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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

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

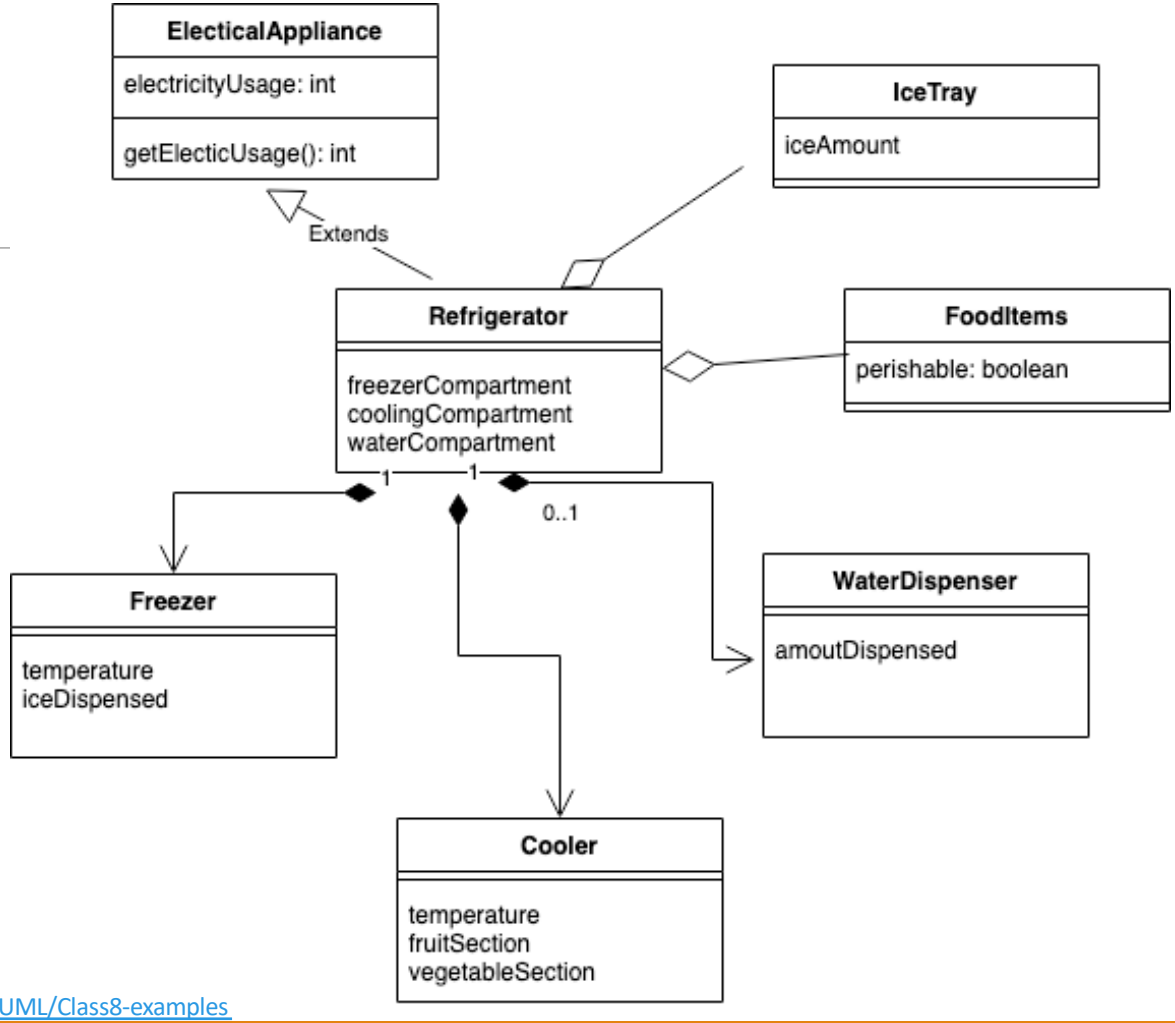


Diagram at:
https://github.com/biplav-s/course-adv-proglang/tree/main/sample-code/UML/Class8-examples

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)

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

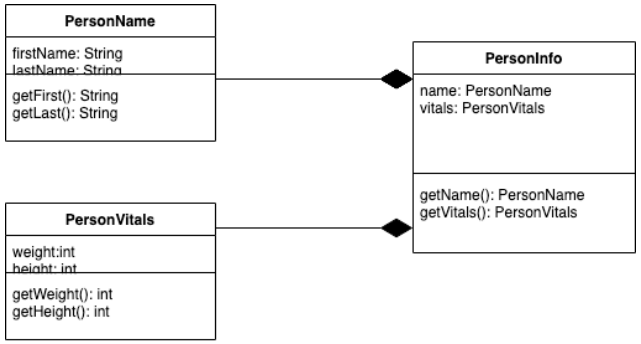
- Search Session: 2021-2022 (124) Find Votes

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 (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	Item 1.	Business
About Pfizer	Item 1A.	Risk Factors
Commercial Operations	Item 1B.	Unresolved Staff Comments
Research and Development	Item 1C.	Cybersecurity
Collaboration and Co-Promotion Agreements	Item 2.	Properties
International Operations	Item 3.	Legal Proceedings
Sales and Marketing	Item 4.	Mine Safety Disclosures
Patents and Other Intellectual Property Rights		
Competition	Part II	
		Market for Registrant's Common Equity, Related Stockholder Matters and
Pricing Pressures and Managed Care Organizations	Item 5.	Issuer Purchases of Equity Securities
Raw Materials	Item 6.	[Reserved]
		Management's Discussion and Analysis of Financial Condition and Results of
Government Regulation and Price Constraints	Item 7.	Operations
Environmental Matters	Item 7A.	Quantitative and Qualitative Disclosures About Market Risk
Human Capital	Item 8.	Financial Statements and Supplementary Data
		Changes in and Disagreements with Accountants on Accounting and Financial
ITEM 1A. RISK FACTORS	Item 9.	Disclosure
ITEM 1B. UNRESOLVED STAFF COMMENTS	Item 9A.	Controls and Procedures
ITEM 2. PROPERTIES	Item 9B.	Other Information
ITEM 3. LEGAL PROCEEDINGS	Item 9C.	Disclosure Regarding Foreign Jurisdictions that Prevent Inspections
ITEM 4. MINE SAFETY DISCLOSURES		
INFORMATION ABOUT OUR EXECUTIVE OFFICERS	Part III	
	Item 10.	Directors, Executive Officers and Corporate Governance
PART II	Item 11.	Executive Compensation
ITEM 5. MARKET FOR THE COMPANY'S COMMON EQUITY, RELATED		Security Ownership of Certain Beneficial Owners and Management and
STOCKHOLDER MATTERS AND ISSUER PURCHASES OF EQUITY SECURITIES	Item 12.	Related Stockholder Matters
ITEM 6. [RESERVED]	Item 13.	Certain Relationships and Related Transactions, and Director Independence
ITEM 7. MANAGEMENT'S DISCUSSION AND ANALYSIS OF FINANCIAL		
CONDITION AND RESULTS OF OPERATIONS	Item 14.	Principal Accountant Fees and Services
ITEM 7A. QUANTITATIVE AND QUALITATIVE DISCLOSURES ABOUT MARKET		
RISK		
ITEM 8. FINANCIAL STATEMENTS AND SUPPLEMENTARY DATA	Part IV	
ITEM 9. CHANGES IN AND DISAGREEMENTS WITH ACCOUNTANTS ON		
ACCOUNTING AND FINANCIAL DISCLOSURE	Item 15.	Exhibit and Financial Statement Schedules
ITEM 9A. CONTROLS AND PROCEDURES	Item 16.	Form 10-K Summary
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

- Which parts are present?
- Which components in each part are present?
- How to model components and parts?
  - Reuse withing document?
- How to model optional components?

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 may 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 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

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