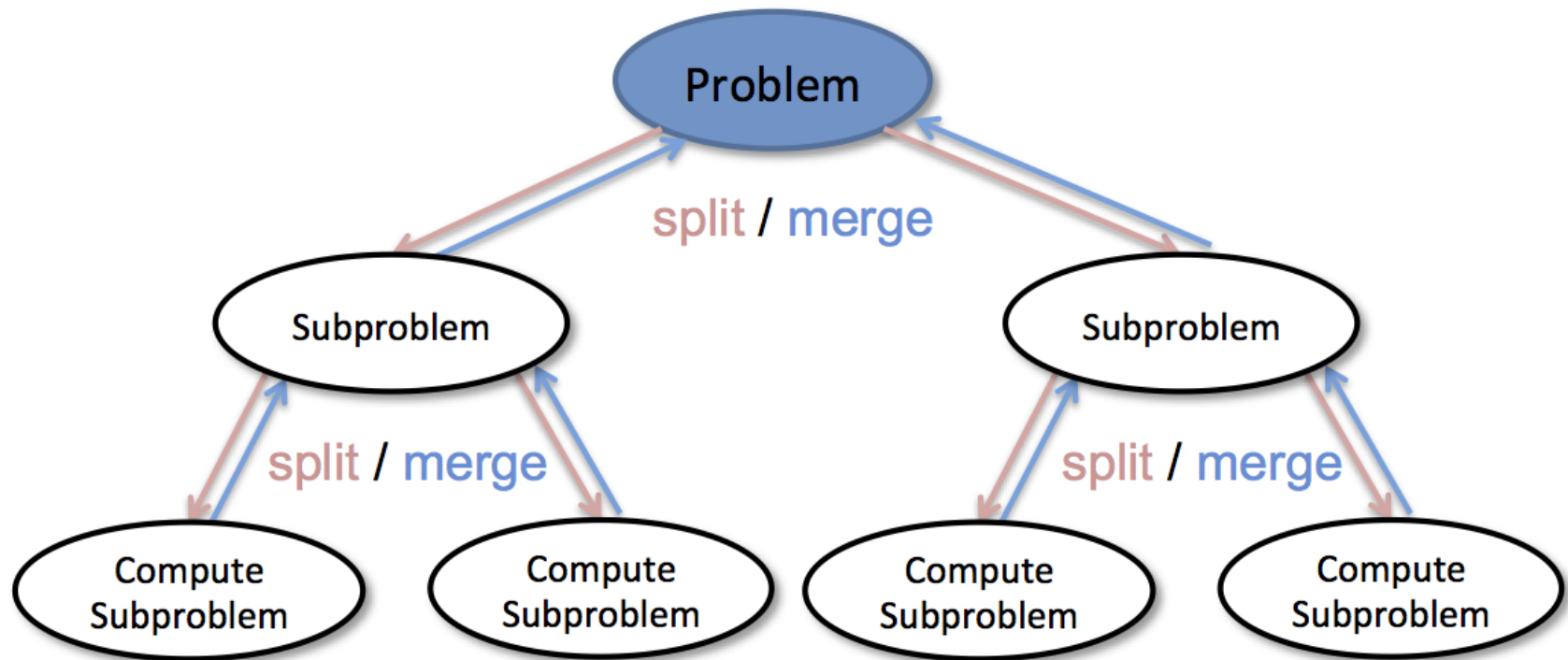
$$2^8 = 2^4 * 2^4$$

$$2^4 = 2^2 * 2^2$$

$$2^2 = 2 * 2$$

We need only 4 calculations!!!

Divide and Conquer is the most basic building block to solve almost all difficult computer problems



How Efficient is it to Compute a^n ?

- Naïve method

- # Computation is linear to n

- Divide and Conquer

- # Computation is : $\log_2(n)$

- Let's say $n = 2147483648$ (2^{31})

- Naïve method takes **2147483647** calculations (~10-30s)
- Divide and Conquer takes only **31** calculations (~1us)
 - 100000000x faster!
- Indeed, this is a **Goog** interview question

Example 2 : Searching

- Consider searching an element in an array

7	11	6	55	98	45	16	96	46
---	----	---	----	----	----	----	----	----

- ❑ What is the index of 6?
- ❑ What is the index of 17?
- ❑ What is the index of 96?

Sort then search



- Consider searching an element in a *sorted* array

7	11	6	55	98	45	16	96	46
---	----	---	----	----	----	----	----	----

6	7	11	16	45	46	55	96	98
---	---	----	----	----	----	----	----	----

- ❑ What is the index of 6?
- ❑ What is the index of 17?
- ❑ What is the index of 96?

Top 10 Programming Languages 2021

Language Types		Rank	Language	Type	Score
Web	Enterprise	1	Python	Web, Mobile, Embedded	100.0
Mobile	Embedded	2	Java	Web, Mobile, Embedded	95.4
		3	C	Mobile, Embedded	94.7
		4	C++	Mobile, Embedded	92.4
		5	JavaScript	Web	88.1
		6	C#	Web, Mobile, Embedded	82.4
		7	R	Mobile	81.7
		8	Go	Web, Mobile	77.7
		9	HTML	Web	75.4
		10	Swift	Mobile, Embedded	70.4

Jan 2022	Jan 2021	Change	Programming Language	Ratings	Change
1	3	↑	Python	13.58%	+1.86%
2	1	↓	C	12.44%	-4.94%
3	2	↓	Java	10.66%	-1.30%
4	4		C++	8.29%	+0.73%
5	5		C#	5.68%	+1.73%
6	6		Visual Basic	4.74%	+0.90%
7	7		JavaScript	2.09%	-0.11%
8	11	↑	Assembly language	1.85%	+0.21%
9	12	↑	SQL	1.80%	+0.19%
10	13	↑	Swift	1.41%	-0.02%
11	8	↓	PHP	1.40%	-0.60%
12	9	↓	R	1.25%	-0.65%
13	14	↑	Go	1.04%	-0.37%
14	19	↑	Delphi/Object Pascal	0.99%	+0.20%
15	20	↑	Classic Visual Basic	0.98%	+0.19%
16	16		MATLAB	0.96%	-0.19%
17	10	↓	Groovy	0.94%	-0.90%
18	15	↓	Ruby	0.88%	-0.43%
19	30	↑	Fortran	0.77%	+0.31%
20	17	↓	Perl	0.71%	-0.31%

<https://spectrum.ieee.org/top-programming-languages/>

<https://www.tiobe.com/tiobe-index/>

Why C++?

- ❑ Most large-scale problems are written in C/C++
- ❑ Most AI backend engines are written in C/C++
- ❑ Most performance-critical blocks are written in C/C++
- ❑ C/C++ allow direct access to memory and hardware components such as registers

Users (companies)

amazon.com

facebook



Microsoft

intel

Google

IBM

Adobe



The F-35 Lightning II (Joint Strike Fighter) relies extensively on C++

Users (games)

ASSASSIN'S CREED

STAR CRAFT

HALO

CALL OF DUTY

WORLD OF WAR CRAFT

MASS EFFECT



OpenJDK

The most widely used Java runtime is written in C++

The Big Picture of C++ ...

- ❑ C++ is a programming language which simplifies complex tasks without sacrificing performance
- ❑ Learning good C++ practices is a great way to better understand computer programming

**Good luck and
have a great
semester!**

