IT 602: Object-Oriented Programming Lab
Assignment 3: Inheritance and Interfaces

February 28, 2022

- **Programming language:** JAVA
- **Due Date:** 27th March 2022 (10:00 PM)

1. Marking scheme and requirements

- Full marks will be given for
    - Working, readable, reasonably efficient, documented code that achieves the assignment goals
    - And for providing appropriate answers to the questions in a prescribed format.
- Please adhere to the lab policies. You are not allowed to copy the codes from the internet. You can discuss the problem with your friends. All the codes should be written by you and submission will be in the prescribed format only.
- Write necessary comments to explain your logic clearly.
- If you submit your work after the deadline, you will get a penalty of 40% of the assignment marks. Your submission will not be accepted if you submit after 48 hours of the deadline.

2. What/how to submit your work

- Please follow the same formatting for creating your submission pdf file.
- You should include these headings for each question in your pdf file:
  Question #1: State the question.
  Code #1: Your code for that respective question.
  Output #1: Put your output screenshots.
  Observations/Remarks #1: In this, you should write any types of remarks or observations you like to highlight regarding your question. If you have taken any assumptions, state those comments clearly.
- **Naming Conventions:** Assignment_1_YOUR-ID.pdf (i.e. Assignment_1_202011017.pdf)
- You have to submit only one PDF file in the Google classroom.

3. Before and in the Introductory lab

In the introductory lab, you will be given introductory information about the inheritance and interface in JAVA.

4. Main Assignment

General Notes:

- Try to make sure you avoid maximum redundancy using the concepts of inheritance and interfaces.
- Whenever you design any hierarchical structure, please put a block diagram of your hierarchy in the remarks section.
- You may have to include necessary member functions and methods based on the requirements of the question.
- Try to modularise your code as much as you can!

Question 1

You're required to create a class for Food. Categorize the food into multiple categories. Create subcategories of the categories. In the end, you'll have a hierarchical structure of Food. For example, Food can be categorized into Fruits and Vegetables. And Fruits can be further classified into summer fruits, winter fruits, and so on. You can add as many categories as you want. Make sure your hierarchical structure has at least three levels and for each level, you should have at least two subcategories. Your goal is to analyze this situation critically and to create necessary classes and member functions. Along with the code, you have to submit a block diagram of your designed hierarchy in the remarks section.

Question 2

Electronic toll collection (ETC) is a wireless system to automatically collect the usage fee or toll charged to vehicles using toll roads. You are required to design such a system for a toll plaza in Ahmedabad. You must take the input from the user.

Type of vehicle	Single Journey (in Rs)	Return Journey (In Rs)
2-Wheeler	10	15
Car/Jeep/Van	105	155
Bus/Truck	350	525

Example Case:
Inputs:
Type of vehicle passing through the toll plaza: Car
Journey type: Single
Output:
Amount to be paid: Rs 105 (should be displayed after entering the above details)

Question 3

You are an HR manager of XYZ company. Your task is to manage their salaries, commissions, and increment details. The company gives commissions to their employees based on the number of referrals he/she brings. As per the policy of the company, the employee gets 0.5% of its salary referral. Employee's increment in the salary per annum is decided based on their post and the current salary. These details are given in the table below. Your job is to incorporate all these details and design an efficient model.

Employee Type	Increment Percentage	Conditions on Increment
Jr. Software Developer	7%	Only if he/she works for at least 2 years
Sr. Software Developer	10%	Only if he/she works for at least 2 years
Team Lead	15%	Must have the lead at least 10 projects
Manager	30%	NA

Question 4

You have to make a calculator for the shapes. Your calculator must be able to calculate the basic requirements of the shape. As a part of this exercise, you can consider only two types of shapes (i.e., Circle and Polygon). Don't forget, the polygon can be categorized into many types based on the number of sides. Your goal is to design appropriate classes and interfaces to deal with this situation. The necessary functionalities are listed below. Try to reduce the redundancy as much as you can. Also, try to make it as generic as you can. In the end, report all your assumptions, the structure of your code in the remarks sections. It is mandatory to use the concepts of Inheritance and Interface to solve this problem.

Your calculator must support at least the following functionalities listed below.

- Area
- Perimeter
- Only Specific to the polygons
    - Calculation of an exterior angle
    - Calculation of an interior Angle
    - Calculate the number of diagonals
    - Identify the type of the polygon (i.e., Regular, Irregular, Convex, Concave)

Question 5

Suppose we have been given the task of creating a program that will keep track of all the accounts for a bank. There are a number of different kinds of accounts that the bank supports. Each account has its own conditions and requirements. These are listed below.

Regular Account: This account charges a fee of which is the smaller of 10 or 10% of the balance at the end of the month. There is no interest. There is a penalty of 10.00 if the balance falls below a minimum of 500.00.

Interest Account - This account charges a fee of which is the smaller of 10 or 10% of the balance at the end of the month. There is an interest of 7% paid monthly. There is no minimum balance required.

Checking Account - This account charges a fee of which is the smaller of 10 or 10% of the balance at the end of the month. There is an annual interest of 7% paid monthly. There is a penalty of 10.00 if the balance falls below a minimum of 100.00. There is a charge of 0.10 for each transaction.

CD Account - This account charges a fee of which is the smaller of 10 or 10% of the balance at the end of the month. There is an interest of 15% paid yearly. There is no minimum balance required, but if there is a withdrawal before 12 months have gone by there will be a penalty of 20% of the current balance.

All of these classes need to have basically the same methods

- Create the account
- Deposit an amount
- Withdraw an amount
- Access the balance
- Access the name
- Check the validity of the PIN
- Compute the fees
- Compute the interest

Notes:

- You have to create appropriate interfaces.
- Utilise the concept of inheritance efficiently.
- Make sure you handle the critical conditions well. (i.e., For example, when you're withdrawing the money, you have to take care of the penalties)
- Transfer of money can be done from any type of account to any type of account