

Submission deadline: April 5, 2020 23:59:59.

For all coding questions: submit Java source files, and screenshots of your output.

For all modeling questions: submit PDF files for your models.

Question#1 (Total 4 points)

```
import java.util.Date;
public class InternetCharge implements Cloneable {

    double bandwidth;
    boolean isLimited;
    double monthlyRate;
    Date startDate;

    public InternetCharge(double bandwidth, boolean limited,
double monthlyRate, Date startDate) {
        this.bandwidth = bandwidth;
        this.isLimited = limited;
        this.monthlyRate = monthlyRate;
        this.startDate = startDate;
    }

    public void setMonthlyRate(int rate) throws Exception {
        if (rate < 0)
            throw new Exception("Rate cannot be negative");
        if (isLimited) {
            this.monthlyRate = rate * 1;
        } else if (!isLimited) {
            this.monthlyRate = rate * 1.5;
        }
    }

    public double getMonthlyCharge() {
        return monthlyRate * bandwidth * 0.5;
    }

    @Override
    public Object clone() {
        // Write your code here
    }
}
```

```
}  
}
```

a.) The method clone is provided in the Object class. Override the method clone to perform deep copy for InternetCharge. (2 points)

b) Write two test methods for InternetCharge. The first test method is to test whether the getMonthlyCharge operation is correct. The second test method is to test whether an exception is thrown by the setMonthlyRate method. (2 points)

Question#2: (Total 3 points)

a) What the Adapter pattern is useful for? What is the difference between class adapter and object adapter? (1 points)

b) Explain what Singleton pattern is useful for? What is the difference between lazy and eager instantiation in the Singleton design pattern. (1 points)

c) Explain what Observer pattern is useful for? (1 points)

Question#3: (Total 6 points)

a) Draw a class diagram that models the following: Animals can eat and move. Birds are animals that can fly. Chicken, Eagle, Cow, Rabbit, and Tiger are animals. Chicken and Eagle are birds. Chicken and Cow are edible. You can not create an object of Animal or Bird. Peas and Carrot are Plants. Plants are edible. Tigers eat any Animal, Chicken eat Peas, Cows eat any plant, Rabbits eat Carrot, and Eagle eat any Animal. Make sure to include methods that model behaviours in each class. If something can be modelled using association, the preference should be given to using association. (3 points)

b) Write a Java program that include classes and interfaces for the above scenario. Each concrete class should override the toString() method to print the name of the animal or plant. Edible animals should have a method that returns string called howToEat(). For edible animals, howToEat() should return “roast it” and for plants, this method should return “eat as you wish”. In addition, you have to write a main method in a separate class. In the main method, you have create an object for each animal or plant, and call toString on it. For edibles, you have to print the string returned from howToEat(). (3 points)

Question#4: (4 points)

A passenger wants to book a flight. First, she checks if the flight has an available seat, if yes, a booking object is created and the passenger is added to the booking object. If the flight doesn't have available seats, it will create a waitlist object and will add the passenger to the object. Draw a sequence diagram that illustrates this scenario.

Question#5: (4 points)

In a course registration system, the student enters the course ID and student ID for registration. In parallel, the system verifies if the student has the prerequisites for the course and if the course is not full. If both conditions are fulfilled, the system will register the student in the course and will exit successfully. If one of the conditions is not fulfilled, the system will exit unsuccessfully. Draw an activity diagram that illustrates this scenario.

Question#6: (3 points)

On Week#10, we discussed JavaFX. Explain in writing the relationship between a Stage, Scene, Nodes, and Parents (Control or Pane). Illustrate using two examples, one using Shape and another using a Control such as Label.

Question#7: (Total 4 points)

- a) Write a Java program to create a file named Assignment3.txt if it does not exist. Write 100 integers created randomly into the file using text I/O. Integers are separated by spaces in the file. Read the data back from the file and display the data in creasing order. (2 points)
- b) Now, in the same Java program replace each number by its multiple of 2. For example, if the number was 4, replace it with 8. (2 points)

Submit Java source file, screenshots of your output and the text file.

Question#8: (2 points)

What is the output of the following program:

```
class Test {
    public static void main(String[] args) {
        try {
            method();
            System.out.println("After the method call");
        }
        catch (RuntimeException ex) {
            System.out.println("RuntimeException");
        }
        catch (Exception ex) {
            System.out.println("Exception");
        }
    }

    static void method() throws Exception {
```

```
try {
    String s = "5.6";
    Integer.parseInt(s); // Cause a NumberFormatException

    int i = 0;
    int y = 2 / i;
    System.out.println("Welcome to Java");
}
catch (NumberFormatException ex) {
    System.out.println("NumberFormatException");
    throw ex;
}
catch (RuntimeException ex) {
    System.out.println("RuntimeException");
}
}
```