(Knowledge for Development)

KIBABII UNIVERSITY
(KIBU)
UNIVERSITY EXAMINATIONS
2020/2021 ACADEMIC YEAR

SPECIAL/SUPPLEMENTARY EXAMINATIONS
YEAR ONE SEMESTER TWO EXAMINATIONS

FOR BACHELORS OF SCIENCE IN

(COMPUTER SCIENCE & INFORMATION TECHNOLOGY)

COURSE CODE: BIT 122/CSC 120

COURSE TITLE: OBJECT ORIENTED PROGRAMMING I

DATE: 30/09/2021   **TIME: 11.00 A.M- 1.00 P.M**

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS

QUESTION ONE (COMPULSORY)   [30 MARKS]

a. Explain the implication and the use of the following concepts

    i.   **extends** keyword and **implements** keyword   **[2 marks]**

    ii.   **static** keyword and **final** keyword   **[2 marks]**

b. How does method overloading differ from method overriding?   **[2 marks]**

c. Explain features of object-oriented paradigms that help in handling the complexity attached to the real-world objects?   **[3 marks]**

d. Differentiate between encapsulation and data abstraction as used in java programming.

        [2 marks]

e. Consider the class definition below:

```
class TwoDArray {
public static void main(String args[])
{
int twoD[][]= new int[4][5];
int i, j, k = 0;
for(i=0; i<4; i++)
for(j=0; j<5; j++)
{
twoD[i][j] = k;
k++;
}
for(i=0; i<4; i++)
{
for(j=0; j<5; j++)
System.out.print (twoD[i][j] + " ");
System.out.println();
}
}
}
```

Simulate the output that this program.   **[2 marks]**
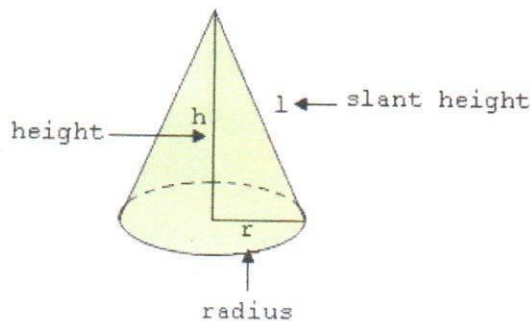
f. Consider the figure 1 below.

Figure 1: Cone

Define a class Called Cone and include the following:

    i.   instance variables radius and height of type double.   **[1 mark]**

    ii.   a parameterized constructor that will used to set the radius and height to new values

                                                        [2 marks]

    iii.   methods to set and return the values of radius and height as necessary.   **[2 marks]**

    iv.   a method getSurfaceArea that compute and return the surface area of the Cones use the Math class for PI and pow( ) functions/ methods.   **[3 marks]**

Use the formula, the total surface area of a cone $= \pi r^2 + \pi r l = \pi r (r + l)$

The relationship between radius (r) , height (h) and slant height (l) is given by

$$l = \sqrt{r^2 + h^2}$$

g. Given the following incomplete Java method with the name *Login* complete it by providing the return type and the body so that it returns either success or fail based on the values.

[2 marks]

```
public _____ Login ()
{

_____;

}
```

h. Explain the effect of the keyword **static** when applied on a variable and method and keyword final when applied on a class   **[3 marks]**

i. Consider the definition of the class C shown below.

```
1   public class A
2   {
3   _____ int m;
4   _____ int n;
5      public C(int mIn, int nIn)
6      {
7        m = mIn;
8        n = nIn;
9      }
10    public int m1()
11      {
12      return m+n;
13      }
14  }
```

Define a subclass of A named B that overrides method m1( ) so that it returns the difference between m and n instead of their sum. Provide the appropriate access modifier for the instance variables **m** (on line 3) and **n** (on line 4). **[4 marks]**

QUESTION TWO   [20 MARKS]

a. Shape is an abstract class defined as shown below.

```
1    public abstract class Shape
2         {
3            private String name;
4             public void setName(String name)
5         {
6             this.name = name
7         }
8            public String getName()
9            {
10           return name;
11           }
12        public abstract getArea();
13        public abstract getPerimeter();
14     }
```

i. **Rectangle** *is a* **Shape** with attributes *length* and *width* in addition to the attributes of **Shape**. Write the class definition for **Rectangle.** **[5 marks]**

ii. **Triangle** *is a* **Shape** with attributes *base* and *height* in addition to the attributes of **Shape**. Write the class definition for **Triangle.** **[5 marks]**

iii. Write a driver class **ShapeTest** to test your class in **(a)** and **(b)** above. Create one rectangle and one triangle objects and initialize all its attributes with values from the user. **[5 marks]**

b. Using relevant java signatures, explain how you will differentiate inheritance and polymorphism, explain conditions in which each concept is handy **[5 marks]**

QUESTION THREE   [20 MARKS]

a. Suppose you have an `Object A`, with public methods `a()`, `b()`, and private method `c()`. And suppose you have a subclass of A named B with methods named `b()`, `c()` and `d()`.

i. Draw the inheritance hierarchy showing the relationship between these two classes.

[2 marks]

ii. Identify those methods which would be considered polymorphic. **[2 marks]**

b. Consider the inheritance hierarchy in **Figure 2** in which a sale object contains the name of the item for sale and the price of the item. A discount sale object is a sale for which the percentage discount has been specified (e.g. 12% discount will be specified as 0.12)

Figure 2: Inheritance Hierarchy
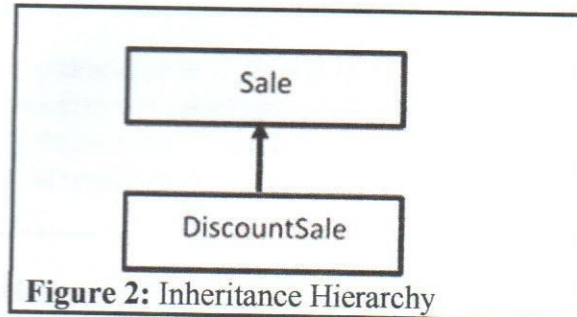
Define a class called Sale to represent a sale. Include in your class the following:

   i. a default constructor that sets the name to "*No name yet*" and price to *0.0* **[1 mark]**

   ii. constructor with two parameters   **[1 mark]**

   iii. a method called bill that returns the price of the item   **[2 marks]**

   iv. a method called greaterThan that receives a Sale object as a parameter and returns true if the received sale is greater than the current sale, returns false otherwise. **[2 marks]**

c. You are required to create a class to represent a Sphere. Your class should contain instance variables for the radius, a default constructor, a parameterized constructor, set and get methods for the radius, as well as member method to calculate the Volume of the Sphere. Include in your class the method **toString** that returns the string "Sphere object" when called.

   i. Draw a class diagram for the Sphere class   **[3 marks]**

   ii. Give the definition of the Sphere class in java   **[4 marks]**

   iii. Write down a driver class with two objects that will be used to demonstrate the capabilities of the class in (**ii**) above use dummy values for radius.   **[3 marks]**

QUESTION FOUR   **[20 MARKS]**

a. Why do we require packages and import statements in java?   **[2 marks]**

b. For a programmer to inputs from the keyboard, Scanner class is required. Import statement is used to import java.utl. Scanner at the start of program file.

   i. Write a java statement that will be used in the main method to create and initialize a Scanner object.   **[2 marks]**

ii.   Write a java code that will be used to capture an integer, a double and a String input value from the keyboard.

[3 marks]

c.   Consider the following class definition that represents a thermostatically controlled water heater.

```
1  public class ThermostatHeatingSystem
2  {
3  public int temperatureLimit; // from 0 to 30 (celsius)
4  public boolean currentHeaterState; // true or false (for on/off)
5  public void evaluateState(); // switch on/off as required
6  public int getCurrentTemp(); // obtain temperature from sensor
7  }
```

a.   Provide a redesigned **ThermostatHeatingSystem** class that uses more appropriate access modifiers.

[2 marks]

b.   Provide accessor and mutator method that will enable the **temperatureLimit** instance variable to be retrieved and modified.

[2 marks]

c.   Provide a constructor for the **Thermostat** class that will initialize the instance variables to suitable (valid) start values.

[2 marks]

d.   Write a body for the **evaluateState()** method that enables it to switch on and off the heater (by changing the **currentHeaterState** instance variable) by comparing the current value of **temperatureLimit** with the current temperature, as returned by **getCurrentTemp()** method.

[3 marks]

e.   Write a short driver program that instantiates the **ThermostatHeatingSystem** class and demonstrates that the methods you designed above behave correctly by using a set of appropriate test values.

[4 marks]

QUESTION FIVE

[20 MARKS]

a.   Explain the differences in meaning of int x [5]; and the meaning of x [5]; as used in arrays.

[2 marks]

b.   Consider the program below:

```
1      import java.io.*;
2      import java.util.Arrays;
3      public class SortingArrayElements {
4      static int sortRowWise(int marks[][]) {
5      for (int i = 0; i < marks.length; i++) {
6      Arrays.sort(marks[i]);
7      }
8
```

```java
9    for (int i = 0; i < marks.length; i++) {
10       for (int j = 0; j < marks[i].length; j++) {
11       System.out.print(marks[i][j] + " ");
12       }
13       System.out.println();
14    }
15    return 0;
16   }
17   public static void main(String args[]) {
18   int marks[ ][ ] = {{45, 78, 72, 71, 57, 70, 58, 80},
19   {34, 56, 76, 24, 54, 75, 49, 64},
20   {60, 64, 65, 42, 63, 73, 80, 67}
21   };
22   sortRowWise(marks);
23   }
24  }
```

Simulate the output of this program.

[3 marks]

c. Write java program that reads an integer between 0 – 999 and adds all the digits in the integer. For example, if an integer is 932, the sum of all its digit is 14. Hint: Use the % operator to extract digits and use the / operator to remove the extracted digit. For instance, 932 % 10 = 2 and 932 / 10 = 93.

[5 marks]

d. In a gymnastics or diving competition, each contestant's score is calculated by dropping the lowest and highest scores and then adding the remaining scores. Write a java program that allows the user to enter eight judges' scores and then outputs the point received by the contestant. A judge awards point between 1 and 10, with 1 being the lowest and 10 being the highest. For example, if the scores are: 9.2, 9.3, 9.0, 9.9, 9.5, 9.5, 9.6 and 9.8, then the contestant receives a total of 56.9 points. (Note: Use arrays Sparingly).

[6 marks]

e. Write a method called computeIncentive that takes one argument salesAmount compute and returns the annual incentives based on sales classification in table 1 below.

[4 marks]

Table 1: Incentive Table

Class	Sales	Incentives
1	0 to 10000	10% of sales amount
2	10001 to 20000	20% of sales amount
3	20001 to 30000	25% of sales amount.