

**INTI**
 INTERNATIONAL COLLEGE PENANG (507232-U)  
 LAUREATE INTERNATIONAL UNIVERSITIES
**FINAL**

(COVER PAGE)

Session : AUGUST 2014  
 Programme : DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING  
 Course : CSC 2181: OBJECT ORIENTED PROGRAMMING IN JAVA  
 Date of Examination : December 5, 2014  
 Time : 11.00am – 1.00pm Reading Time : Nil  
 Duration : 2 Hours  
 Special Instructions :

This paper consists of **SIX (6)** questions. Answer any **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

Materials permitted : Nil

Materials provided : Answer Booklet

Examiner(s) : KOO LEE CHUN

Moderator : DR. VINCENT KHOO

*This paper consists of 11 printed pages, including the cover page.*

## INTI INTERNATIONAL COLLEGE PENANG

## DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING

## CSC2181: OBJECT-ORIENTED PROGRAMMING IN JAVA

## FINAL EXAMINATION: AUGUST 2014 SESSION

**Question 1**

- (a) Identify the errors in the following code segments. Briefly explain the reason of the error and suggest the fixes. Some errors are syntactical while others are logical. Assume all required classes are imported without errors.

(i) //assign value 10.3 to variable j with float data type  
float j = 10.3;

(ii) //Read an integer value from GUI dialog box and display the result of  $a^2$   
int a = JOptionPane.showInputDialog ("Enter a number:");  
a = a \* a;  
System.out.println ("a="+a);

(iii) //Expected output : 5,4,3,2,1  
int i=5;  
do{  
--i;  
System.out.println (i);  
}while (i <=5);

(iv) //Read an integer value, a, and double value, b, from user.  
//Display the result of a+b if value of a is more than 10, otherwise, display the  
//value of a

```
Scanner s = new Scanner (System.in);
int a = console.nextInt();
double b = console.nextDouble();
if (a>10)
    a = a + b;
    System.out.println (a);
else
    System.out.println (a);
```

(7 marks)

- (b) Trace the output for the following code segment:

```
int a=5,b=6;
double c=8.5;
String str = "Java Exam";
boolean logic = true;
```

```

logic = a >= 5 && ! (b < 6);
a = a + a/b% (a+1);
c -= a-b/a*a;
b = a++ - a % ++b * --b;

```

```

if (logic)
    System.out.println( "First line");
else
    System.out.println( "Second Line");

```

```

System.out.print ("a=" +a);
System.out.println(" b=" +b);
System.out.printf ("c=%.2f",c);
System.out.println( "str=" + str.replace ("Java", "C++")+ " now " + a + b );

```

(6 marks)

- (c) Write a program that prompts the user to enter ten numbers, and displays the mean and standard deviations of these numbers using the following formula. Write your program using while loop. Display your output in 2 floating points.

$$\text{mean} = \frac{\sum_{i=1}^n x_i}{n} = \frac{x_1 + x_2 + \dots + x_n}{n} \quad \text{deviation} = \sqrt{\frac{\sum_{i=1}^n x_i^2 - \frac{\left(\sum_{i=1}^n x_i\right)^2}{n}}{n-1}}$$

Here is the sample run :

```

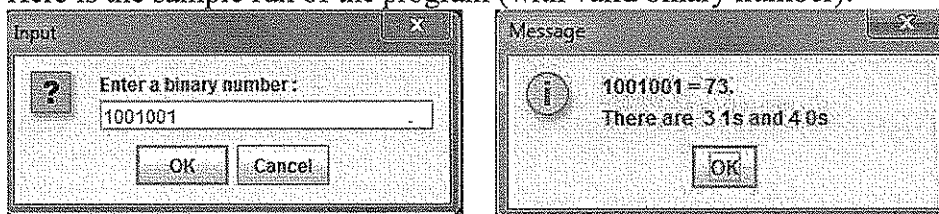
Please enter 10 numbers :1 2.3 4 5 6 7 8 9 10
Mean is 5.50
Standard Deviation is 3.03

```

(5 marks)

- (d) Write a program to calculate the value (in integer), frequency of 1 and 0 for a binary number input by the user. If the input is 1001001, then the program will display the "value of 1001001 = 73. There are 3 1s and 4 0s". The program shall verify the user input is binary number, otherwise display error and end the program. The program must use GUI dialog box to accept user input and display output (including error message). The program must use at least **ONE (1)** switch statement to solve the problem.

Here is the sample run of the program (with valid binary number):



(7 marks)

**Question 2**

- (a) Briefly explain the differences between standard array and ArrayList. Give an example of a scenario in which the use of an ArrayList would be preferable to a standard array. (4 marks)

- (b) An Armstrong number of 3 digit is a number for which the sum of cube of its digits are equal to the number e.g. 371 is an Armstrong number because  $3^3 + 7^3 + 1^3 = 371$ . Write a method that determines if a number is Armstrong number. The method shall receive an integer number and return the result. (5 marks)

- (c) Write a method to eliminate the duplicate values in the array using following method header:

```
public static int[] eliminateDuplicates(int[] numbers)
```

Write a code segments that use method, Math.random(), randomly assign ten integers value from 10-50 (inclusive both numbers), and displays the result.

Here is the sample run:

Original List:

44 34 32 41 36 37 46 37 28 46

List without duplication:

44 34 32 41 36 37 46 28

(10 marks)

- (d) Trace the output for the following code segment below

```
int[][] s1 = new int [3][6];
int [][] s2 = {{1,2,3,4,5,6,7},
               {10,20,30,40,50,60,70},
               {5,6,7,8,9,10,11},
               {11,12,13,14,15,16,17}};

for (int i=1;i<s1.length;i++){
    for (int j=1;j<s1[i].length;j++){
        s1[i][j] = s2[i][j-1] - s1[i-1][j];
        if (s1[i][j] % 4 == 0){
            s1[i][j] += 3 * s2[i][j];
        }
    }
}

for (int i=1;i<s1.length;i++){
    for (int j=0;j<s1[i].length;j++){
        System.out.println (s1[i][j]+" ");
    }
}
```

(6 marks)

**Question 3**

- (a) Define the terms class and object. Briefly explain the relationship between them. (2 marks)
- (b) Assume ClassA has two public data members, x(integer) and y(integer), and a public class(static) data member, z (double). Class A has two overloading constructors and three methods as below :

```

ClassA () {
    this(-1,-1)
}
ClassA (int a, int b){
    x=a;
    y=b;
}

public int M1(int y){
    System.out.println ("y=" + y);
    x = x % y ;
    return x*this.y+y;
}
public void M1 (ClassA c){
    if (c.y!=0){
        this.y = this.x + c.x/c.y % 2;
    }
}
public void M2(double z){
    z = z * 2;
    this.z = z;
}

```

Trace the output for the following code segment:

```

ClassA obj1 = new ClassA(3,8);
ClassA obj2 = new ClassA(4,6 );
ClassA obj3 = new ClassA();

obj1.x = obj2.M1(10);
obj1.M1(obj2);
obj1.M2(5.2);
System.out.printf( "x=%d, y=%d,z=%.2f",obj1.x,obj1.y, ClassA.z);
System.out.printf( "x=%d, y=%d,z=%.2f",obj2.x,obj2.y, ClassA.z);
System.out.printf( "x=%d, y=%d,z=%.2f",obj3.x,obj3.y, ClassA.z);

obj3 = obj1;
obj1= obj2;
obj2.x = M1(4) * obj2.y;
obj1.y=4;
System.out.printf( "x=%d, y=%d,z=%.2f",obj1.x,obj1.y, ClassA.z);
System.out.printf( "x=%d, y=%d,z=%.2f",obj2.x,obj2.y, ClassA.z);
System.out.printf( "x=%d, y=%d,z=%.2f",obj3.x,obj3.y, ClassA.z);

```

(8 marks)

- (c) Create a class named Student. Student has name, course, cgpa and status as the attributes. Provide accessor and mutator methods for each instance variable. The cgpa value shall be in between 0 and 4 (inclusive both numbers), otherwise display the warning message and set the value to 0. The attribute status uses 'A' for active, 'W' for warning, 'P' for probation and 'T' for terminated, otherwise set it to "I" – invalid and display warning message. The class shall provide a constructor that takes arguments for object initialization.

Provide a toString method that return string of the object information. The status of the student shall display as ACTIVE, WARNING, PROBATION, TERMINATED OR INVALID.

Provide another method named isCgpaHigherThan that compare current student's cgpa with another student. The method shall return true if the current student's cgpa is higher than another student, otherwise return false.

(10 marks)

- (d) Based on the class defined in (c), write a code segment that create 2 objects, std1 and std2, and store them into an ArrayList data structure. Invoke the method isCgpaHigherThan to compare std1 and std2 cgpa and display appropriate message.

(5 marks)

**Question 4**

- (a) Briefly describe the differences between :
- (i) Method overriding and overloading
  - (ii) Inheritance and composition

(4 marks)

- (b) ClassA is the superclass of ClassB and both classes are defined in the same package. ClassA consists of two instance members, num1 and num2; two constructors, accessor and mutator methods (for num1), a static method display and an abstract method M1.

Identify and describe **NINE (9)** errors for the following code segment. Use the line references and provide your answer in the following format :

Line No	Error

```

1 public class ClassA {
2     private int num1;
3     protected double num2;
4
5     public void ClassA(){
6         this (1.5,3);
7     }

8     public ClassA(int n1, double n2 ){
9         num1 = n1;
10        num2 = n2;

```

```
11     return n1*n2;
12 }

13 public void setNum1( int num1) {
14     this.num1 = num1;
15 }

16 public double getNum1(){
17     return num1;
18 }

19 public static void display(){
20     System.out.println ("Num1=" + num1 + " num2=" + num2);
21 }
22 public abstract void M1();
23 }

24 public class ClassB{
25     private int num1,num2,num4;

26     public ClassB(int num1, double num2, int num4){
27         this.num4 = num4;
28         super (num1, num2);
29     }
30
31     public ClassB(){
32         super.num1 = 10;
33         super.num2 = 20;
34         num1=30;
35         num2 = 40;
36         ClassA.display();
37     }

38     public void test3 (ClassA a){
39         System.out.println ("test3 Method");
40         display( );
41         a.display();
42     }

43 }
```

(9 marks)

(c) Cupboard class is defined as show below :

```
public class Cupboard {
    //save the open/closed state. open=true,closed - false
    protected boolean open;

    public Cupboard() { // By default, the cupboard is closed.
        open = false;
    }

    public Cupboard(boolean openStatus){
        //initialiaze the open status
        open = openStatus;
    }

    public boolean isOpen() {
        return open; // returns true if open
    }

    public void openDoor() {
        // open the cupboard
        open = true;
    }

    public void closeDoor() {
        // close the cupboard
        open = false;
    }

} // Cupboard
```

A Safe is similar to a Cupboard except that it can be locked and unlocked. Write the Java code for the Safe class that inherits from the Cupboard based on following requirement:

- Add a new attribute named lock to keep track of the lock state (true for locked, false for unlocked).
- A Safe shall be in unlocked state if the door is opened. Therefore, the parameterized constructor (constructor with arguments) for the Safe class shall initialize the lock state based on the open state provided. However, if the door is closed, set the lock state to locked (true) for the new Safe.
- Provide a non-arguments constructor for the Safe class by calling the constructor with argument. Assume the Safe is closed by default.
- A Safe cannot be opened if it is in locked state. Therefore, you shall override the method openDoor and prompt appropriate error message.
- Provide additional methods isLock, lockDoor, unlockDoor.
  - Method isLock return the lock state.
  - Method lockDoor shall allow users to lock the door only if the door is closed. Otherwise, display appropriate error message.
  - Method unlockDoor shall allow users to unlock the door.
- Override method toString() to return the object information in a string format .

(12 marks)

**Question 5**

(a) Define the term polymorphism.

(2 marks)

(b) Suppose we have following class definition :

<pre>class A {     public int f(int x) {         return 2 * x;     }     public int g(int x) {         return f(x * 3);     } }</pre>	<pre>class B extends A {     public int f(int x) {         return 5 * x;     }     public int h(int x) {         return f(7 * x);     } }</pre>
---	---

(2 marks)

What is the output after executing following code segment?

```
B b = new B();
System.out.println(b.f(1) + " " + b.g(1));
A a = b;
System.out.println(a.f(1) + " " + a.g(1));
```

(c) Class LivingThing and Animal are two abstract classes. Class Plant and Animal are the subclass of the LivingThing, whereas, class Fish is the subclass of Animal. Fish is the superclass of class OilyFish and WhiteFish. Assume all classes implement the default constructor.

Based on the information described above, discuss (line by line) why the codes below will or will not work.

```
1 LivingThing L1 = new LivingThing();
2 LivingThing L2 = new Plant();
3 Animal A = new OilyFish();
4 WhiteFish w = new OilyFish();
```

(4 marks)

(d) Comparable interface defined below:

```
interface Comparable {
    int compareTo(Object);
}
```

where `x.compareTo(y)` should return -1 if `x` is less than `y`, 0 if they are equal, and 1 otherwise.

Class MyArray is defined below :

```
class MyArray {
    private int[] a;
    MyArray(int[] b) { a = b;
    }
}
```

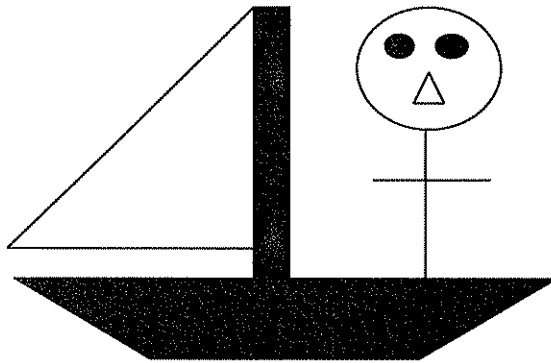
Modify the class MyArray to implement Comparable. MyArray should be compared based on the sum of their elements. For example,

```
int[] a = new int[] {1,2,3,4}; //create an array and initialize the elements
int[] b = new int[] {-1,2,-3,4,-5};
MyArray m1 = new MyArray(a); //the elements of m1 are those of a
MyArray m2 = new MyArray(b); //the elements of m1 are those of b

System.out.println(m1.compareTo(m2)); //prints 1, since 1+2+3+4 > -1+2-3+4-5
```

(6 marks)

- (e) Write a Java Applet Application to draw the following picture.



(11 marks)

### Question 6

- (a) Briefly explain **TWO (2)** main advantages of Object-oriented programming. (3 marks)
- (b) Given the following scenario, identify and draw an initial class diagram (in UML format) showing classes, attributes, operations (including constructor, accessor and mutator operations), and the relationships between classes.

Sin Tex Airline wants an application to store information about their ticketing operation. They offer numerous flights for many destinations within Asia. All flights have flight number, departure date and time, departure city, arrival date and time, arrival city and seat availability.

Each customer must purchase a ticket to reserve a seat in a flight. They offer various types of tickets: business class, VIP class and normal class. Each ticket has flight number, departure date and time, departure city, arrival date and time, arrival city and seat number and customer information such as their name and passport number. VIP class tickets have a VIP waiting room number. Business class tickets have a priority queue number.

To purchase a ticket, a customer must give the ticket agent their name, address and credit card number. The customer who has membership card can purchase the ticket with discounted price. The membership card has details information such as date of issue,

expiry date and total point collected. The collected points can be used to make redemption of Sin Tex Airline signature products.

(15 marks)

- (c) Using a diagram, show the detailed workings of an insertion sort in ascending order for the following :

5	3	1	9	8	2	4	7
---	---	---	---	---	---	---	---

(7 marks)

**--THE END--**

*CSC2181/AUGUST 2014/Ver1.0*