



## CICT PART II SECTION 4

### OBJECT ORIENTED PROGRAMMING

THURSDAY: 23 May 2019.

Time Allowed: 3 hours.

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.

ALL programs written should be in Java object oriented programming language.

#### QUESTION ONE

- (a) Java object oriented programming language is a pass by value and not pass by reference.  
Explain the above statement. (4 marks)
- (b) Distinguish between the following as used in conceptualising object oriented programming:
- (i) Aggregation and composition. (2 marks)
  - (ii) Static and dynamic data structures. (2 marks)
  - (iii) Inherited and compiled languages. (2 marks)
  - (iv) Class and instance variables. (2 marks)
- (c) Write a Java program to:
- (i) Find the sum of all integers greater than 100 and less than 200 that are divisible by 7. (4 marks)
  - (ii) Generate 5 random integer numbers between 1 and 100. (4 marks)
- (Total: 20 marks)**

#### QUESTION TWO

- (a) The signature for the main ( ) method is always in the form "public static void main ( )".  
Explain the meaning of the following:
- (i) Public. (2 marks)
  - (ii) Static. (2 marks)
  - (iii) Void. (2 marks)
- (b) Java language programs are portable across operating systems and hardware environments.  
Analyse three features that enhance portability of Java string programs. (6 marks)
- (c) One of the best features of Java programming language is the automatic garbage collection.  
Enumerate three steps involved in the process of garbage collection. (3 marks)
- (d) Write a program with readline ( ) method that reads the input from the keyboard as a string which is then converted to the integer data type using the data type wrapper class.  
Use the keywords try and catch to handle any errors that might occur during the reading process. (5 marks)
- (Total: 20 marks)**

**QUESTION THREE**

(a) Explain each of the following characteristics of object oriented programming language principles:

- (i) Robustness. (2 marks)
- (ii) Distributed. (2 marks)
- (iii) Extensibility. (2 marks)

(b) The table below contains two objects, their attributes and methods:

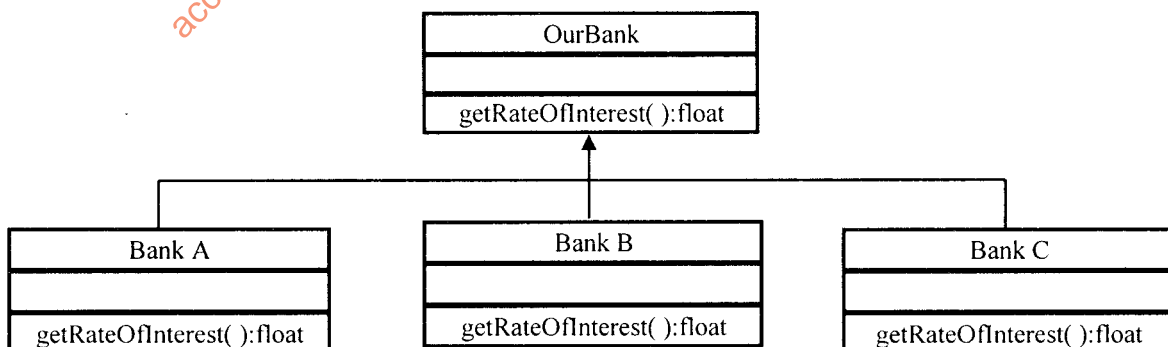
Object	Book	Magazine
Attributes	<ul style="list-style-type: none"> <li>• title</li> <li>• author</li> <li>• price</li> <li>• copies</li> </ul>	<ul style="list-style-type: none"> <li>• title</li> <li>• price</li> <li>• orderQty</li> <li>• currentIssue</li> <li>• copies</li> </ul>
Methods	<ul style="list-style-type: none"> <li>• sellCopy ( )</li> <li>• orderCopies ( )</li> </ul>	<ul style="list-style-type: none"> <li>• sellCopy ( )</li> <li>• adjustQty ( )</li> <li>• receiveNewIssue ( )</li> </ul>

**Required:**

- (i) Define the term “generalisation” as used in object oriented programming. (2 marks)
  - (ii) Using the generalisation concept, create a well labelled inheritance relationship model by using the information provided in the table and adding a new class, “publication”. (6 marks)
  - (iii) Highlight three rules used to create the model in (b) (ii) above. (3 marks)
  - (c) Citing a suitable example, explain the meaning of the term “type coercion” as used in Java programming. (3 marks)
- (Total: 20 marks)**

**QUESTION FOUR**

- (a) State three rules for writing a constructor in Java programming language. (3 marks)
- (b) Create a base class “Animal” which has a virtual function “eat”. Add a subclass cow to implement eat ( ) for a cow which eats grass. (4 marks)
- (c)
  - (i) Describe a static member in the context of Java programming language. (2 marks)
  - (ii) Identify two types of static members. (2 marks)
- (d) Consider the diagram below which shows a class named OurBank that provides a method to get the rate of interest. The rate of interest differs according to three banks. The rate of interest differs according to three banks at the rate of 8.4%, 7.3% and 9.7% for Bank A, Bank B and Bank C respectively.



**Required:**

Write a program that demonstrates the use of polymorphism so that its output is given as:

Bank A Rate of Interest: 8.4  
 Bank B Rate of Interest: 7.3  
 Bank C Rate of Interest: 9.7

(9 marks)  
**(Total: 20 marks)**  
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**QUESTION FIVE**

(a) Appraise two differences between “instance variables” and “class variables”.

(4 marks)

(b) Consider the Java program below that uses a generic method:

```

public class GenericMethodTest {
    // generic method printArray
    public static < E > void printArray ( E [] inputArray ) {
        // Display array elements
        for ( E element : inputArray ) {
            System.out.printf ("%s ", element);
        }
        System.out.println ();
    }

    public static void main (string args [] ) {
        // create arrays of Integer, Double and Character
        Integer [] intArray = { 1, 2, 3, 4, 5 };
        Double [] doubleArray = { 1.1, 2.2, 3.3, 4.4 };
        Character [] charArray = { 'H', 'E', 'L', 'L', 'O' };

        System.out.println ("Array integerArray contains:");
        printArray (intArray); // pass an Integer array

        System.out.println ("\n Array doubleArray contains:");
        printArray (doubleArray); // pass a Double array
        System.out.println ("\n Array characterArray contains:");
        printArray (charArray); // pass a Character array
    }
}

```

**Required:**

(i) Generate the expected output from the above program

(6 marks)

(ii) Argue the case for the use of generic methods in Java programming.

(4 marks)

(c) Kadzo created the following Java program to calculate the area of a circle and stored it in a file called AreaCircle:

```

import java.util.scanner;
public class areaCircle
{
    public static void main ( string [ ] args)
    {
        int radius;
        double pi = 3.14, area;
        scanner s = new scanner (system.in);
        system.out.print ("Enter radius of circle:");
        radius = s.nextInt ();
        area = pi * math.pow (radius, 2);
        system.out.println ("Area of circle:" + area );
    }
}

```

**Required:**

Explain the changes Kadzo would make in the above program to ensure the following:

(i) The value of pi is not modified.

(1 mark)

(ii) The function pow ( ) works correctly.

(1 mark)

(iii) The program does not result into runtime error on execution.

(1 mark)

(d) Using a method, rewrite the program in (c) above.

(3 marks)

**(Total: 20 marks)**