IT 602: Object-Oriented Programming Lab
Assignment 1: Declarations - Classes and Arrays

January 31, 2022

- **Programming language:** JAVA
- **Due Date:** 13th February 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 declaration of arrays and the classes. Implementation details will be shared in the lab regarding the same.

4. Main Assignment

Question 1

You are supposed to create a class for vehicles. In the class, you should include at least two private members named no_of_seats and no_of_wheels. You should have methods for getters and setters for the required private members. In the driver code, you have to create two objects of the same class. (i.e., one for Motorcycle and one for Class). Your output should show the descriptions for Car and Motorcycle. Also, output the size occupied by the objects in the memory.

Question 2

You have to design a class for the calendar. Your class should include basic information related to the calendar. In this, you are allowed to create only one public method, which will decide whether a given year is a leap year or not. Design a constructor through which you can assign the values to your private members. For the output, create three different objects of the calendar for three different years. Output whether the given years are leap years or not.
Note: A year is a leap year if,

- It has an extra day i.e. 366 instead of 365
- It occurs every 4 years e.g. 2008, 2012 are leap years
- For every 100 years, a special rule applies-1900 is not a leap year but 2000 is a leap year. In those cases, we need to check whether it is divisible by 400 or not.

Question 3

You are supposed to create a calculator class. In this class, you can create methods for addition, subtraction, and multiplication. Your methods should have support for both integer values and float values. Method names must be the same for the respective tasks. Create overloading methods for doing this. You should have at least two overloaded methods. You can assign values to your private variables via different constructors. (i.e. One for integer values and one for the float values)

Question 4

You are in a locker room with 100 open lockers, numbered 1 to 100. Toggle all of the lockers that are even. By toggle, we mean close if it is open, and open if it is closed. Now toggle all of the lockers that are multiples of three. Repeat with multiples of 4, 5, up to 100. Output the number of lockers that will be open after the simulation.

Question 5

Write a Java program that prints all real solutions to the quadratic equation $ax^2 + bx + c = 0$. Read in a, b, c and use the quadratic formula. Before finding the solution, you should make a check for the real solutions. Find the value of the discriminant (i.e. $b^2 - 4ac$). If the discriminant value is negative, display a message stating that there are no real solutions. To implement this solution, make an appropriate class and appropriate methods.

Question 6

The program needs to calculate the nth power of a matrix whose elements, as well as the value of n, are specified by the user. You should store your matrix in the 2D Array. You must create supporting methods for doing matrix multiplications.