

CSCE 240: Advanced Programming Techniques

Lecture 6: Object Oriented Concepts, HW 2 (Review)

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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 6

- Introduction Section
 - Recap of Lecture 5
- Main Section
 - Home work 2 – peer review
 - Concept: OO Thinking
 - Concept: Classes, Objects
 - Background for project: Chatbots
- Concluding Section
 - About next lecture – Lecture 7
 - Ask me anything

Introduction Section

Recap of Lecture 5

- We discussed
 - the concept of functions
 - the concept of user-defined types
 - the concepts of static and dynamic memory allocation
- Discussed Home Work 2 (due today - Thursday, Jan 25)
 - Peer evaluation in class
- Discussed Programming Assignment #1 (due Thursday, Feb 1)

Main Section

Peer Review of Home Work 2

Feedback from Peer Reviewing of HW 1

- Home works marks will be best of 4, out of 6
- The same person should not be the coder, reviewer and tester (**conflict of interest**)
- For a coder, the same person should not be the reviewer/ tester for ALL the home works
 - Change seats sometimes
 - Don't miss the opportunity to get more feedbacks
- Do not try to just give marks. Give feedback
 - Coders may be asked to show code to class to illustrate good practices or critical issues
 - Be both reviewer and tester. If you are just one, you will get marks for just one.
- Weightage give as follows
 - 60%: coding
 - 20%: how well reviewing of others' code is done
 - 20%: how well testing of others' code is done

Programming Home Work (#2) – C++

- Write a program called GeometricPropertyCalculator.
 - The program reads an input file (called input.txt). Each line in the file contains dimensions of a geometric shape – rectangle, shape and triangle. Specifically:
 - For rectangle, it contains – RECTANGLE <length-in-cm> <breadth-in-cm>
 - For circle, it contains – CIRCLE <radius-in-cm>
 - For triangle, it contains – TRIANGLE <side-1-in-cm> <side-2-in-cm> <side-3-in-cm>
 - The user specifies the property to calculate as argument to the program: 1 for AREA and 2 for PERIMETER
 - The program writes output lines to an output file (called output.txt) for each shape that it reads and the property – AREA or PERIMETER.
 - For example, for RECTANGLE and property as AREA, the program should write – RECTANGLE AREA <calculated value>
- Write GeometricPropertyCalculator in C++
 - It should support RECTANGLE, CIRCLE and TRIANGLE
 - It should support properties AREA and PERIMETER
 - If there is insufficient information, the program should give an error. E.g. TRIANGLE AREA “Not enough information to calculate”

Programming Home Work (#2) – C++

- Code guidelines
 - Have sub-directories in your folder
 - src sub-folder, (or code) for code
 - data sub-folder, for input.txt and output.txt
 - doc sub-folder, for documentation on what the code does or sample output
- Hint
 - Area
 - Rectangle: length x breadth
 - Circle: $\pi * r^2$
 - Triangle: -
 - Perimeter
 - Rectangle: $2 * (\text{length} + \text{breadth})$
 - Circle: $2 * \pi * r$
 - Triangle: sum of sides

Peer Review: Homework Assignment #2

1. Go to spread sheet and on "Homework Assignments - Peer Review" tab. Go for today's date
2. Go to the row with your name
3. Peer review (10 mins)
 1. Enter roll number of person on your **LEFT** under "ID of code reviewer"
 2. Share code for the reviewer to see
 3. Reviewer: enter review (1-5)
 4. **Note**: negotiate – review code of neighbor or get own's code reviewed
4. Peer test (10 mins)
 1. Enter roll number of person on your **RIGHT** under "ID of code tester"
 2. Share command line for the tester to see
 3. Tester: enter review (1-5)
 4. **Note**: negotiate – test code of neighbor or get own's code tested

Peer Reviewing Guideline (10 mins)

- Look out for
 - Can you understand what the code is doing ?
 - Can you explain the code to someone else (non-coder) ?
 - Can you spot possible issues without running it?
 - Are the variables initialized ?
 - Are files closed?
 - Is their unnecessary code bloat ?
- What not to judge
 - Usage of language features, unless they are inappropriate
- Assign rating
 - 1: code not available
 - 2: code with major issues
 - 3: code with minor issues
 - 4:
 - 5: no issues

Peer Testing Guideline (10 mins)

- 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 ?
 - Any special feature?
- What not to judge
 - Person writing the code
- Assign rating
 - 1: code not available
 - 2: code runs with major issues (abnormal termination, incomplete features)
 - 3: code runs with minor issues
 - 4:
 - 5: No issues

Discussion

- Peer Code Reviewing
- Peer Testing

Concept: Object Oriented Thinking

World as Procedures or Objects ?

- View 1: World as procedures
 - Data as inputs and outputs
 - Functions with arguments that manipulate data
 - Control-based view of the world
- View 2: World as objects
 - Objects, representing concepts in the world, with properties and methods
 - Data (object) passed to (their or others) objects' methods to operate on them or get modified
 - Data-based view of the world

Relation to User Defined Types (UDTs)

- When we start solving real world problems, we often use a set of information together
 - Examples:
 - Name = {title, first-name, middle-name, last-name, suffix}
 - Address = {Street name, Number, City, State, Zip code}
 - Need not be of the same type as a language's pre-determined / basic data types
- May be of the same or different basic data types
- Note:
 - In UDTs, there is no provision to define function specifically for a UDT*
 - All data members are public (i.e., anyone can edit)

***Note:** Another term for UDT is ADT – abstract data type*

Concept: Classes and Objects

Terminology

- Class: a well-defined concept
 - Could be related to a physical or abstract idea
 - Something which can be identified in a domain that is of interest
 - Examples: People, Students, Lectures, Dreams, Exception, Programming Languages
- Object: an instance of a class
 - Examples:
 - People: US-President, Dalai Lama, R2D2
 - Exceptions: Known, Unknown, IO-Exception, Memory-Exception

Why Objects / Classes

- Ease of writing and maintaining code
 - Abstraction helps in communication
 - Code is easier to understand
 - Code becomes easier to test
- No impact on code's executional performance
- C++ concepts
 - Struct
 - Class (Object Oriented Programming)
- Encapsulation
 - Easier to understand
- Abstraction
 - Easier to understand
- Separation of concerns
 - Write code with a focus on an issue (concern) at a time; do not overload issues
 - Makes code reuse easier
- Drive code reuse
 - Code improves with reuse; drive quality
 - Brings productivity

Goals similar to user defined types and more!

Programming Languages: Classes and Objects

- Class: general concept that has properties that all instances share
 - Data members
 - Functions
- Object: specific instances
 - Reuses the definitions of data members (variables) and methods of the class
 - Data types and values of the member variables can be cast/ updated

Struct v/s Classes

- All members (data) are public
- There are no functions
- All members are private by default
 - Can be stated as public, protected or private
- Functions to interact with data
 - Can be stated as public, protected or private
- Has default functions: constructor and destructors

Both can be considered to support user-defined types / abstract data types

Code Demo – C++

- **Function:** demoPersonClass()
- **Note**
 - Separate file for class specification
 - Separate file for class implementation
 - Explicit destructor

Code:

https://github.com/biplav-s/course-adv-proglang/blob/main/sample-code/CandC%2B%2B/Class5and6_C%2B%2B_MemoryUserDefined/src/PersonClassDemo.cpp

Code Demo – Java

- **File / Class** : L6ClassDemo.java / L6ClassDemo
 - File name has to be the same as class name
 - Three different constructors with varying arguments (i.e., constructors can be overloaded)

Code:

https://github.com/biplav-s/course-adv-proglang/blob/main/sample-code/Java/L6L7L8_ClassOO/src/mypackage/L6ClassDemo.java

Code Demo – Python

- **File / Class:** L6_ClassDemo / PersonInfo
- **Note**
 - One constructor but with default values for parameters

Code:

https://github.com/biplav-s/course-adv-proglang/blob/main/sample-code/Python/L6L7L8_ClassOO/L6_ClassDemo.py

In-Class Exercise – Properties of Geometric Shapes

Background:

- Geometric shapes
 - Point
 - Line
 - Polygons
 - Triangle
 - Rectangle: square,
 - Pentagon
 - Hexagon
 - Circular
 - Circle
 - Ellipse

Properties:

- Area
- Perimeter
- Vertices
- Edge

Things to consider:

- How to model ?
 - With classes?
 - Without classes?
- What are member functions?
- How to model without classes?

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 content is also fixed.
 - Enter selection in column F of spreadsheet
- 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

Discussion: Chatbot Loop

- Input: from user (called utterance)
 - Problem specific query (i.e., about company risk factors)
 - Chitchat
 - Unrelated
- Output: from system (response)
 - Handle unrelated
 - Handle chitchat
 - Answer to query
- **Do it until user say over!**

Programming Assignment # 1

- **Goal:** extract data from the disease 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

Concluding Section

Lecture 6: Concluding Comments

- We experienced peer review on home works #2
- Discussed objects v/s procedural view of problems
- Introduced Classes/ Objects

About Next Lecture – Lecture 7

Lecture 7: Object Oriented Continued, UML Notations

- OO support in C++
 - Methods and encapsulation
 - Different access restrictions
- Unified Modeling Language Notations
- Chatbot basics