

Question 1:In the following multiple choice questions, identify the choice that represents the correct answer. (5 points)

1. Which of the following is true regarding the javacompiler?

- a. It runs files with .class extension.
- b. It is responsible for detecting run-time errors.
- c. It is responsible for detecting syntax errors.
- d. It is an interpreter.
- e. c& d.

2. Which of the following is not true regarding local variables of a method in java?

- a. They include the methods parameters.
- b. They are initialized with their default values.
- c. They are stored in the activation record of the method in the stack.
- d. They are stored in the activation record of the method in the heap.
- e. b& d.

3. Given the following method invocation: operation(3, 5), which of the following methods is invoked, assuming that they are all defined in the same class where the method is invoked?

- a. public static void operation (int x, int y)
- b. public static void operation (double x, int y)
- c. public static void operation (int x, double y)
- d. public static void operation (double x, double y)
- e. None of the methods above is invoked since they cause ambiguous invocation.

4. What does the following program print?

```
public class MainClass {  
  
    public static void main(String [] args){  
        B b1 = new B();  
        B b2 = new B(2);  
  
        B b3 = new B(B.getW());  
  
        System.out.print(b1.getZ()+" "+b1.getW()+" ");  
        System.out.print(b2.getZ()+" "+b2.getW()+" ");  
        System.out.print(b3.getZ()+" "+b3.getW()+" ");  
    }  
  
}  
class B {  
    private double z;  
    private static double w=0;  
  
    public B(){ this(1); }  
    public B(double num){  
        z=num;  
        w+=z;  
    }  
    public double getZ(){return z;}  
    public static double getW(){return w;}  
}
```

- a. 1.0 1.0 2.0 3.0 3.0 6.0
- b. 1.0 1.0 2.0 2.0 2.0 4.0
- c. 0.0 0.0 2.0 2.0 2.0 4.0
- d. 1.0 6.0 2.0 6.0 3.0 6.0
- e. The code will not run since it contains a syntax error.

5. What does the following program print?

```
public class A {
    public B bObject;

    public A (int [] array){
        bObject = new B(array, false);
    }
    public A (B b){
        bObject = b;
    }
    public static void main(String [] args){
        int [] myArray = {1,2,3,4};
        B b = new B(myArray, true);
        A a1 = new A(myArray);
        A a2 = new A(b);

        b.updateArray();
        a1.bObject.updateArray();
        a2.bObject.updateArray();

        for (int i=0; i<myArray.length; i++){
            System.out.print(myArray[i]+" ");
        }
    }
}
class B {
    public int [] values;

    public B(int [] array, boolean f){
        if (f)
            values = array;
        else{
            values= new int [array.length];
            for (int i=0; i<values.length; i++) values[i]=array[i];
        }
    }
    public void updateArray(){
        for (int i=0; i<values.length; i++) values[i]++;
    }
}
```

- a. 1 1 1 1
- b. 1 2 3 4
- c. 2 3 4 5
- d. 3 4 5 6
- e. 4 5 6 7

Question 2: Study the following code, then answer the questions below.

(5 points)

```
1. public class Building{
2.     private Apartment [] apartments;
3.     private int numOfApartments;
4.
5.     public Building(int [] numbers){
6.         numOfApartments=numbers.length;
7.         apartments=new Apartment [numbers.length];
8.         for (int i=0; i<numbers.length; i++){
9.             apartments[i]=new Apartment(numbers[i]);
10.        }
11.    }
12.    public int method1(){
13.        int sum =0;
14.        for (int i=0; i<apartments.length; i++)
15.            //Missing Statement
16.        return sum;
17.    }
18.
19. }
20. class Apartment{
21.     private Room [] rooms;
22.
23.     Apartment (int numberOfRooms){
24.         rooms = new Room[numberOfRooms];
25.         for (int i=0; i<rooms.length; i++){
26.             rooms[i]=new Room(4, 12);
27.         }
28.     }
29.     public Room [] getRooms(){return rooms;}
30. }
31. class Room{
32.     private int numOfWindows;
33.     private double area;
34.
35.     public Room(int number, double area){
36.         this.numOfWindows=number;
37.         this.area=area;
38.     }
39.     public int getNumWindows(){return numOfWindows;}
40.     public double getArea(){return area;}
41.
42. }
```

1. What is the name and extension of the file that contains the code above? (1 point)

2. How many .class files are generated when the file is compiled? Name them. (1 point)

3. Which of the classes Building, Apartment, and Room is immutable and which is not? Justify your answer. (2 points)

Class	Immutable?	Why?
Building		
Apartment		
Room		

4. Based on the following code: (1 points)


```
int [] x = {3, 4, 2, 5, 4, 3};
Building b = new Building (x);
```

What does the following statements print?

Statement	Output
<code>System.out.println(b.appartments.length);</code>	
<code>System.out.println(b.appartments[3].getRooms().length);</code>	

Question 3: The following code contains 5 errors. In the table below, list the line where the error occurs, the cause of the error, then identify the type of the error: whether the error is a syntax, runtime, or logical error. (5 points)

A.java	
1.	package p1;
2.	public class A {
3.	public B bObject;
4.	public A (int [] array){
5.	bObject = new B(array, true);
6.	}
7.	public static void main(String [] args){
8.	int [] myArray = {1,2,3,4};
9.	B b = new B(myArray, false);
10.	A a1 = new A(myArray);
11.	a1.updateArray();
12.	printArray(a1.bObject.values);
13.	}
14.	public void printArray(int [] myArray){
15.	for (int i=0; i<myArray.length; i++){
16.	System.out.print(myArray[i]+" ");
17.	}
18.	}
19.	}
20.	public void updateArray(){
21.	for (int i=0; i<bObject.values.length; i++){
22.	bObject.values[i]+=bObject.y;
23.	}
24.	}
25.	class B {
26.	public int [] values=new int[10];
27.	private int y=3;
28.	}
29.	public B(int y){
30.	y=y;
31.	}
32.	public B(int [] array, boolean f){
33.	if (f)
34.	values = array;
35.	else
36.	for (int i=0; i<values.length; i++){
37.	values[i]=array[i];
38.	}
39.	}

C.java	
40.	package p2;
41.	
42.	public class C{
43.	public A a;
44.	
45.	public C(){
46.	int[] myArray={1,1,1,1};
47.	a = new A(myArray);
48.	}
49.	}

	Line #	Cause of Error	Error Type
1.			
2.			
3.			
4.			
5.			

Question 4: You are required to design a model for a company using object oriented problem solving concepts you learned so far. Each company has a name, ID number, a number of employees and a number of owners as follows:

-Each employee has a name, social security number (رقم الضمان الاجتماعي), salary (راتب), hiring date (تاريخ التعيين), and number of vacation days. Note that all employees should have the same number of vacation days.

-Each owner has a name and share value (قيمة السهم).

A company also has a number of partner companies as well.

Your design should include the following:

- Operations that add and remove employees from the company.
- Operations that increase or decrease the share value of a certain owner.
- Print the details of a certain employee or a certain owner.
- All data fields should be encapsulated

Draw the UML diagram of your design. Note that no code writing is required for this question.

(5 points)