

CSCE 240: Advanced Programming Techniques

Lecture 8: Object Oriented Concepts - Continued

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 8

- Introduction Section
 - Recap of Lecture 7
- Main Section
 - Concept: Multiple classes – UML diagrams and Object Oriented programs
 - Concept: Code organization
 - Discussion: Project discussion, Prog. Assignment #1
- Concluding Section
 - About next lecture – Lecture 9
 - Ask me anything

Introduction Section

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

ACM Hackathon in Spring 2024

Find out: website <https://acm.cse.sc.edu/>

ACM Student Chapter, USC

Contact: Daniel Gleaves

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

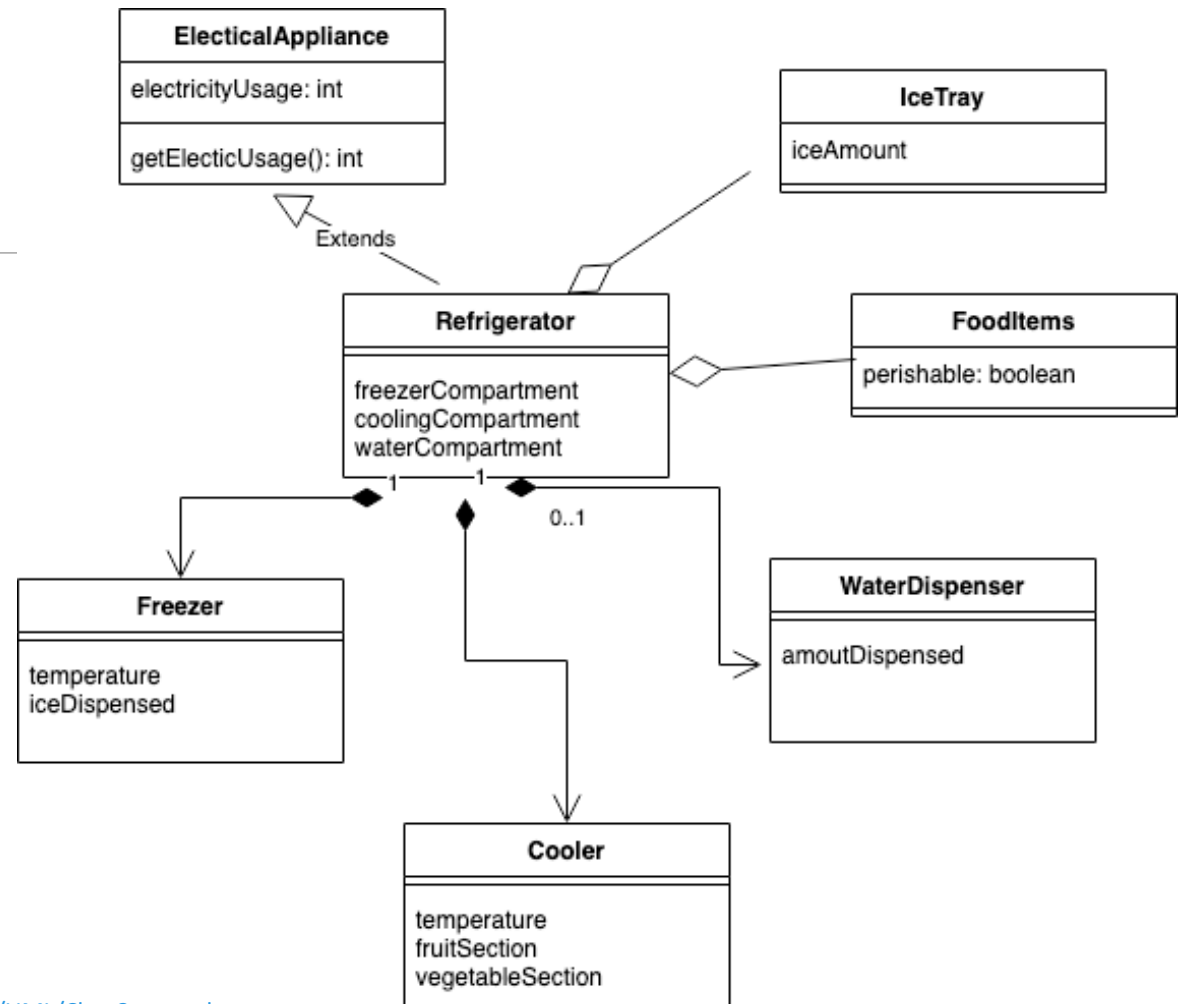


Diagram at:

<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: [Find Bills](#)

Voting Record


- Search Session: [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: [Find Bills](#)

Voting Record

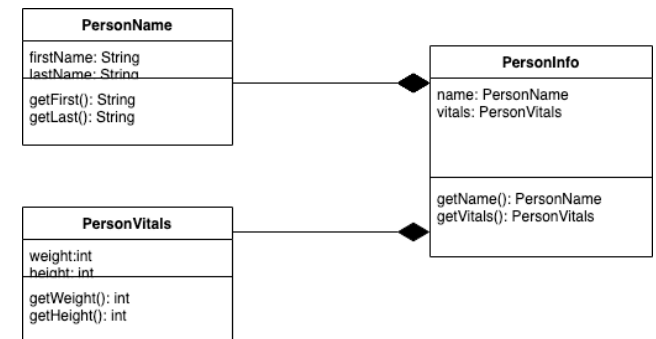
- Search Session: [Find Votes](#)

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 (59 or 104) 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



Example: Disease

- What (is the disease)?
 - What are they types?*
 - What causes it?
 - What are the symptoms?
 - What should one do to treat the disease ?
- Who is affected?
 - Who is at risk?
- How is the disease diagnosed?
- When to call doctor?
- More information
 - After travel*

S1: <https://www.cdc.gov/travel/diseases/malaria>

- What is malaria?
- Who is at risk?
- What can travelers do to prevent malaria?
- After Travel
- More Information

S2: <https://www.webmd.com/a-to-z-guides/malaria-symptoms>

- [What Is Malaria?](#)
- [Malaria Causes and Risk Factors](#)
- [Types of Malaria](#)
- [Symptoms](#)
- [When to Call a Doctor About Malaria](#)
- [Malaria Diagnosis](#)
- [Malaria Treatment](#)
- [Malaria Complications](#)
- [Malaria Vaccine](#)

* Possible to omit ?

* Too specialized? Consider omitting for a super-class

Examples: Companies Data

EDGAR interface: <https://www.sec.gov/edgar/searchedgar/companysearch>

- Apple: <https://www.sec.gov/edgar/browse/?CIK=320193&owner=exclude>
- 10-k: https://www.sec.gov/ix?doc=/Archives/edgar/data/320193/000032019323000106/aapl-20230930.htm#i1cb1ba018cb1455aa66bd3f9ab0c5b1a_175
- Pfizer info: <https://www.sec.gov/edgar/browse/?CIK=78003&owner=exclude>
- 10-k: https://www.sec.gov/ix?doc=/Archives/edgar/data/78003/000007800323000024/pfe-20221231.htm#i8050b09ca8a0411dbcb0b6576ce1fc7a_298

Structure From Examples (Tentative)

Parts

- Part 1: Business Background and Risks
 - Business
 - Risk factors
- Part 2: Operations and Disclosures
 - Market
 - Disclosures
- Part 3: Company Structure
 - Directors
 - Compensation
- Part 4: Financial Statements
 - Statements

PFIZER	Apple
PART I	Part I
ITEM 1. BUSINESS	Business
About Pfizer	Risk Factors
Commercial Operations	Unresolved Staff Comments
Research and Development	Cybersecurity
Collaboration and Co-Promotion Agreements	Properties
International Operations	Legal Proceedings
Sales and Marketing	Mine Safety Disclosures
Patents and Other Intellectual Property Rights	
Competition	Part II
	Market for Registrant's Common Equity, Related Stockholder Matters and Issuer Purchases of Equity Securities
Pricing Pressures and Managed Care Organizations	[Reserved]
Raw Materials	Management's Discussion and Analysis of Financial Condition and Results of Operations
	Quantitative and Qualitative Disclosures About Market Risk
Government Regulation and Price Constraints	Financial Statements and Supplementary Data
Environmental Matters	Changes in and Disagreements with Accountants on Accounting and Financial Disclosure
Human Capital	Controls and Procedures
	Other Information
ITEM 1A. RISK FACTORS	Disclosure Regarding Foreign Jurisdictions that Prevent Inspections
ITEM 1B. UNRESOLVED STAFF COMMENTS	
ITEM 2. PROPERTIES	Part III
ITEM 3. LEGAL PROCEEDINGS	Item 10. Directors, Executive Officers and Corporate Governance
ITEM 4. MINE SAFETY DISCLOSURES	Executive Compensation
INFORMATION ABOUT OUR EXECUTIVE OFFICERS	Security Ownership of Certain Beneficial Owners and Management and Related Stockholder Matters
	Certain Relationships and Related Transactions, and Director Independence
PART II	Item 11. Principal Accountant Fees and Services
ITEM 5. MARKET FOR THE COMPANY'S COMMON EQUITY, RELATED STOCKHOLDER MATTERS AND ISSUER PURCHASES OF EQUITY SECURITIES	
ITEM 6. [RESERVED]	Part IV
ITEM 7. MANAGEMENT'S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS	Item 15. Exhibit and Financial Statement Schedules
ITEM 7A. QUANTITATIVE AND QUALITATIVE DISCLOSURES ABOUT MARKET RISK	Form 10-K Summary
ITEM 8. FINANCIAL STATEMENTS AND SUPPLEMENTARY DATA	
ITEM 9. CHANGES IN AND DISAGREEMENTS WITH ACCOUNTANTS ON ACCOUNTING AND FINANCIAL DISCLOSURE	
ITEM 9A. CONTROLS AND PROCEDURES	
ITEM 9B. OTHER INFORMATION	
ITEM 9C. DISCLOSURE REGARDING FOREIGN JURISDICTIONS THAT PREVENT INSPECTIONS	
PART III	
ITEM 10. DIRECTORS, EXECUTIVE OFFICERS AND CORPORATE GOVERNANCE	
ITEM 11. EXECUTIVE COMPENSATION	
ITEM 12. SECURITY OWNERSHIP OF CERTAIN BENEFICIAL OWNERS AND MANAGEMENT AND RELATED STOCKHOLDER MATTERS	
ITEM 13. CERTAIN RELATIONSHIPS AND RELATED TRANSACTIONS, AND DIRECTOR INDEPENDENCE	
ITEM 14. PRINCIPAL ACCOUNTING FEES AND SERVICES	
PART IV	
ITEM 15. EXHIBITS, FINANCIAL STATEMENT SCHEDULES	
15(a)(1) Financial Statements	
15(a)(2) Financial Statement Schedules	
15(a)(3) Exhibits	
ITEM 16. FORM 10-K SUMMARY	
SIGNATURES	
N/A = Not Applicable	

Verifying for Own Companies

- Answer
 - Which parts are present?
 - Which components in each part are present?
 - How to model components and parts?
 - Reuse within document?
 - How to model optional components?
- Draw a Class diagram for 10-K based on your companies

Parts

- Part 1: Business Background and Risks
 - Business
 - Risk factors
- Part 2: Operations and Disclosures
 - Market
 - Disclosures
- Part 3: Company Structure
 - Directors
 - Compensation
- Part 4: Financial Statements
 - Statements

Updated 10-K Model

Concepts: 10-K, Parts, Items

Parts

- Part 1: Business Background and Risks
 - Item 1: Business
 - Item 2: Risk factors
 - Item 3: Properties
 - Item 4: Legal Proceedings
- Part 2: Operations and Disclosures
 - .. Market
 - .. Disclosures
- Part 3: Company Structure
 - Directors
 - Compensation
- Part 4: Financial Statements
 - Statements

Parts

- Part 1: Business Background and Risks
 - Business
 - Risk factors
- Part 2: Operations and Disclosures
 - Market
 - Disclosures
- Part 3: Company Structure
 - Directors
 - Compensation
- Part 4: Financial Statements
 - Statements

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 – Knowing About Companies

- **Project:** Develop collaborative assistants (chatbots) that offer useful information about companies
- Specifically, use the EDGAR dataset on companies at:
<https://www.sec.gov/edgar/searchedgar/companysearch>.
 - For Apple, it is: <https://www.sec.gov/edgar/browse/?CIK=320193&owner=exclude>
- **Each student will choose two companies (from thousand available).**
- Programming assignment programs will: (1) extract data about two companies from 10-k, (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 10-k report of a company filing
- 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

Discussion: Nature and Simplifications

- Once you select a company, the scope of answers is fixed.
- Some simplifications
 - **Download local copy** v/s web query
 - **Read 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

Suggested Scope is a Drastic Simplification

- **Users:** 1
- **Modality:** text
- **Data:** static (optionally: dynamic – voting history)
- **Personalization:** none
- **Form:** command line
- **Purpose:** information provider
- **Domain:** specific to companies and their 10-K report

Programming Assignment # 1

- **Goal:** extract data from the companies of choice
 - Language of choice: Any from the three (C++, Java, Python)
- Program should do the following:
 - Take company / 10-k page (URL) as input
 - Read content about the 10-k page
 - a local text version of the report page // Store it as file with names <companyname>-<quarter-year>.txt
// Optional: get reports for multiple quarters (say 3). Keep them as separate files with names <companyname>-<quarter-year>.txt
 - **Identify how many parts are there in the report** //Hint: You can search for a hardcoded string/ pattern
 - Report statistics of content: lines, words, chars, and parts.
 - 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 update Google sheet

PA: Code **Testing** Rubric Used

- Look out for
 - Does the program run as the coder wanted it to be (specification) ?
 - Does the program run as the instructor wanted it to be (requirement - customer) ?
 - Does the program terminate abruptly ?
 - Is there a hardcoding of directory ? Paths should be relative to code base directory.
 - Any special feature?
- What not to judge
 - Length of documentation. It can just be short and accurate.
 - Person writing the code

Assign rating (out of 100 -/+)

- -100: code not available
- -80: code with major issues (e.g., abnormal termination, incomplete features)
- -60: code with minor issues
- -20:
- (full marks): no issues
- +20: special features

Discussion

Concluding Section

Lecture 8: Concluding Comments

- We rellooked 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

Feb 1 (Th)	Code org (C++)	Prog 1 - end
Feb 6 (Tu)	OO – inheritance	Prog 2 - start
Feb 8 (Th)	Regex, OO - polymorphism	HW 3 due
Feb 13 (Tu)	Exceptions	
Feb 15 (Th)	Review: inheritance, Polymorphism	Prog 2 – end