INSTITUTE OF TECHNOLOGY
TALLAGHT
Higher Certificate in Science
Bachelor of Science
Bachelor of Science (Honours)

Computing

Full Time

Semester Three : January 2015

Software Development 3

Internal Examiners
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External Examiners
Mr. John Keating

Day	**Wednesday**
Date	**14th January 2015**
Time	**15.30-17.30**

Instructions to Candidates

Answer Question One and any two other questions

Question 1 **(40 Marks)**

a) Briefly describe the use of the static modifier in the context of Java programming, both when applied to variables and when applied to methods.
(6 Marks)

b) Outline four differences between interfaces and abstract classes in Java.
(12 Marks)

c) The abstract class MoneyDevice represents various machines which accept money. One such item represented below is a Jukebox. Trace through the following code and explain the meaning of the following:

i) an abstract class
ii) an abstract method
iii) the protected access modifier

(9 Marks)

```
abstract class MoneyDevice {
        protected int volume;
        private Boolean on;


public void switchOn() {
        on = true;
}

public void switchOff() {
        on = false;
}

public abstract void changeVolume(int volume);

}


class JUKEBOX extends MoneyDevice {

        private int songNumber;

public void changeVolume(int amount) {
        volume += amount;
}
}
}
```

d) Write a method as part of the class JUKEBOX to enable the song number to be changed.
(3 Marks)

e) We now want to represent the idea of a MoneyManager that has responsibility of maintaining a record of how much money is collected by such machines.

Write the code required to implement the MoneyManager interface with the following methods:

i) setStartAmount: to set the amount of money collected at the start of day to 0.
ii) getDailyTotal: to return the total amount of money collected by the Jukebox in one day.

(8 Marks)

f) Re-write the heading of the JUKEBOX class to incorporate the use of an interface called MoneyManager

(2 Marks)

Question 2 **(30 Marks)**

Consider the following code extract from the definition of a class Building with four members. This class contains an inner member class called Room with two member variables. The completed test class is also provided.

```
import java.util.ArrayList;

public class Building {
   private int sqrFeet;
   private String name;
   private double cost;
   private ArrayList<Room> rList;

   public Building() {
      this.sqrFeet = 0;
      this.name = "";
      this.cost = 0.0;
   }

   public int calculatremainingCapacity() {

      return 0;
   }

   class Room {
      private int roomNumber;
      private int capacity;

      Room(int roomNumber, int capacity) {
         this.roomNumber = roomNumber;
         this.capacity = capacity;
      }
   }
}
```

```
public class TestBuilding {
   public static void main(String argsp[])
   {
      int[] numbers = {1,2,3};
      int[] cap = {300, 500, 600};
      Building b = new Building(15000,"Icon Court", 25000.00, numbers, cap);

      System.out.println("Remaining capacity in the building is:" +
      b.calculateRemainingCapacity());
   }
}
```

a) Write the code for the overloaded constructor in the outer class based on the call to this constructor in the test class. Inside this constructor the member variables should be initialized and the inner class objects should be created and stored in the array list.

(8 Marks)

b) Write the code for the method **calculateRemainingCapacity()** which should calculate and return the remaining capacity in the building after creating the three rooms of varying sizes.

(6 Marks)

c) The code extract provided demonstrates the user of an **Inner Class** and **Composition.** Explain what you understand by these two concepts in Java.

(8 Marks)

d) Explain with the aid of an example the use of a **local class** in Java.

(8 Marks)

Question 3 **(30 Marks)**

a) Within Java it is possible to create *your own* exceptions. Discuss why this is desirable and outline how this is achieved.

(10 Marks)

b) The following code consists of 2 classes: an **Account** class and a **TestAccount** class for an Internet banking system.

```
class Account
{
   private double balance;

   public Account (double balance)
   {
      this.balance =balance;
   }
   public void withdraw(double amt)
   {
     balance -= amt;
   }

   public double getBalance()
   {
      return balance;
   }
}

public class TestAccount
{
   public static void main(String[] arg)
   {
      Account theAccount = new Account(200);
      theAccount.withdraw(-300);
   }
}
```

i) Develop an exception class **PositiveWithdrawalException** that prints an error message "Withdrawal amount must be positive".

(5 Marks)

ii) Modify the above code such that: If a negative amount is entered, a **PositiveWithdrawalException** exception is ***thrown*** within the withdrawal method and is ***caught*** in the calling method (main).

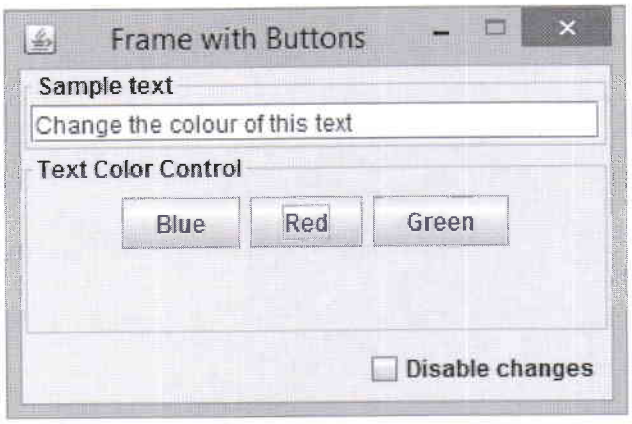
(9 Marks)

iii) Modify the above code (again the original code as specified above) such that: If a negative amount is entered, the **PositiveWithdrawalException** exception is handled *locally* within the withdrawal method.

(6 Marks)

Question 4 **(30 Marks)**

Consider the following GUI application that displays the String "Change the colour of this text" across the top panel of the frame window. The middle panel has three buttons, labelled Black, Red and Green. When the user clicks a button the sentence above the buttons changes colour accordingly. The bottom panel has a check box labelled Disable changes. The user clicks the check box to disable or enable the buttons.



a) The code below partially implements the above window, but is missing most of the GUI components. You are required to complete this code to include the missing GUI components/widgets in the correct layout so as to display the frame as above. Only write the new code in your answer, there is no need to rewrite the code given below. You do not need to write event handling code at this stage.

(20 Marks)

```
package q4skeleton;
import javax.swing.*;
import java.awt.*;

public class ThreePanels extends JFrame {
   private JPanel upper, middle, lower;
   private JTextField text;
   private JButton black, red, green;
   private JCheckBox disable;

   private static final int FRAME_WIDTH = 300;
   private static final int FRAME_HEIGHT = 200;
   private static final int FRAME_X_ORIGIN = 150;
   private static final int FRAME_Y_ORIGIN = 250;

   public ThreePanels(String textTitle) {
```

```
        super(textTitle);
        setTitle("Frame with Buttons");
        setSize (FRAME_WIDTH, FRAME_HEIGHT);
        setLocation (FRAME_X_ORIGIN, FRAME_Y_ORIGIN);
        setResizable(false);
        setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
        // GUI Code goes here
    }

    public static void main(String args[])
    {
      ThreePanels t = new ThreePanels("Three Panel Sample");
    }
}
```

b) The code given above has no event handling capability. Write the extra code that would be required in order for the events for the Black, Red and Green buttons to be handled by the program. When a button is pressed the text changes to the clicked button's colour. No event handling code is necessary for the check box.

(10 Marks)