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Course: CS1073

Section: FR03B

Assignment number: 4

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Box.java:

```java
/**
 This class represents a box.
 @author Zohaib Khan 3740572.
*/

public class Box {

    /**
     This is the length l of the box.
    */
    private double l;

    /**
     This is the width w of the box.
    */
    private double w;

    /**
     This is the height h of the box.
    */
    private double h;

    /**
     This is the constructor method to initialize the instance
     variables.
     @param l the length of the box.
     @param w the width of the box.
     @param h the height of the box.
    */
    public Box (double l, double w, double h) {
        this.l = l;
        this.w = w;
        this.h = h;
    }

    /**
     This method retrieves the length of the box.
     @return l the length of the box.
    */
    public double getLength() {
        return l;
    }

    /**
     This method retrieves the width of the box.
     @return w the width of the box.
    */
```

```java
public double getWidth() {
      return w;
   }

   /**
    This method retrieves the height of the box.
    @return h the height of the box.
   */
   public double getHeight() {
      return h;
   }

   /**
    This method retrieves the volume of the box.
    @return the volume of the box.
   */
   public double getVolume() {
      return l * w * h;
   }

   /**
    This method retrieves the surface area of the box.
    @return the surface area of the box.
   */
   public double getSurfaceArea() {
      return (2 * l * w) + (2 * l * h) + (2 * w * h);
   }

}
```

Tube.java:

```java
/**
 This class represents a tube.
 @author Zohaib Khan 3740572.
*/

public class Tube {

    /**
     This is the radius r of the tube.
    */
    private double r;

    /**
     This is the height h of the tube.
    */
    private double h;

    /**
     This is the constructor method to initialize the instance
     variables.
     @param r the radius of the tube.
     @param h the height of the tube.
    */
    public Tube (double r, double h) {
        this.r = r;
        this.h = h;
    }

    /**
     This method retrieves the radius r.
     @return r the radius of the tube.
    */
    public double getRadius() {
        return r;
    }

    /**
     This method retrieves the height h.
     @return h the height of the tube.
    */
    public double getHeight() {
        return h;
    }

    /**
     This method retrieves the volume of the tube.
     @return the volume of the tube.
    */
```

```java
    public double getVolume() {
        return Math.PI * r * r * h;
    }

    /**
     This method retrieves the surface area of the tube.
     @return the surface area of the tube.
    */
    public double getSurfaceArea() {
        return (2 * Math.PI * r * h) + (2 * Math.PI * r * r);
    }

}
```

ContainerTest.java:

```java
/**
 This is a driver program for the Box and Tube classes.
 @author Zohaib Khan 3740572.
*/

import java.util.Scanner;
import java.text.NumberFormat;

public class ContainerTest {

    public static void main (String[] args) {

        NumberFormat formatter = NumberFormat.getNumberInstance();
        formatter.setMaximumFractionDigits(3);
        formatter.setMinimumFractionDigits(3);

        Scanner sc = new Scanner(System.in);
        int choice = 0;
        double largestBVolume = Double.NEGATIVE_INFINITY;
        double largestTVolume = Double.NEGATIVE_INFINITY;
        double smallestBArea = Double.POSITIVE_INFINITY;
        double smallestTArea = Double.POSITIVE_INFINITY;

        while (choice != 3) {
                System.out.println("\nWhat would you like to do?"
                                    + "\n1 - Get info for a box"
                                    + "\n2 - Get info for a tube"
                                    + "\n3 - Quit");

                System.out.print("Enter your choice: ");

                choice = sc.nextInt();

                if (choice == 1) {
                   System.out.print("Length (in cm): ");
                                    double l = sc.nextDouble();

                    System.out.print("Width (in cm): ");
                                    double w = sc.nextDouble();

                    System.out.print("Height (in cm): ");
                                    double h = sc.nextDouble();

                    Box box = new Box (l, w, h);

                    System.out.println("The volume is: "
                                    + formatter.format(box.getVolume())
                                    + " cubic centimeters.");
```

```java
            System.out.println("The surface area is: "
                        + formatter.format(box.getSurfaceArea())
                        + " square centimeters.");

            if (box.getVolume() > largestBVolume) {
               largestBVolume = box.getVolume();
            }

            if (box.getSurfaceArea() < smallestBArea) {
               smallestBArea = box.getSurfaceArea();
            }
         }

         else if (choice == 2) {

            System.out.print("Radius (in cm): ");
            double r = sc.nextDouble();

            System.out.print("Height (in cm): ");
            double h = sc.nextDouble();

            Tube tube = new Tube (r, h);

            System.out.println("The volume is: "
                                 +
                                 formatter.format(tube.getVolume())
                                 + " cubic centimeters.");

            System.out.println("The surface area is: "
                        + formatter.format(tube.getSurfaceArea())
                        + " square centimeters.");

            if (tube.getVolume() > largestTVolume) {
               largestTVolume = tube.getVolume();
            }

            if (tube.getSurfaceArea() < smallestTArea) {
               smallestTArea = tube.getSurfaceArea();
            }
      }
      else if (choice > 3 || choice < 1) {
         System.out.println("Invalid choice. Please choose from the
                           options provided.");
      }
   }

   if (largestTVolume > largestBVolume) {
      System.out.println("The container with the largest volume
                        is a tube."
                        + "\nThe volume is: "
                        + formatter.format(largestTVolume)
```

```java
                                        + " cubic centimeters.");
        }
        else {
            System.out.println("The container with the largest volume
                                is a box."
                                + "\nThe volume is: "
                                + formatter.format(largestBVolume)
                                + " cubic centimeters.");
        }

        if (smallestBArea < smallestTArea) {
            System.out.println("The container with the smallest
                                surface area is a box."
                                + "\nThe surface area is: "
                                + formatter.format(smallestBArea)
                                + " square centimeters." );
        }
        else {
            System.out.println("The container with the smallest
                                surface area is a tube."
                                + "\nThe surface area is: "
                                + formatter.format(smallestTArea)
                                + " square centimeters.");
        }
    }
}
```

Q1Output:

```
[zohaib@Zohaibs-MBP assign4 % java ContainerTest

What would you like to do?
1 - Get info for a box
2 - Get info for a tube
3 - Quit
Enter your choice: 1
Length (in cm): 4.5
Width (in cm): 6.0
Height (in cm): 13.3
The volume is: 359.100 cubic centimeters.
The surface area is: 333.300 square centimeters.

What would you like to do?
1 - Get info for a box
2 - Get info for a tube
3 - Quit
Enter your choice: 1
Length (in cm): 4.5
Width (in cm): 8.7
Height (in cm): 2.2
The volume is: 86.130 cubic centimeters.
The surface area is: 136.380 square centimeters.

What would you like to do?
1 - Get info for a box
2 - Get info for a tube
3 - Quit
Enter your choice: 2
Radius (in cm): 14.3
Height (in cm): 6.2
The volume is: 3,983.031 cubic centimeters.
The surface area is: 1,841.916 square centimeters.

What would you like to do?
1 - Get info for a box
2 - Get info for a tube
3 - Quit
Enter your choice: -6
Invalid choice. Please choose from the options provided.

What would you like to do?
1 - Get info for a box
2 - Get info for a tube
3 - Quit
Enter your choice: 3
The container with the largest volume is a tube.
The volume is: 3,983.031 cubic centimeters.
The container with the smallest surface area is a box.
The surface area is: 136.380 square centimeters.
```

NumberSystem.java:

```java
/**
 This is a class for a number conversion system from Arabic to Mayan.
 @author Zohaib Khan 3740572.
*/

import java.util.Scanner;

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

        Scanner sc = new Scanner (System.in);

        System.out.print("Enter an arabic number: ");
        int userInput = sc.nextInt();
        String str = "";
        int remainder = 0;
        int quotient = 0;
        String final_str = "";

        while (userInput < 0) {
            System.out.println("Invalid input. You must enter a non-
                                negative number.");
            System.out.print("Please enter another Arabic number now: ");
            userInput = sc.nextInt();
        }

        int originalInput = userInput;

        while (userInput > 0) {
            remainder = userInput%20;
            quotient = (userInput - remainder ) / 20;

            while (remainder > 5) {
                str += "_ ";
                remainder = remainder - 5;
            }

            if (remainder == 0) {
                str += "U";
            }

            else if (remainder == 1) {
                str += "O";
            }
            else if (remainder == 2) {
                str += "O O";
            }
```

```java
        else if (remainder == 3) {
            str += "O O O";
        }
        else if (remainder == 4) {
            str += "O O O O";
        }
        else if (remainder == 5) {
            str += "_ ";
        }

        userInput = quotient;
        final_str = str+"\n"+final_str;
        str = "";


        }

    System.out.print("The Mayan output for "
                    + originalInput + " is: \n"
                    + final_str);
    }

}
```

Q2Output:

```
zohaib@Zohaibs-MBP assign4 % java NumberSystem
Enter an arabic number: 729
The Mayan output for 729 is:
O

_ _ _  O
_ O O O O
zohaib@Zohaibs-MBP assign4 % 400
zsh: command not found: 400
zohaib@Zohaibs-MBP assign4 % java NumberSystem
Enter an arabic number: 729
The Mayan output for 729 is:
O

_ _ _  O
_ O O O O
zohaib@Zohaibs-MBP assign4 % java NumberSystem
Enter an arabic number: 400
The Mayan output for 400 is:
O
U
U
zohaib@Zohaibs-MBP assign4 % java NumberSystem
Enter an arabic number: -20
Invalid input. You must enter a non-negative number.
Please enter another Arabic number now: 416
The Mayan output for 416 is:
O
U
_ _ _  O
```