INSTRUCTIONS SHEET

Perusal Time: 15 minutes

Examination Duration: 180 minutes (3 hours)

Total Marks: 65 marks

There are three (3) sections in the examination.

Section 1: Contains five (5) questions worth four (4) marks each. To get full marks the student needs to answer all questions.

Section 2: Contains four (4) questions worth five (5) marks each. To get full marks the student needs to answer all questions.

Section 3: Contains three (3) questions, the first two are worth eight (8) marks each, and the third is worth nine (9) marks. To get full marks the student needs to answer all questions.
Section 1 – Five (5) Questions 20 MARKS

Question 1.1 (4 marks)

State whether each of the following is true or false.

a) Suppose Car is a java class, the source code for the Car class should be saved as Car.java. (T)

b) When you create an object instance, you decide the parameters by inspecting the class methods of the class. (F)

c) Array is a primitive data type in Java. (F)

d) Static fields belong to whole class. (T)

e) A method is called by specifying an object, the method name, and the method parameters. (T)

f) Multiple object variables cannot contain references to the same object. (F)

g) A final variable is a constant. Once its value has been set, it cannot be changed. (T)

h) A predicate method returns a numeric value. (F)
Question 1.2
(4marks)

Select one correct answer from the four options given (a, b, c, and d) for the following questions.

i. A method that accesses an object and returns some information about it, without changing the object, is called a(n) ____________ method.
   a) explicit  
   b) implicit  
   c) mutator  
   d) accessor  
   Answer: d

ii. What are the two categories of data types in the Java programming language?
   a) primitive and string  
   b) primitive and literal  
   c) primitive and reference  
   d) string and reference  
   Answer: c

iii. The _________ Java layout manager places components side by side, from left to right, wrapping onto the next row as required.
   a) BorderLayout  
   b) FlowLayout  
   c) GridLayout  
   d) null  
   Answer: b

iv. A(n) __________ field belongs to the class, not to any object of the class.
   a) static  
   b) instance  
   c) private  
   d) public  
   Answer: a
Question 1.3

Debug the following code.

```java
01  import java.util.Scanner;
02  // This program converts dollar to euros.
03  public class CurrencyConverter
04  {
05    public void main (String[] args)
06    {
07      Scanner in = new Scanner(System.in);
08      System.out.print("How many euros is one dollar: ");
09      double rate = in.nextDouble();
10      bool done = false;
11      while (!done)
12      {
13        System.out.print("Dollar value (Q to quit): ");
14        String input = in.next();
15        if (input.equalsIgnoreCase("Q"))
16          done = true;
17        then
18          double amount = Double.parseDouble(input);
19          double exchange = amount * rate;
20          System.out.printf
21            ("%.2f dollar = %.2f euro\n", amount, exchange);
22        }
23    }
24  }
```

**Solution:**

- Line 03: main method must be static
- Line 08: system should start with upper case “S”
- Line 10: bool should be boolean
- Line 17: then should be else
Question 1.4 (4 Marks)

The following program compiles and runs. What is the output of this program?

```java
public class Book
{
    private String title;
    private String author;
    private double price;

    public Book()
    {
        this("Unknown","Unknown",0.0);
    }

    public Book(String t, String a, double p)
    {
        title = t;
        author = a;
        price = p;
    }

    public String getDescription()
    {
        return ("Title=" + title + "\t\tAuthor="+ author + "\t\t Price="+ price);
    }

    public static void main(String[] args)
    {
        Book b1 = new Book();
        System.out.println(b1.getDescription());

        Book b2 = new Book("Big Java", "Horstma", 100);
        System.out.println(b2.getDescription());
    }
}
```

Answer:
Title=Unknown           Author=Unknown           Price=0.0
Title=Big Java          Author=Horstma           Price=100.0
Question 1.5  

Give an example of how you would call the method.

```java
public class BankAccount
{
    private double balance = 0.0;

    //default constructor
    public BankAccount()
    {
        balance = 0;
    }

    // constructor
    public BankAccount(int initialBalance)
    {
        balance = initialBalance;
    }

    public void transfer(BankAccount toAccount, double amount)
    {
        balance = balance - amount;
        myAccount.deposit(amount);
    }

    //other bank account methods
}

Answer:
BankAccount harrysChecking = new BankAccount();
BankAccount mumsSaving = new BankAccount(10000);
mumsSaving.transfer(harrysChecking, 200);
```
Section 2 – Four (4) Questions 20 MARKS

Question 2.1 (5 marks)

Based on the following program structure, predict the output (main method is in next page).

```java
public class Goods {
    private double value;
    public Goods(double v) {
        value = v;
    }
    public double getValue() {
        return value;
    }
    public String getDescription() {
        return "Goods is worth "+value;
    }
}

//--------------
public class Box extends Goods {
    private String content;
    public Box(String c, double vb) {
        super(vb);
        content = c;
    }
    public String getDescription() {
        return "a box containing "+ content + " is worth "+ super.getValue();
    }
}

//--------------
public class Car extends Goods {
    private String label;
    public Car(String c, double vc) {
        super(vc);
        label = c;
    }
    public String getDescription() {
        return label +" car is worth " + super.getValue();
    }
}
```
/-------------------
public class MyProg
{
    public static void main(String[] arguments)
    {
        Goods g1 = new Box("Socks", 700);
        System.out.println(g1.getDescription());

        Goods g2 = new Car ("BMW", 35000);
        System.out.println(g2.getDescription());

        Goods g3 = new Goods(100);
        System.out.println(g3.getDescription());
    }
}

Answer:
a box containing Socks is worth 700.0
BMW car is worth 35000.0
Goods is worth 100.0
Question 2.2

Insert the missing statements in the following code.

```
// Class PlayListener is an action listener
import ________________________________________
import java.awt.event.ActionListener;

public class PlayListener implements ActionListener
{
    public void actionPerformed(ActionEvent event)
    {
        System.out.println("Play is selected");
    }
}

// Class PlayTester is a GUI to use PlayListener
import javax.swing.JButton;
import javax.swing.JFrame;
import java.awt.event.ActionListener;

public class PlayTester
{
    JFrame fm = new JFrame();
    JButton bt = new JButton("Start Play");
    fm.add(bt);

    // add your code here to install PlayListener to "Start Play" button

    ________________________________
    ________________________________

    fm.setSize(500,400);
    fm.setVisible(true);
}

Solution:

import java.awt.event.ActionEvent;

ActionListener listener = new PlayListener();
bt.addActionListener(listener);
```
Question 2.3  

In an object-oriented traffic simulation system, we have the following classes:

- Vehicle
- Car
- Truck
- Sedan
- Coupe
- PickupTruck
- SportUtilityVehicle
- Minivan
- Bicycle
- Motorcycle

Draw an inheritance diagram that shows the relationships between these classes.

Answer:
Question 2.4 (5 marks)

Identify the javax.swing components from the following GUI. And explain how the layout managers can be used for this GUI.

(Note: The javax.swing components must be written in correct case ie; same as the class name defined in javax.swing)

Answer (sample)

components:

JFrame – for the main frame
JPanel – main panel, central panel, bottom panel, central left panel, central right panel, top left central panel, bottom central left panel,
JCheckBox – for A input, B input
JRadioButton – gate type, i.e, AND, OR, NOT, NAND, NOR and XOR
ButtonGroup – gate type
JButton – Default, Exit
JTextArea – Truth table display (right panel)
JTextField – formula display (top left panel)
JLabel – some dummy labels may need to form Gate interaction display area

Layout management:
main panel (BorderLayout) = central panel (CENTER) + bottom panel (SOUTH)
central panel (GridLayout(1,2)) = central left panel + central right panel
central left panel (GridLayout(2,1)) = top left central panel + bottom central left panel
top left central panel (GridLayout(3,2)) = Two input checkboxes + formula text field + some dummy labels
bottom central left panel (GridLayout(2,3)) = radio buttons for gate type
bottom panel (GridLayout(1,2)) =Default button + Exit button
Section 3 – Three (3) Questions 25 MARKS

Question 3.1 (8 marks)

The following program compiles and runs. Examine it closely and predict the output

```java
import java.util.ArrayList;

public class MyProg {
    public static void main(String[] args) {
        String[] team = {"Australia","New Zealand","Indian","UK","Pakistan","China"};
        ArrayList<String> teamList = new ArrayList<String>();
        for (int i=0; i<team.length; i++) {
            teamList.add(team[i]);
        }
        for (int i=0; i<teamList.size(); i++) {
            String tempTeam = teamList.get(i);
            if (tempTeam.startsWith("N")) {
                teamList.remove(i);
            }
        }
        for (int j=0; j<teamList.size(); j++) {
            System.out.println(teamList.get(j).toString());
        }
    }
}
```

Answer:

- Australia
- Indian
- UK
- Pakistan
- China
Question 3.2  

Class DataSet computes the sum and average of a sequence of integers. Supply methods

- `void addValue(int x)`
- `int getSum()`
- `double getAverage()`

then write a main method to test it.

(solutions in red)

```java
// A DataSet computes the total and average value of a
collection of numbers.
public class DataSet
{
    // Constructs an empty data set.
    public DataSet()
    {
        total = 0;
        count = 0;
    }

    // Adds a value to this data set.
    public void addValue(int x)
    {
        count++;
        total = total + x;
    }

    // Computes the sum of the values.
    public int getSum()
    {
        return total;
    }

    // Computes the average of the values.
    public double getAverage()
    {
        return (double) (total) / count;
    }

    private int total;
    private int count;
} 
```
import java.util.Scanner;

/**
 * Tests the DataSet class.
 */
public class DataSetTester
{
    public static void main(String[] args)
    {
        DataSet myDataSet = new DataSet();
        myDataSet.addValue(13);
        myDataSet.addValue(-2);
        myDataSet.addValue(3);
        myDataSet.addValue(0);

        System.out.println("Sum: " + myDataSet.getSum());
        System.out.println("Expected: 14");
        System.out.println("Average: " + myDataSet.getAverage());
        System.out.println("Expected: 3.5");
    }
}
Question 3.3  

In Java API, class Math (from the java.lang package) has the following definition

```
public final class Math
extends Object
```

The class Math contains methods for performing basic numeric operations such as the elementary exponential, logarithm, square root, and trigonometric functions.

The field PI is described as

```
static double PI
```

The double value that is closer than any other to pi, the ratio of the circumference of a circle to its diameter.

The method cbrt method is described as

```
static double cbrt(double a)
```

Returns the cube root of a double value.

Write a java class containing a main method to

- calculate $x$ from the following formula

\[ x = 3 \sqrt{\frac{\pi}{4}} \]

- display the result in the console window

Answer:

```
public class TestMath {
    public static void main(String[] args) {
        double x = Math.cbrt(Math.PI/4);
        System.out.println(x);
    }
}
```