# CSCE 240: Advanced Programming Techniques
## Lecture 8: Object Oriented Concepts - Continued

PROF. BIPLAV SRIVASTAVA, AI INSTITUTE

3RD FEBRUARY 2022

*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 8

- Introduction Section
  - Recap of Lecture 7
  - TA and SI Updates

- Main Section
  - Concept: Multiple classes – UML diagrams and Object Oriented programs
  - Concept: Code organization
  - Discussion: Prog. Assignment #1 and Project discussion

- Concluding Section
  - About next lecture – Lecture 9
  - Ask me anything

# Introduction Section



**CEC UNDERGRADS: GRADUATE SCHOOL FAIR**

LEARN ALL ABOUT GETTING A MASTERS OR PhD

SIGN UP NOW:

- Tuesday, February 15
- 300 Main RM B213 or remote via livestream
- 6:00-8:00 PM

**FREE PIZZA!**

# Recap of Lecture 7

- We introduced UML – a language independent notation for communicating about OO software

- Looked at concept of encapsulation

- Discussed background of chatbot

# Updates from TA, SU

- TA update: Yuxiang Sun (Cherry)

- SI update: Blake  Seekings

# Main Section

# Concept: Working with Multiple Classes

# Example: Refrigerator

- is a type of electrical appliance [Generalization/ Specialization]

- has freezer section, cooler section, water compartment [Composition]

- can have ice tray, food items [Aggregation]
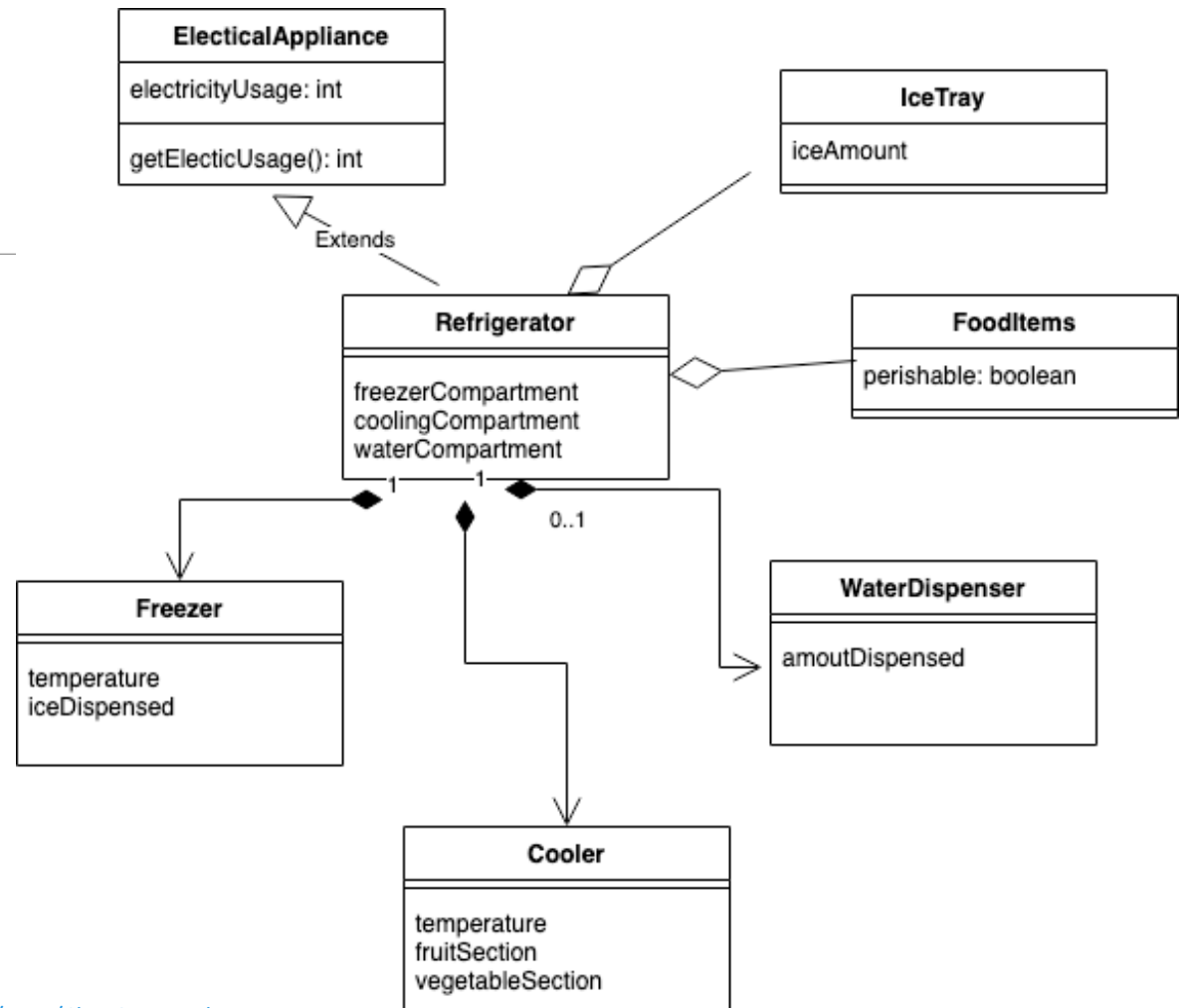
# Example: Refrigerator in UML Classes



Diagram at:
https://github.com/biplav-s/course-adv-proglang/tree/main/sample-code/UML/Class8-examples

# Relationship Types

- Association: is related to

- Generalization: is a special type of (inverse relationship: specialization of)

- Aggregation: is made up of, but can also exist independently

- Composition: is made up of, but cannot exist independently

References:
1. UML 2.5.1 specs
2. Tutorial: https://www.visual-paradigm.com/guide/uml-unified-modeling-language/uml-aggregation-vs-composition/

# Example: Representative Information

- Contact Information (Type-I1)
  - Name
  - Label: District, County, Party
  - Addresses: Columbia, Home
  - Phone: Business, Home

- Personal Information (Type-I2)

- Committee Assignments (Type-I3)

- Sponsored Bills in the House (Type-I4)

- Voting Record (Type-I5)



**Representative William H. Bailey**

Republican - Horry
District 104 - Horry County - **Map**

**Columbia Address**
420D Blatt Bldg.
Columbia 29201

**Home Address**
4487 Lake Circle
Little River 29566

**Business Phone** (803) 212-6918

**Home Phone** (843) 458-0844

**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

**Sponsored Bills in the House**
- Primary Sponsor: ⦿ Yes ◯ No
- Search Session: 2021-2022 (124) ⌄ Find Bills

**Voting Record**
- Search Session: 2021-2022 (124) ⌄ Find Votes

# Modeling Questions

- Consider: **Contact Information (Type-I1)**
  - Name
  - Label: District, County, **Party**
  - Addresses: Columbia, Home
  - Phone: **Business**, Home

- Composition or aggregation
  - If reusing information, model as aggregation (e.g., Party)
  - If specific to the class, model as composition (e.g., Business phone number)

# Example: Representative Information

- Contact Information (Type-I1)
  - Name
  - Region
  - Addresses: Columbia, Home
  - Phone: Business, Home

- Personal Information (Type-I2)

- Committee Assignments (Type-I3)

- Sponsored Bills in the House (Type-I4)

- Voting Record (Type-I5)

- **Service in Public Office (Type-I6)**



**Representative Terry Alexander**

Democrat - Florence
District 59 - Darlington & Florence Counties - **Map**

**Columbia Address**
314C Blatt Bldg.
Columbia 29201

**Home Address**
1646 Harris Court
Florence 29501

**Business Phone** (803) 734-3004    **Home Phone** (843) 665-7321

**Send message to Representative Alexander**

**Personal Information**
- Education Consultant & Pastor
- Residing at 1646 Harris Court, Florence
- Born January 23, 1955 in Florence
- Son of the late James and Adell Alexander
- Durham Business College, A.D., 1976
- Francis Marion University, B.A., 1991
- Howard University School of Divinity, M. Div., 1998
- Married to Starlee Davis Alexander, 2 children, Terrell McClain and Matthew
- Pastor, Wayside Chapel Baptist Church
- Career Development Consultant
- Adjunct Professor of Religion, Limestone College
- Pee Dee Regional Council of Governments
- Past President, Habitat for Humanity, Board of Directors
- Charter member, The Florence Breakfast Rotary Club
- Past President, Boys and Girls Club of Florence
- Boy Scouts of the Pee Dee Executive Boards
- Florence Branch, NAACP, past President
- Mercy Medicine Board
- Pee Dee Chapter American Red Cross
- 100 Black Men of the Pee Dee
- Kappa Alpha Psi Fraternity, Inc.
- Francis Marion Society
- National Association of County Officials
- National Association of Black County Officials
- South Carolina Association of Black County Officials
- South Carolina Association of Guidance Counselors
- South Carolina Alliance of Black Educators

**Committee Assignments**
- **Education and Public Works**, *2nd V.C.*
- **Regulations and Admin. Procedures**

**Sponsored Bills in the House**
- Primary Sponsor: ⦿ Yes ◯ No
- Search Session: [2021-2022 (124) ▾] [Find Bills]
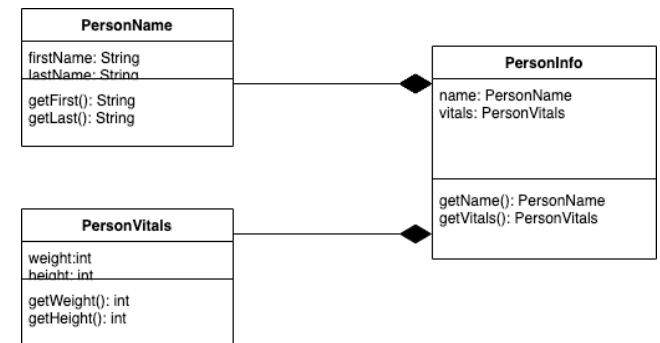
**Voting Record**
- Search Session: [2021-2022 (124) ▾] [Find Votes]

**Service In Public Office**
- Florence County Council, 1990-06, District Number 3
- House of Representatives, 2007 - Present

# Exercise

- Using browser, go to: https://app.diagrams.net/

- Go to: File -> Open from -> Device -> and load file "Example.drawio"
  (From: https://github.com/biplav-s/course-adv-proglang/tree/main/sample-code/UML/Class7-examples)

- Extend it to represent
  Contact Information (Type-I1) // Sub-type of PersonInfo
  - Name                                      // Type: String or reuse PersonName
  - Label: District, County, Party
  - Addresses: Columbia, Home
  - Phone: Business, Home

- Review it
  - Does your chosen district's representative have weight/ height information on the website ? If so, we can already handle it !!

- You can save file or export the diagram in any supported format

**PersonName**

firstName: String
lastName: String

getFirst(): String
getLast(): String

**PersonInfo**

name: PersonName
vitals: PersonVitals

getName(): PersonName
getVitals(): PersonVitals

**PersonVitals**

weight:int
height: int

getWeight(): int
getHeight(): int

# Concept: Code Organization

# Options to Organize Code

- Option 1: All classes in the same file
  - Not suggested
  - Makes code hard to reuse
  - Makes code hard to understand

- Option 2: Have classes as separate header (.h) and implementation files (.cpp)
  - Each class should have a clear purpose
  - Header file has specification of the class: data members and function specification, but not implementation; implementation is in .cpp
  - Good suggestions in: http://websites.umich.edu/~eecs381/handouts/CppHeaderFileGuidelines.pdf
  - Someone reusing the code will only need to look at the header file, not implementation
  - **Pitfall**: too many files if the project is small, especially if development is by a single person team

- Option 3: Mix and match of above
  - Separate classes for important concepts
  - Utility "class" for rest of the data members, functions

# Review: Code Implementation in Instructor Code

- As supported by Eclipse IDE !
  - Creates header and implementation files automatically
  - sub-directories with clear purpose

- Keeping project size small

# Code Review

- PersonName: has separate header and implementation files for a class

- SimpleRelational: has single class implementation file

- Class7and8_C++_OO: is a utility file

# Discussion: Course Project

# Course Project – Assembling of Prog. Assignments

- **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.

# Core Programs Needed for Project

- Prog 1: extract data from the district

- Prog 2: process it based on questions

- Prog 3: make content available in a command-line interface

- Prog 4: handle any user query and

- Prog 5:  report statistics on interaction of a session, across session

# Programming Assignment # 1

- Goal: extract data from the district of choice
  - Language of choice: Any from the three (C++, Java, Python)

- Program should do the following:
  - Take district name as input
  - Read content from the district's URL or a local text version of the district page
  - Report statistics of content: lines, words, chars
  - Write content out in an output file formatted with indentation

- Code organization
  - Create a folder in your GitHub called "prog1-extractor"
  - Have sub-folders: src (or code), data, doc, test
  - Write a 1-page report in ./doc sub-folder
  - Send a confirmation that code is done to instructor and TA, and update Google sheet

# Discussion

# Concluding Section

# Lecture 8: Concluding Comments

- We relooked at relationships between classes

- We discussed code organization

- We discussed prog. Assignment #1 due today

# About Next Lecture – Lecture 9

# Lecture 9: Object Oriented - Inheritance

- OO - Inheritance

- Home work 3 will be given

- Programming assignment #2 begins – hints given

| 8 | Feb 3 (Th) | Code org (C++) | Prog 1 - end |
|---|---|---|---|
| 9 | Feb 8 (Tu) | OO – inheritance | Prog 2 - start |
| 10 | Feb 10 (Th) | OO - polymorphism | HW 3 due |
| 11 | Feb 15 (Tu) | In class test | Quiz 1 – In class |