BITS, Pilani – K K Birla Goa Campus		
CS F213 **Object Oriented Programming** (CB)	Sem 1 2022-23 Comprehensive Exam	**35% (70 Marks)** **23-12-22 (FN)**

INSTRUCTIONS: (1) Write your name and ID number in the spaces provided. **(2)** No overwriting or canceling is allowed. ***(3) Answers written anywhere other than space provided will not be considered for evaluation.***(5) There are 10 questions in this paper. (6) Code should be **minimum** Java code using **all relevant library methods**. Assume the existence of setter/getter method unless specified.

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Given the following Shape class. Answer questions 1, 2, 3 and 4

```
public abstract class Shape {
    public Shape (String id)
    {this.id = id;}

    public abstract double getArea();

    public String getId()
    {return id;}

    public String toString( )
    {return "Shape[id="+id+",area="+getArea()+"]";}

    private String id;

}
```

Q1. **[Marks 10]**

a) Define a variable int PK = 1 within the Shape class. Its value should not be changeable.
Give code for a concrete subclass **Rectangle** of Shape
Which will have 4 fields of int type for x, y, width and height

b) No argument constructor which sets all field values to default.

c) Five argument constructor which sets all field values. (id and 4 int)

d) Translate method: which will move a Rectangle to the coordinates passed as arguments.

Q1.

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Q2. Give complete code to do all of the following. **[Marks 24]**

a) Include all the libraries which are needed.

b) Create a **ArrayList arl** which can contain only Shape type objects. Create two objects of the RectangleCircle class R1 and R2. Add it to arl.

c) Give code for a method **readShapes,**

i. which takes as an argument a **String dataShape** and returns an Object which will be a Rectangle.

ii. It will convert dataShape to String id and 4 ints using space as a delimiter.

iii. It will handle separately exceptions related to IllegalArgumentException by printing as an output the type of exception. Ensure that there is an output of dataShape under all circumstances.

d) Give code for method **areaOfCollection** which will

i. Will take as an argument a Collection class containing **only Objects of subclass** of Shape class.

ii. Returns a double value which is a sum of Areas of all shapes in the Collection.

iii. Ensure an optimal **for loop** is used

Q2.

a)

public class SimpleCollection {
public static void main(String[] args) {

b)

c)

public Object readShapes(String dataShape){

}

d)

public double areaOfCollection

Q3. Give a Sequence diagram for Q1 and 2. Ensure that all objects created and external packages are included. (Answer at the back of Page 1) **[Marks 5]**

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Q4. Give relevant Java code for **[Marks 4]**

a) Creating an **Iterator arlIterator** for arl
b) Initialize a Map **shpMap**
c) Use the Iterator to search arl and append to shpMap all Shapes with width less than 10. Use id as a key (assume id are unique).

Q5. Give code for a method **min** **[Marks 6]**

a) Take as parameters two objects of one class implementing the Comparable interface which is of the same type as the class.
b) Returns the minimum of the two objects
c) Ensure that the parameters and the return type is an object of the same class

Q6. Give a complete Class diagram for Q5 **[Marks 5]**

(Answer at the back of Page 2)

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Q7. Give code for a class **DLinkedList** which will

a) Have a nested class **DNode** which points to two nodes **next** and **prev**

b) DNode also Points to an Object **data**

c) DLinkedList has two DNode objects **first** and **last**

d) Has a no argument constructor which will set next and prev to default values

e) Has an one Object List argument constructor which will take an Object List **oAry** as an argument. Create DNodes for all elements in oAry, set first and last suitably to ensure traversal in both directions from all DNodes.

(Answer e) at the back of Page 3)

[Marks 10]

Q8. Give code for a CreateDLL class which will have

a) main: No of DNodes **nDnd**, Strings nDnd
b) Verify that there are nDnd strings. If there are more ignore the excess, if less use strings with A, AA, AAA… to complete the requirements
c) Create a DLinkedList dll .

[Marks 6]

(Answer at the back of this page)