

Question 1 & 2

Gender.java

```
public enum Gender {
    male, female
}
```

Animal.java

```
public abstract class Animal {

    protected String name = "unknow";
    protected int height = 0; // in cm
    protected int weight = 0; // in kg
    protected Gender gender = Gender.male;

    public abstract void move();

    public int height() {
        return height;
    }

    public void height(int height_) {
        this.height = height_;
    }

    public void display() {
        System.out.println("name: " + name);
        System.out.println("height: " + height);
        System.out.println("weight: " + weight);
        System.out.println("gender: " + gender.name());
    }

    public Animal(String name_, int height_, int weight_, Gender gender_) {
        this.name = name_;
        this.height = height_;
        this.weight = weight_;
        this.gender = gender_;
    }
}
```

Dog.java

```
public final class Dog extends Animal {

    public Dog(String name_, int height_, int weight_, Gender gender_) {
        super(name_, height_, weight_, gender_);
    }

    @Override
    public void move() {
        System.out.print(name + " is moving");
    }

    public void move(String destination) {
        move();
        System.out.println(" to " + destination);
    }
}
```

Main.java

```
public class Main {  
  
    public static void main(String[] args) {  
        Dog bob = new Dog("bob", 170, 60, Gender.male);  
        bob.display();  
        bob.move("Dublin");  
    }  
}
```

Question 3

Main.java

```
public class Main {  
  
    public static void by_reference_modifier(Dog reference) {  
        reference.height(50);  
    }  
  
    public static void main(String[] args) {  
        Dog bob = new Dog("bob", 170, 60, Gender.male); // height is 170  
        by_reference_modifier(bob); // height is now 50  
        bob.display(); // display height = 50  
    }  
}
```

Question 4

Main.java

```
public class Main {  
  
    public static String lastTwo(String input) throws Exception {  
        if(input == null || input.length() < 2) {  
            throw new Exception("Input string must be at least 2 characters.");  
        }  
        char buffer;  
        char array[] = input.toCharArray();  
        buffer = array[array.length-1];  
        array[array.length-1] = array[array.length-2];  
        array[array.length-2] = buffer;  
        return new String(array);  
    }  
  
    public static void main(String[] args) {  
        try {  
            System.out.println(lastTwo("coding"));  
            System.out.println(lastTwo("cat"));  
            System.out.println(lastTwo("ab"));  
        } catch (Exception e) {  
            e.printStackTrace();  
        }  
    }  
}
```

Question 5

```
public class Main {

    public static String nTwice(String input, int range) throws Exception {
        if(range > input.length()) {
            throw new Exception("range should be <= input.length()");
        }
        String output = input.substring(0, range);
        output += input.substring(input.length()-range, input.length());
        return output;
    }

    public static void main(String[] args) {
        try {
            System.out.println(nTwice("Hello", 2));
            System.out.println(nTwice("Chocolate", 3));
            System.out.println(nTwice("Chocolate", 1));
        } catch (Exception e) {
            e.printStackTrace();
        }
    }
}
```

Question 7

```
public class Main {

    public static int[] lotteryNumbers() {
        int[] output = {0,0,0,0,0,0,0};
        for(int i=0; i<7; i++) {
            if(i<5) {
                output[i] = (int) (50*Math.random()+1);
            }
            else {
                output[i] = (int) (11*Math.random()+1);
            }
        }
        return output;
    }

    public static void main(String[] args) {
        int[] numbers = lotteryNumbers();
        for(int i=0; i<7; i++)
            System.out.println(numbers[i]);
    }
}
```

Question 8, 9 & 10

Main.java

```
public class Main {

    public static void main(String[] args) {
        double[] anArray = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10};
        Statistics s = new Statistics(anArray);
        s.display();
        System.out.println("average is " + s.average());
        System.out.println("min is " + s.min());
        System.out.println("max is " + s.max());
        System.out.println("standard deviation is " + s.getStandardDeviation());
    }
}
```

Statistics.java

```
public class Statistics {

    private double datas[]=null;
    private int arrayLength=0;

    public Statistics(double datas_[]) {
        this.arrayLength = datas_.length;
        this.datas = datas_;
    }

    public void display() {
        System.out.print("Array [ ");
        for(int i=0; i<arrayLength; i++) {
            System.out.print(datas[i]+" ");
        }
        System.out.println("]");
    }

    public double average() {
        double average=0;
        for(int i=0; i<arrayLength; i++) {
            average += datas[i]/arrayLength;
        }
        return average;
    }

    public double min() {
        double min=Double.MAX_VALUE;
        for(int i=0; i<arrayLength; i++) {
            if(min>datas[i]) {
                min = datas[i];
            }
        }
        return min;
    }

    public double max() {
        double max=-Double.MAX_VALUE;
        for(int i=0; i<arrayLength; i++) {
            if(max<datas[i]) {
                max = datas[i];
            }
        }
        return max;
    }

    public double getStandardDeviation() {
        double average = average();
        double sum=0;
        for(int i=0; i<arrayLength; i++) {
            sum += Math.pow(datas[i]-average, 2);
        }
        return Math.sqrt(sum/=arrayLength);
    }
}
```