King Fahd University of Petroleum & Minerals
College of Computer Science and Engineering
Information and Computer Science Department
ICS 202 – Data Structures
Second Semester 2023-2024 (231)

Exercises for OO Concepts Review Lab

Objectives

The objective of this lab is to review object-oriented concepts.

Outcomes

After completing this Lab, students are expected to:

- Use inheritance when designing classes.
- Use polymorphism when designing classes.
- Design abstract classes and interfaces.

Practice Exercise

Write a class called **Book** in java that has the following instance variables: String **title**, int **pages** with the required accessor and **toString**() methods.

Now write a subclass "Textbook" of this class "Book" that has the following additional instance variable: String **course**. Override the **toString()** method of the "**Book**" class by printing the type of the book (**TextBook**), the title of the book, the number of pages and the course. Use another accessor method **getCourse().**

Now in a main class, create an array of 10 books with some of them being textbooks. Using a for-loop print their titles, number of pages and if it is a textbook, then its course. Finally, count the number of textbooks, the number of books and print their quantities.

SAMPLE OUTPUT: The following is a sample output>>

```
Book: ABC, # Pages = 100
Book: Arabic, # Pages = 100
Text Book: Data Structures, ICS-202, # Pages = 200, Course = ICS-202
Text Book: Writing Practice, ENGL-101, # Pages = 300, Course = ENGL-101
Text Book: Algebra, MATH-101, # Pages = 500, Course = MATH-101
Book: Water Conservation, # Pages = 200
Book: Environment, # Pages = 150
Book: Teach yourself Visual C++, # Pages = 300
Book: Notebook, # Pages = 300
Text Book: Introduction to Technology, TECH-102, # Pages = 500, Course = TECH-102
Number of Books = 6
Number of TextBooks = 4
```

Lab Exercise

Design an abstract class **Student**. A student has the following information: **ID** and **GPA**. The student class has an abstract method **getStatus** that returns the status as a string and a non-abstract final method **displayStudent** that returns the details of a student (ID, GPA and status).

Design two subclasses **Undergraduate** and **Graduate**. The **status** of the graduate student is **good** if his GPA is 3.0 or above otherwise it is **probation**. The undergraduate's **status** is **honor** if his GPA is 3.0 or above, **good** if his GPA is 2.0 or above, **probation** otherwise. Write a test class that randomly generates 10 students and prints their type "Undergraduate or Graduate", ID, GPA and status.

A sample output is shown below:

```
Undergraduate ID>> 858711, GPA>> 1.55, Status>> probation
Graduate ID>> 464910, GPA>> 0.9, Status>> probation
Undergraduate ID>> 383254, GPA>> 1.83, Status>> probation
Graduate ID>> 119240, GPA>> 3.66, Status>> good
Undergraduate ID>> 520227, GPA>> 2.18, Status>> good
Graduate ID>> 47816, GPA>> 3.65, Status>> good
Undergraduate ID>> 558083, GPA>> 2.55, Status>> good
Graduate ID>> 918083, GPA>> 2.7, Status>> probation
Undergraduate ID>> 714181, GPA>> 3.4, Status>> honor
Graduate ID>> 332491, GPA>> 0.63, Status>> probation
```