Week 2, Lab B – Linked Classes

# Lab Intro & Prep

This lab will introduce the idea of a class (and objects of that class) having variables that are themselves references to other objects. We have actually done this in Part A of the lab – a Fish object has a String for its name – and Strings are objects in Java. This lab will take that idea further by having a Unit class that contains an ArrayList of students and keeps track of each student grade, including the average unit grade.

## Learning Objectives

* Creating objects that contain references to other objects
* Implement static variables for data that is shared across all instances of a class

# Exercise 1 – Portfolio Grade Calculator

This exercise will involve creating multiple classes, one of which will have a main method that will be responsible for creating objects of other classes.

A portfolio grade calculator will involve creating student objects. Each student has **four** portfolio marks, which are equally weighted at 25% each, for a total unit mark of 100%. A **Unit** class will then contain links to multiple students through an ArrayList.

## Part 1 – GradebookDemo.java

Start by creating a class with a main method named **GradebookDemo**. This class will remain empty for now, but we will soon create multiple objects in the main method.

## Part 2 – Student.java

The second class in our Program will represent a Student. A student in our case has a name, age, degree/pathway, and four portfolio scores – stored in an array of integers.

1. Create a 2nd class named Student **(without a main method)**. Populate this class with the following variables:

String name;

**int** age;

String degree;

**final** **static** **int** ***numPortfolios*** = 4;

**int**[] portfolioMarks = **new** **int**[***numPortfolios***];

There is something new here – a **final static variable**. Every student has a name, age, and degree, which will vary across all students. However, one thing does not vary – every single student is assessed through four portfolios – and this is something that is shared between all instances of the Student class. A **static** **variable** indicates that every object of the class will ‘share’ the variable, and it will remain constant by the use of the **final** keyword.

1. Add a constructor to the student class which accepts the following:
   1. **String** for their name
   2. **int** for their age
   3. **String** for their degree (course title)
2. Add a method named **setPortfolioMark** to the Student class with the following method header:

**public** **void** setPortfolioMark(**int** portfolioNumber, **int** grade)

This method will require the user to pass the portfolio number (int), and the grade achieved for that portfolio (int).

1. Implement the method by modifying the appropriate item in the portfolioMarks array. **Hint:** Think about how the method should interact with the array (should portfolio number 1 be stored in portfolioMarks[1]?)
2. In the main method of the **GradebookDemo** class, create a student object, and call the setPortfolioMark method four times, passing in the grade for portfolio 1, 2, 3, and 4.
3. In the **Student** class, add a method that calculates the unit mark for the student – the method header is provided below. The method needs to add all of the portfolio grades together (using a loop to iterate through the array) and divide by the number of portfolios, and then return this result as a double.

**public** **double** getUnitMark()

1. Test this method works by calling it (in the main method) on one of the student objects that has been assigned portfolio grades

## Part 3 – Unit.java

Create another class named **Unit (without a main method).** This class will represent a unit of study – like programming.

A unit has many things – the students studying it, the name of the Unit, the name of the lecturer etc. Add to the unit class the following variables:

* **name** – name of the Unit (of type **String**)
* **lecturer** – name of the lecturer (of type **String**)
* **unitSize** – size of the Unit (number of students – of type **int**)
* **unitAvgMark** – average unit mark (of type **double**) – this will store the average grade across all students for their portfolios
* **students** – An ArrayList of **Students** – this will store all of the students on the Unit

1. Implement a method that allows a student to be added to the Unit. This method should be added to the Unit class and accept one parameter – a student. **Hint:** when we add a student to the Unit, what should happen to the **unitSize** variable?
2. Add a method called unitAverage to the **Unit** class, which returns the average student mark. This method should return a **double**.
3. Finally, in your main method, create a unit object and add some students to it (using the addStudent method of the Unit class). Test the Unit class’ unitAverage method works by calling it.