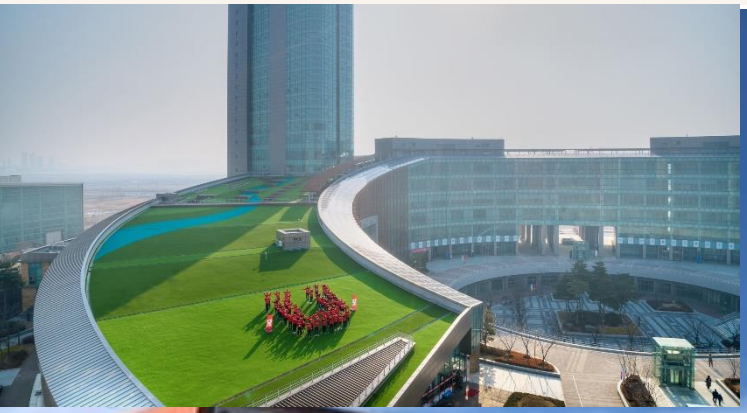
THE UNIVERSITY OF UTAH
ASIA CAMPUS
SOUTH KOREA

Habtamu Minassie Aycheh,PhD

Department of Electrical and Computer Engineering



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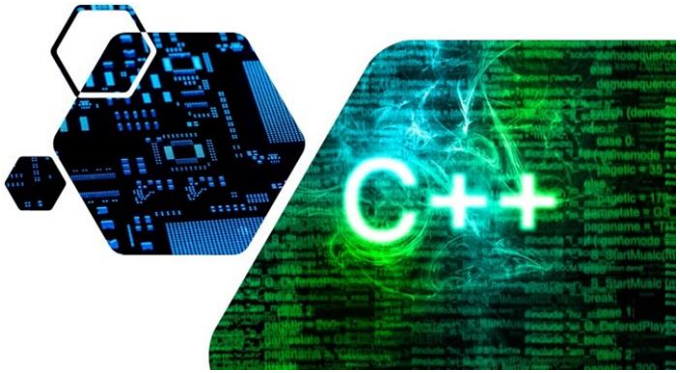
Department of Electrical and Computer Engineering
Spring 2022

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++.
  - Computation 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	~~28/02/202~~	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	11/04/04/2022	**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 • STL Containers • STL Iterators • STL Algorithms
13	Mon	16/05/2022	
	Wed	18/05/2022	
14	Mon	23/05/2022	
	Wed	25/05/2022	Input and Output Streams in C++
15	Mon	30/05/2022	
	Wed	~~01/06/2022~~	Local Election Day
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

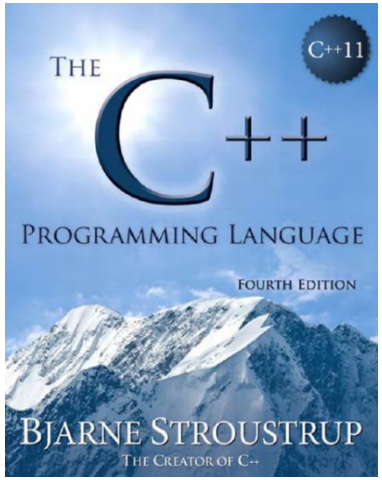
- Class participation: 10%
- Quiz : 10%
- Programming Assignments(PAs) : 40%
- Mid test : 20%
- Final test: 20%

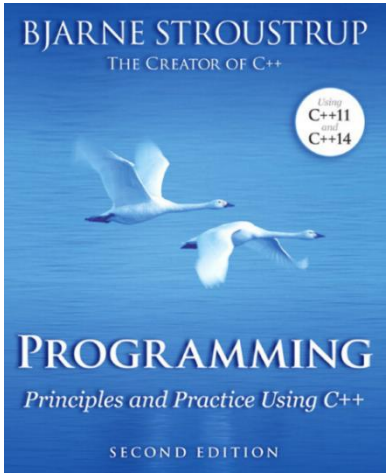
Academic integrity

- 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!

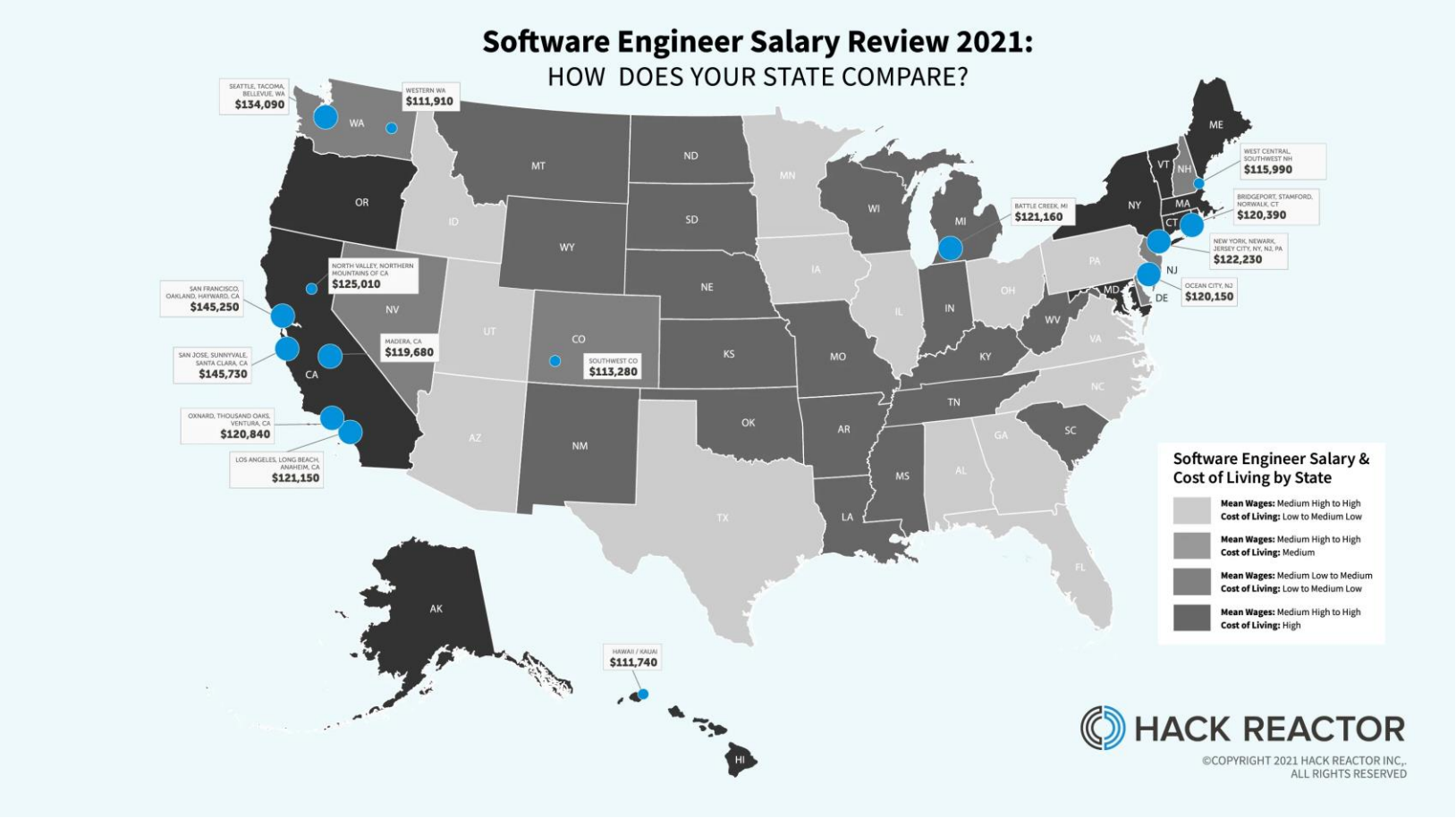
cppcon the c++ conference

- 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 is "good" source code?

- 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
  - $2^{16} = 2*2*2*2*2*2*\ldots*2$ total 15 calculations
- Can we do better?

A better way

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

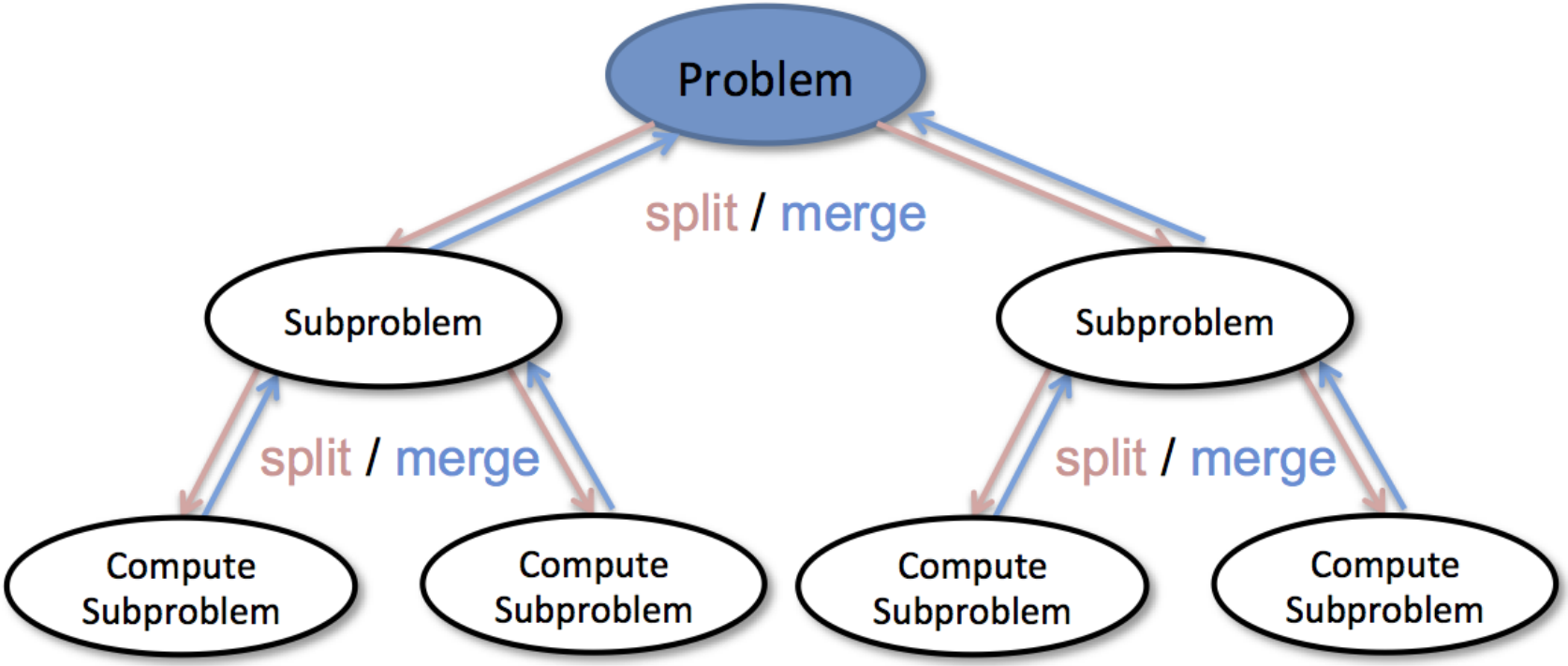
$2^8 = 2^4 * 2^4$

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

$2^2 = 2 * 2$

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)
    - 10000000x faster!
  - Indeed, this is a Goo___ 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

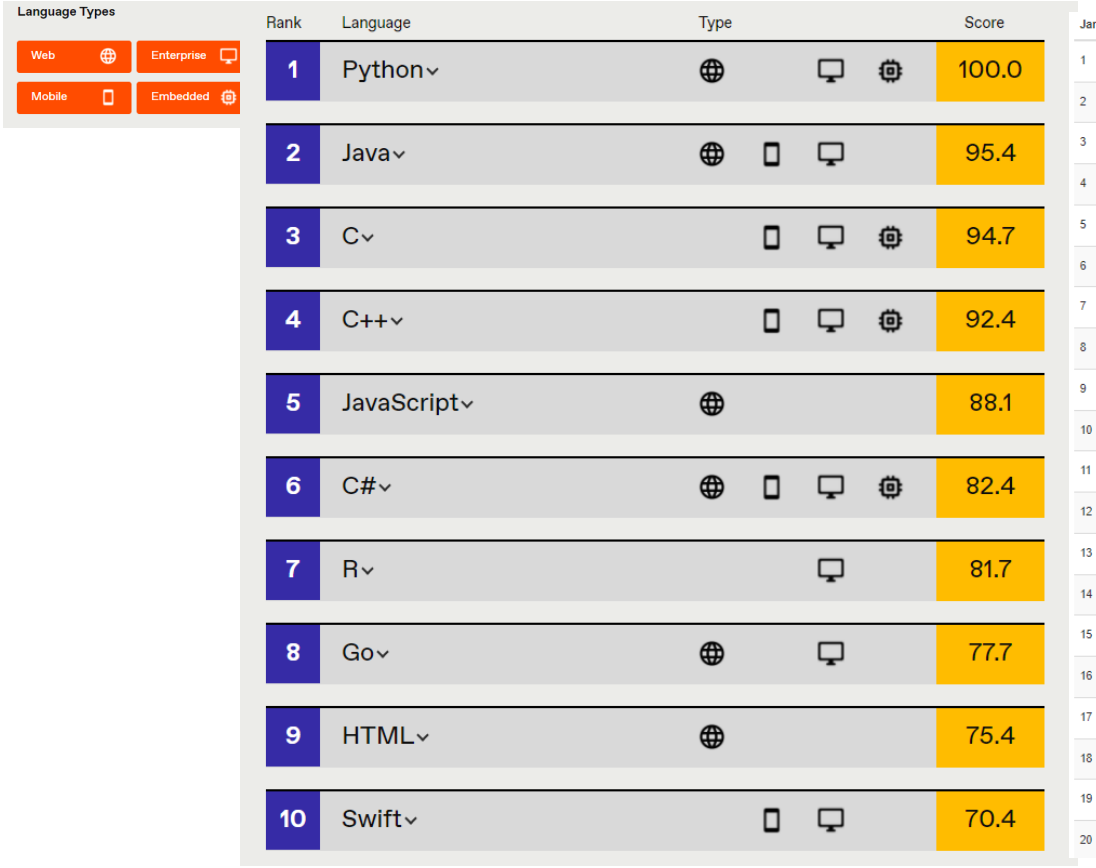
- Consider searching an element in a *sorted* array

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



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, IBM, facebook, intel, Adobe, Google, Microsoft

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

Users (games)

Assassin's Creed, Call of Duty, StarCraft II, World of Warcraft, Halo, Mass Effect

Java, 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!