Lab Assignment 09

Inspiring Excellence

Course Code:	**CSE111**
Course Title:	**Programming Language II**
Topic:	**Polymorphism**
Number of Tasks:	**10**

Task 1

1.a. Write the **Pokemon** class so that the following code generates the output below:

Driver Code	Output

public class PokemonTester{
  public static void main(String[] args){
  Pokemon pikachu = new Pokemon("Pikachu");
  pikachu.attack();
  pikachu.attack("Thunderbolt");
  pikachu.attack("Iron Tail", 90);
  }
}
	Pikachu attacks with a basic move!
	Pikachu uses Thunderbolt!
	Pokemon uses Iron Tail with power 90!

1.b. What type of polymorphism is depicted in the code above?

Task 2

Write the **Mango** and the **Jackfruit** classes derived from Fruit class so that the following code generates the output below:

Parent Class

```
public class Fruit{
  private boolean formalin = false;
  private String name = "";
  public Fruit(boolean formalin, String name){
    this.formalin = formalin;
    this.name = name;
  }
  public String getName(){
    return name;
  }
  public boolean hasFormalin(){
    return formalin;
  }
}
```

Driver Code	Output

public class FruitTester{
  public static void testFruit(Fruit f){
  System.out.println("----Printing Detail-----");
  if(f.hasFormalin()){
  System.out.println("Do not eat the "+f.getName()+".");
  System.out.println(f);
  }else{
  System.out.println("Eat the "+f.getName()+".");
  System.out.println(f);
  }
  }
  public static void main(String [] args){
  Mango m = new Mango();
  testFruit(m);
  Jackfruit j = new Jackfruit();
  testFruit(j);
	----Printing Detail-----
	Do not eat the Mango.
	Mangos are bad for you
	----Printing Detail-----
	Eat the Jackfruit.
	Jackfruits are good for you

} }	

Task 3

Write the **CSEStudent** and **CSE111Student** classes derived from **Student** class so that the following code generates the output below:

Parent Class

```
public class Student{
  public String msg = "I love BU";
  public String shout(){
    return msg;
  }
}
```

Driver Code	Output

public class StudentTester{
  public static void printShout(Student s){
  System.out.println("------------------");
  System.out.println(s.msg);
  System.out.println(s.shout());
  }
  public static void main(String [] args){
  Student s = new Student();
  CSEStudent cs = new CSEStudent();
  CSE111Student cs111 = new CSE111Student();
  System.out.println(s.msg);
  System.out.println(cs.msg);
  System.out.println(cs111.msg);
  printShout(s);
  printShout(cs);
  printShout(cs111);
  }
}
	I love BU
	I want to transfer to CSE
	I love Java Programming
	------------------ 	
	I love BU
	I love BU
	------------------ 	
	I love BU
	I want to transfer to CSE
	------------------ 	
	I love BU
	I love Java Programming

Task 4

Write the **PlatinumCard** and **SignatureCard** classes derived from **CreditCard** class so that the following code generates the output below.

Note: Platinum card users initially have 100 reward points and will get 2 reward points for spending 100 taka each. Signature card users initially have 200 reward points and will get 4 reward points for spending 100 taka each. Signature card users are allowed to bring upto 5 companions at lounges.

Parent Class

```
public class CreditCard {
   public String cardHolder;
   public String accountNo;
   public int rewardPoints;
   public CreditCard(String cardHolder, String accountNo, int rewardPoints){
       this.cardHolder = cardHolder;
       this.accountNo = accountNo;
       this.rewardPoints = rewardPoints;
   }

   public void cardDetails(){
       System.out.println("Card Holder Name: " + cardHolder);
       System.out.println("Account Number: " + accountNo);
       System.out.println("Reward point gained: " + rewardPoints);
   }
}
```

Driver Code

```
public class CardTester {
  public static void main(String[] args) {
    CreditCard card1 = new PlatinumCard("Ali", "345 127");
    CreditCard card2 = new SignatureCard("Rahul", "514 123");
    CreditCard card3 = new SignatureCard("Rohan", "147 965");
    CreditCard [] cards = {card1, card2, card3};
    for (int i = 0; i<cards.length; i++)
    {
      System.out.println("================");
      if (cards[i] instanceof SignatureCard)
      {
        SignatureCard new_card = (SignatureCard) cards[i];
        new_card.spendCash(500);
      }
      else if (cards[i] instanceof PlatinumCard)
      {
        PlatinumCard new_card = (PlatinumCard) cards[i];
        new_card.spendCash(200);
      }
      System.out.println("================");
      cards[i].cardDetails();
    }
  }
}
```

Output

```
================
Previous Reward Points: 100
Reward points after spending 200
taka: 104
================
Card Holder Name: Ali
Account Number: 345 127
Reward point gained: 104
================
Previous Reward Points: 200
Reward points after spending 500
taka: 220
================
Card Holder Name: Rahul
Account Number: 514 123
Reward point gained: 220
Possible Number of Companions for
Lounge: 5
================
Previous Reward Points: 200
Reward points after spending 500
taka: 220
================
Card Holder Name: Rohan
Account Number: 147 965
Reward point gained: 220
Possible Number of Companions for
Lounge: 5
```

Task 5

Design a set of classes for a Fantasy Game Character System. There is a parent class called **Character**. From it, there are two different child classes: **Warrior** and **Mage**. Additionally, there is a subclass called **Paladin** that extends Warrior.
Each character has:

- name (String)
- level (int)

Lastly, you need to Override the .equals() method inside the parent class

Parent Class

```
public class Character {
  public String name;
  public int level;

  public Character(String name, int level) {
    this.name = name;
    this.level = level;
  }

  public void specialMove() {
    System.out.println("Character uses a generic move.");
  }

  // Override the .equals() method
}
```

Driver Code	Output

`public class GameTester {`
`  public static void main(String[] args) {`
`  Character c1 = new Paladin("Arthur", 10);`
`  Character c2 = new Mage("Merlin", 12);`
`  Character c3 = new Warrior("Leon", 10);`
 	
`  c1.specialMove();`
`  c2.specialMove();`
`  c3.specialMove();`
 	
`  if (c1 instanceof Paladin) {`
`  Paladin p = (Paladin) c1;`
`  p.specialMove();`
`  }`
 	
`  Warrior w1 = new Warrior("Leon", 10);`
`  System.out.println("c3 equals w1? " + c3.equals(w1));`
 	
`  Mage m1 = new Mage("Merlin", 15);`
`  System.out.println("c2 equals m1? " + c2.equals(m1));`
`  }`
`}`
	`Arthur unleashes a holy strike!`
	`Merlin casts a powerful fireball!`
	`Leon performs a heavy sword slash!`
	`Arthur unleashes a holy strike!`
	`c3 equals w1? true`
	`c2 equals m1? false`

Task 6

Write the Garage, Bike and Car class. **Car, Bike** are child classes of **Vehicle** class. But **Garage** is neither a parent nor a child class. The Garage class has **two arrays as instance variables** called *cars* and *bikes* that can store **Car and Bike objects**.

Hint: In this task you'll need to use the **instanceof** keyword and **downcasting**.

Vehicle Class

```
public class Vehicle {

    private String brand;
    private int year, wheels;

    public Vehicle(String b, int y){
        this.brand = b;
        this.year = y;
    }

    public String getBrand(){
        return this.brand;
    }

    public int getYear(){
        return this.year;
    }

    public void setWheels( int w ){
        this.wheels = w;
    }

    public int getWheels(){
        return this.wheels;
    }

    public String toString(){
        return "Brand: "+this.brand+", Year: "+this.year+", Wheels: "+this.wheels;
    }

}
```

DRIVER CODE	OUTPUT

Garage g = new Garage(2, 3);
System.out.println("==========0==========");
Vehicle vC1 = new Car("Ford", "Mustang", 2022, 2, 4, false);
Vehicle vC2 = new Car("Tesla", "Model S", 2025, 4, 4, true);
Vehicle vC3 = new Car("Reliant", "Robin", 1981, 2, 3, false);
System.out.println("==========1==========");
System.out.println(vC1);
System.out.println("==========2==========");
g.addVehicle(vC1);
g.addVehicle(vC2);
g.addVehicle(vC3);
System.out.println(g.cars[1]);
System.out.println("==========3==========");
g.cars[0].startAutoPilot();
g.cars[1].startAutoPilot();
System.out.println("==========4==========");
Vehicle vB1 = new Bike("Honda", "Gold Wing", 2022, 3, true);
System.out.println(vB1);
g.addVehicle(vB1);
System.out.println("==========5==========");
Vehicle vB2 = new Bike("Royal Enfield", "Classic 350", 2021, 2, false);
g.addVehicle(vB2);
System.out.println(g.bikes[1]);
System.out.println("==========6==========");
Vehicle vB3 = new Bike("Harley-Davidson", "Street 750", 2022, 2, false);
g.addVehicle(vB3);
Vehicle vB4 = new Bike("Yamaha", "MT-15", 2023, 2, false);
g.addVehicle(vB4);
System.out.println("=========7==========");
g.bikes[0].doAWheelie();
g.bikes[1].doAWheelie();
	Welcome to the Garage!
	Car Capacity: 2
	Bike Capacity: 3
	==========0==========
	==========1==========
	Car Brand: Ford, Year: 2022, Wheels: 4, Model: Mustang, Doors: 2, AI: false
	==========2==========
	A Ford CAR has been added to the Garage
	A Tesla CAR has been added to the Garage
	Can't add more Cars! Capacity: 2
	Car Brand: Tesla, Year: 2025, Wheels: 4, Model: Model S, Doors: 4, AI: true
	==========3==========
	Ford:Mustang has NO AutoPilot
	Tesla:Model S AutoPilot Started
	==========4==========
	Bike Brand: Honda, Year: 2022, Wheels: 3, Model: Gold Wing, SideCar: true
	A Honda BIKE has been added to the Garage
	==========5==========
	A Royal Enfield BIKE has been added to the Garage
	Bike Brand: Royal Enfield, Year: 2021, Wheels: 2, Model: Classic 350, SideCar: false
	==========6==========
	A Harley-Davidson BIKE has been added to the Garage
	Can't add more bikes! Capacity: 3
	=========7==========
	Wheelie Failed. Honda:Gold Wing has SideCar
	Royal Enfield:Classic 350 is doing Wheelie!!

Task 7

```
1  public class Gandalf {
2    public void method1(){
3      System.out.println("Gandalf 1");
4    }
5
6    public void method2(){
7      System.out.println("Gandalf 2");
8      method1();
9    }
10 }
11 public class Bilbo extends Gandalf{
12   public void method1(){
13     System.out.println("Bilbo 1");
14   }
15 }
16 public class Gollum extends Gandalf{
17   public void method3(){
18     System.out.println("Gollum 3");
19   }
20 }
21 public class Frodo extends Bilbo{
22   public void method1(){
23     System.out.println("Frodo 1");
24     super.method1();
25   }
26
27   public void method3(){
28     System.out.println("Frodo 3");
29   }
30 }
```

Assuming the following variables have been defined:

```
Gandalf var1 = new Frodo();
Gandalf var2 = new Bilbo();
Gandalf var3 = new Gandalf();
Object var4 = new Bilbo();
Bilbo var5 = new Frodo();
Object var6 = new Gollum();
```

In the table below,

- The output produced by the statement in the left-hand column, should be written in the right-hand column
- If the statement produces more than one line of output, indicate the line breaks with slashes as in "a/b/c" to indicate three lines of output with "a" followed by "b" followed by "c".
- If the statement causes an error, fill in the right-hand column with either the phrase "compiler error" or "runtime error" to indicate when the error would be Detected.

	Statement	**Output**
1	var1.method1();	
2	var2.method1();	
3	var4.method1();	
4	var6.method1();	
5	var1.method2();	
6	var3.method2();	
7	var4.method2();	
8	var5.method2();	
9	var6.method2();	
10	((Frodo)var4).method3();	
11	((Frodo)var6).method2();	
12	((Gollum)var1).method3();	
13	((Gollum)var4).method1();	
14	((Gandalf)var1).method2();	
15	((Frodo)var4).method1();	
16	((Gollum)var6).method2();	
17	((Gandalf)var2).method1();	
18	((Bilbo)var6).method2();	
19	((Frodo)var1).method3();	
20	((Gandalf)var5).method3();	

Task 8

```
1  public class Sue {
2   void method1() {
3     System.out.println("sue 1");
4   }
5   void method3() {
6     System.out.println("sue 3");
7   }
8  }
9
10 public class Blue {
11  void method1() {
12    System.out.println("blue 1");
13    method3();
14  }
15  void method3() {
16    System.out.println("blue 3");
17  }
18 }
19
20 public class Moo extends Blue {
21  void method2() {
22    super.method3();
23    System.out.println("moo 2");
24    this.method3();
25  }
26  void method3() {
27    System.out.println("moo 3");
28  }
29 }
30
31 public class Crew extends Moo {
32  void method1() {
33    System.out.println("crew 1");
34  }
35  void method3() {
36    System.out.println("crew 3");
37  }
38 }
```

Assuming the following variables have been defined:

```
Moo var1 = new Crew();
Blue var2 = new Moo();
Object var3 = new Sue();
Sue var4 = new Sue();
Blue var5 = new Crew();
Blue var6 = new Blue();
```

In the table below,

- The output produced by the statement in the left-hand column, should be written in the right-hand column
- If the statement produces more than one line of output, indicate the line breaks with slashes as in "a/b/c" to indicate three lines of output with "a" followed by "b" followed by "c".
- If the statement causes an error, fill in the right-hand column with either the phrase "compiler error" or "runtime error" to indicate when the error would be detected.

	Statement	Output
1	var1.method1();	
2	var2.method1();	
3	var3.method1();	
4	var4.method1();	
5	var5.method1();	
6	var6.method1();	
7	var1.method3();	
8	var2.method3();	
9	var3.method3();	
10	((Blue)var1).method1();	
11	((Crew)var1).method2();	
12	((Sue)var1).method3();	
13	((Blue)var3).method1();	
14	((Crew)var3).method1();	
15	((Sue)var3).method3();	
16	((Moo)var2).method2();	
17	((Crew)var3).method2();	
18	((Moo)var5).method2();	
19	((Moo)var6).method2();	
20	((Moo)var2).method1();	

Task 9

```
1  public class Foo {
2      String name = "foo";
3      public void call1() {
4          System.out.println("Foo 1");
5      }
6      public void call2() {
7          call1();
8          System.out.println("Foo 2");
9      }
10 }
11
12 public class Bar extends Foo {
13     public void call2() {
14         System.out.println("Bar 2");
15     }
16     public void call3() {
17         System.out.println("Bar 3");
18     }
19 }
20
21 public class Buzz extends Bar {
22     String name = "Buzz";
23     public void call1() {
24         System.out.println("Buzz 1");
25     }
26     public void call4() {
27         call3();
28         System.out.println("Buzz 4");
29     }
30 }
31 public class Bux extends Foo {
32     String name = "Bux";
33     public void call1() {
34         System.out.println("Bux 1");
35     }
36     public void call3() {
37         System.out.println("Bux 3");
38     }
39 }
```

Assuming the following variables have been defined:

```
Foo foo1 = new Foo();
Bar bar1 = new Bar();
Bux bux1 = new Bux();
Foo foo2 = new Buzz();
Bar bar2 = new Buzz();
Object obj1 = new Foo();
```

In the table below,

- The output produced by the statement in the left-hand column, should be written in the right-hand column
- If the statement produces more than one line of output, indicate the line breaks with slashes as in "a/b/c" to indicate three lines of output with "a" followed by "b" followed by "c".
- If the statement causes an error, fill in the right-hand column with either the phrase "compiler error" or "runtime error" to indicate when the error would be detected.

	Statement	Output
1	bar1.call1();	
2	foo2.call1();	
3	foo2.call2();	
4	bar2.call3();	
5	System.out.println(bar1.name);	
6	System.out.println(bar2.name);	
7	System.out.println(((Buzz)bar2).name);	
8	((Buzz)bar1).call4();	
9	((Bar)foo1).call3();	
10	((Foo)bux1).call1();	
11	((Bux)foo1).call1();	
12	bux1.call1();	
13	bux1.call2();	
14	((Foo)foo2).call2();	
15	((Buzz)obj1).call3();	
16	((Buzz)obj1).call2();	
17	((Bux)foo2).call2();	
18	((Buzz)obj1).call1();	
19	System.out.println(foo2.name);	
20	System.out.println(((Bux)foo2).name);	

Task 10

```
1  public class Caramel extends SilkOreo{
2    String texture = "Softy";
3    public void method1() {
4      System.out.println("Caramel m1");
5    }
6    public void method4() {
7    System.out.println("Caramel m4");
8    }
9    public String toString(){
10     method2();
11     return "Caramel is "+ texture;
12   }
13 }
14 public class Chocolate{
15   String texture = "Chocolaty";
16   public void method1() {
17     method2();
18     System.out.println("Chocolate m1");
19   }
20   public void method2() {
21     System.out.println("Chocolate m2");
22   }
23   public String toString(){
24     method2();
25     return "Chocolate is "+ texture;
26   }
27 }
28 public class DairyMilk extends Chocolate{
29   String texture = "Yummy";
30   public void method2() {
31     System.out.println(this.texture);
32     System.out.println("DairyMilk m2");
33   }
34   public void method3() {
35     System.out.println("DairyMilk m3");
36   }
37 }
38 public class KitKat extends Chocolate{
39   String texture = "Crunchy";
40   public void method1() {
```

```
41      System.out.println("KitKat m1");
42    }
43    public void method4() {
44      System.out.println("KitKat m4");
45    }
46    public String toString(){
47      method2();
48      return "KitKat is "+ texture;
49    }
50  }
51  public class SilkOreo extends DairyMilk{
52    String texture = "Silky";
53    public void method1() {
54      super.method1();
55      System.out.println("SilkOreo m1");
56    }
57    public void method3() {
58      System.out.println("SilkOreo m3");
59      System.out.println(this);
60    }
61  }
```

Assuming the following variables have been defined:

```
Chocolate choco1 = new Chocolate();
KitKat kit = new KitKat();
DairyMilk dairyMilk1 = new DairyMilk();
DairyMilk dairyMilk2 = new SilkOreo();
Object obj1 = new DairyMilk();
Object obj2 = new KitKat();
Chocolate caramel1 = new Caramel();
```

In the table below,

- The output produced by the statement in the left-hand column, should be written in the right-hand column
- If the statement produces more than one line of output, indicate the line breaks with slashes as in "a/b/c" to indicate three lines of output with "a" followed by "b" followed by "c".
- If the statement causes an error, fill in the right-hand column with either the phrase "compiler error" or "runtime error" to indicate when the error would be detected.

	Statement	Output
1	choco1.method1();	
2	dairyMilk1.method1();	
3	dairyMilk2.method4();	
4	caramel1.method1();	
5	System.out.println(caramel1);	
6	System.out.println(caramel1.texture);	
7	((Chocolate)kit).method2();	
8	((SilkOreo)dairyMilk2).method3();	
9	((DairyMilk)kit).method2();	
10	((Chocolate)kit).method3();	
11	((Chocolate)dairyMilk2).method1();	
12	((Chocolate)obj1).method2();	
13	((Caramel)obj1).method2();	
14	((SilkOreo)obj2).method3();	
15	System.out.println(((Object)choco1).toString());	
16	System.out.println(((Chocolate)kit).texture);	