

# CSCE 240: Advanced Programming Techniques

## Lecture 1: Introduction

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PROF. BIPLAV SRIVASTAVA, AI INSTITUTE

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***Carolinian Creed: “I will practice personal and academic integrity.”***

**Credits:** Some material reused with permission of Dr. Jeremy Lewis.  
Others used as cited with thanks.

# Organization of Lecture 2

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- Introduction Section
  - Recap of Lecture 1
  - TA overview and Piazza
- Main Section
  - Review additional tasks: GitHub setup, Enhanced Hello World!
  - Concept: Pointers
  - Concept: Iteration
  - Numeric processing: Quicksort
  - Team activity: code review, testing
- Concluding Section
  - About next lecture – Lecture 3
  - Ask me anything

# Introduction Section

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# Recap of Lecture 1

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- We discussed course aims
  - Learn programming techniques
  - **C/C++ will be the “mother language”: everyone should know**
  - **Choose one or more languages to have multi-lingual learning: Java or Python preferred**
- Learn important programming concepts
- Learn in real-world setting, i.e., with others
- Solve real-world problems

# About the TA, Piazza

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- TA Intro
- Piazza, for answering student issues and questions

# Main Section

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# Review: GitHub

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- GitHub basics
  - Sharing code, replicating others work
  - <https://docs.github.com/en/get-started/quickstart/hello-world>
- Course GitHub
  - <https://github.com/biplav-s/course-adv-proglang>
- Share your private repo on “Students and Code Links” spreadsheet
  - Also mention **district** to be working on in column F

# Review: Enhanced Hello World

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- C++, Java, Python



# Concept: Pointers

- Pointers refer to accessing and manipulating location of variables
  - `a = 12` // variable is a, value is 12
  - `b = &a` // b has the address of a, i.e., 0 here. It is called a pointer
  - `c = a` // c has the value of a, i.e., 12
  - `d = *b` // will refer to a. That is, d will be equal to value pointed by b, i.e., 12

Variable	Location	Value
a	0	12
b	4	0
c	8	

Reference: <https://www.cplusplus.com/doc/tutorial/pointers/>

# Pointers in Languages

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- C++: fully supported
  - “A pointer is a variable that stores a memory address, for the purpose of acting as an alias to what is stored at that address.”
  - Pointer arithmetic
  - Arguments of functions can be passed by value or by pointers
- Java, Python: references
  - “A reference is a variable that refers to something else and can be used as an alias for that something else.”
  - When a variables is initialized to another variable, references are passed.
  - No pointer arithmetic by programmer

## Reference:

- <https://nickmccullum.com/python-pointers/#why-dont-pointers-exist-in-python>
- <https://www.geeksforgeeks.org/is-there-any-concept-of-pointers-in-java/>

# Programming Exercise – C++

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- Write a function, ***addNumbers()***, with two arguments containing numbers
  - Adds the two numbers
  - Returns the sum
- Write a function, ***addNumbersAtFirstLocation()***, with two arguments containing pointers to variables
  - Adds the two numbers
  - Updates the sum at the location of the first variable

# Review With Peers

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- Code walk through
- Unit testing

# Concept: Iteration

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- For – number of iterations is known
  - **for**(initial condition; end condition; update action) {  
//body of the for loop  
}
  - **for**(i = 0; i < 10; i++) {  
cout << i << endl; // print from 0 to 9  
}
- While – number of iterations is unknown
  - **while**(condition) {  
// body of while loop  
}
  - **while**(true) {  
; // Do nothing -- infinite loop  
}

# Numeric Processing

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- Problem: Sort numbers
  - Specification: arrange a given sequence of numbers into a sorted (e.g., ascending order)
  - Requirement:
    - Input: any sequence of numbers with  $n=0$  or more integers
    - Output: a sequence of same length as input but where for  $i=0..n-2$ ,  $a[i] \leq a[i+1]$
  - Design
    - What functions to have?
  - Coding
  - Testing
    - Input is empty string
    - Input has one number
    - Input has two or more numbers
    - Input has all numbers of same value

# Illustration: C++

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- Usage of pointers
- Passing inputs and outputs is cumbersome
- Notice length of code

# Illustration: Java

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- Inputs passed as arguments
- Notice smaller length of code



# Illustration: Python

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- Inputs passed as arguments
- Notice smaller length of code

# Discussion: Course Project

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# Course Project – Assembling of Prog. Assignments

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- **Project:** Develop collaborative assistants (chatbots) that offer innovative and ethical solutions to real-world problems ! *(Based on competition - <https://sites.google.com/view/casy-2-0-track1/contest> )*
- Specifically, **the project will be building a chatbot that can answer questions about a South Carolina member of state legislature from:**  
<https://www.scstatehouse.gov/member.php?chamber=H>
  - Each student will choose a district (from 122 available).
  - Programming assignment programs will: (1) extract data from the district, (2) process it, (3) make content available in a command-line interface, (4) handle any user query and (5) report on interaction statistics.

# Problem Scale

- Text and images
- Static and dynamic content; direct and indirect content
- Semi-structured and unstructured content

https://www.scstatehouse.gov/member.php?code=0372727228

Senate House Committee Postings and Reports Legislative Council Citizens' Interest Publications

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House > Members of the House > Representative Gilda Cobb-Hunter

**Representative Gilda Cobb-Hunter**

Democrat - Orangeburg  
District 66 - Orangeburg County - [Map](#)

**Columbia Address**  
309C Blatt Bldg.  
Columbia 29201

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4188 Five Chop Road  
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[Send message to Representative Cobb-Hunter](#)

**Personal Information**

- Social Work Administrator
- Residing at 4188 Five Chop Rd., Orangeburg
- Born November 5, 1952 in Gifford, Florida
- Daughter of Selvin, Sr. and the late Nina (Walker) Cobb
- Florida A & M University, B.S., 1973
- Florida State University, M.A., 1978
- South Carolina Board of Social Work Examiners, LISW, 1990
- August 30, 1975 married Terry Keith Hunter
- Member, Leadership South Carolina, Class of 1986
- House Minority Leader, 1997-00
- South Carolina Chapter of National Association of Social Workers
- South Carolina American Civil Liberties Union
- Branchville NAACP
- Orangeburg County Democratic Party
- National Committeewoman, Democratic National Committee
- President, National Black Caucus of State Legislators
- Joint Bond Review Committee
- Awarded Florida A & M University National Alumni Association 2014 Distinguished Alumnus Award

**Committee Assignments**

- Ways and Means, 1st V.C.

**Sponsored Bills in the House**

- Primary Sponsor: ☒ Yes ☐ No
- Search Session:  [Find Bills](#)

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- Search Session:  [Find Votes](#)

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- House of Representatives, January 28, 1992 - Present

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House > Members of the House > Representative William H. Bailey

**Representative William H. Bailey**

Republican - Horry  
District 104 - Horry County - [Map](#)

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420D Blatt Bldg.  
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[Send message to Representative Bailey](#)

**Personal Information**

- Retired Public Safety - Law Enforcement & Fire
- Residing at 4487 Lake Cir., Little River
- Born Dec. 4, 1962 in Conway
- Son of William W., Sr. and Katherine Gause
- Horry-Georgetown Technical College, A.D., 1999
- Coastal Carolina University, B.A., 2001
- Webster University, M.S., 2004
- Sept. 23, 1983 married Karen Elizabeth, 2 children, Anne Marie and Christopher
- City of North Myrtle Beach, Public Safety, Officer, 1990-04, Director, 2005-10
- FBI National Academy, 2003
- Horry County Airport Advisory Committee, 2004-10
- S.C. Supreme Court Task Force and Probate, 2009

**Committee Assignments**

- Interstate Cooperation, 2nd V.C.
- Judiciary

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**Voting Record**

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# Discussion: Nature and Simplifications

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- Once you select a district, the elected legislator is fixed.
- Some simplifications
  - Download local copy v/s web query
  - Handle static content first
  - Handle a subset of content
  - Have default handling for questions the chatbot does not understand
- Do project in a language you are most comfortable with
- Use all advanced programming concepts to simplify coding

# Concluding Section

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# Lecture 2: Concluding Comments

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- We discussed the concepts of pointers and references
- We discussed the concept of iteration
  - For and while are most common
  - Others available (like do-while) but not that helpful in practice
- Looked at enhanced “Hello World”
- Looked at numeric processing – quick sort
- Discussed projects

# Additional Tasks

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- Implement sorting in C++
- Implement sorting in another language (Java or Python)
- Add code on personal GitHub
- Update TA/ Instructor on Piazza



# About Next Lecture – Lecture 3

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# Lecture 3: I/O

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- Overview of streams, file processing
- Error handling
- Printing values