

Object Oriented Problem Solving (CPE 342)
Midterm Exam (70 Minutes)

الاسم الثلاثي: _____ الرقم الجامعي: _____

Question 1: In the following multiple choice questions, identify the choice that represents the correct answer. (4 points)

1. Which of the following statements is true regarding the Java virtual machine?

- a. It finds syntax errors in the source code.
- b. It translates the source code into bytecode.
- c. It translates each statement of the source code into machine code and executes it immediately.
- d. It translates each statement of the bytecode into machine code and executes it immediately.
- e. It generates the .class file.

2. What is the output of the following code?

```
public class Test {
    public static void main (String [] args){
        int [] x = {1, 2, 3, 4, 5};
        modify (x);

        int [] y = x;
        modify (y);

        int [] z = {1, 2, 3, 4, 5};
        modify(z[0]);

        System.out.println(x[0]+" "+y[0]+" "+z[0]);
    }
    public static void modify(int i){
        i++;
    }
    public static void modify (int [] i){
        for (int j=0; j<i.length; j++){
            i[j]++;
        }
    }
}
```

- a. 2 2 1 b. 2 2 2 c. 3 3 1 d. 2 3 2 e. 3 3 2

3. What is the output of the following code if the user enters the following numbers when requested: 1, 1, 1, -1?

```
import java.util.Scanner;
public class Test {
    public static void main(String [] args){
        count c1 = new count();
        count c2 = new count(4);

        Scanner input = new Scanner (System.in);
        while (input.nextInt()!=-1){
            c1.add(c2);
        }
        System.out.println(c1.getX()+" "+c2.getX());
    }
}
class count{
    private int x;
    count () {x=1;}
    count (int y){
        x=y;
    }
    public void add(count c){
        x += c.x;
    }
    public int getX(){return x;}
}
```

- a. 1 4
- b. 4 7
- c. 13 4
- d. 1 7
- e. The code will not compile because it has a syntax error.

4. Which of the following is true regarding the way variables are stored in memory in Java?

- a. Primitive data type variables of a method are stored in its activation record in the heap.
- b. Primitive data type variables of a method are stored in its activation record in the stack.
- c. Reference data type variables contains a reference to where data are stored in the method's activation record in the heap.
- d. Reference data type variables contains a reference to where data are stored in the method's activation record in the stack.
- e. b & c

Question 2: The following code contains 4 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. (4 points)

```

1. public class Foo {
2.     private int x;
3.     private double y;
4.     private static int z;
5.     private Foo myFoo;
6.
7.     public static void main(String[] args) {
8.         z = 5;
9.         Foo [] f = new Foo[3];
10.
11.         for (int i=0; i < f.length; i++){
12.             f[i] = new Foo (i);
13.             f[i].myFoo.y = i++;
14.             x = i*j;
15.         }
16.
17.         for (int i=0; i<f.length; i++){
18.             int i = z;
19.             z = f[i].x;
20.             f[i].x = i;
21.         }
22.     }
23.
24.     public Foo(){ }
25.     public Foo(int x){
26.         x = x;
27.     }
28. }

```

	Line number	Cause of Error	Error Type
1.			
2.			
3.			
4.			

Question 3: Study the following code which models a library. Then, answer the questions below. (8 points)

```
1. package LibrarySystem;
2.
3. public class Library {
4.     private String name;
5.     private Book [] books;
6.
7.     public Library (String n, Book [] b){
8.         name = n;
9.         books = b;
10.    }
11.
12.    public int x (){
13.        int sum = 0;
14.        for (int i=0; i<books.length; i++){
15.            if (books[i].borrowed) sum++;
16.        }
17.        return sum;
18.    }
19.
20.    public boolean y (int isbn){
21.        for (int i=0; i<books.length; i++){
22.            if (books[i].ISBN == isbn && !books[i].borrowed){
23.                return true;
24.            }
25.        }
26.        return false;
27.    }
28. }
29. class Book{
30.     private String title;
31.     public int ISBN;    //Book ID
32.     public boolean borrowed;
33.
34.     public void setTitle(String title){
35.
36.     }
37. }
```

1. What is the name and extension of the file that contains this code? (0.5 point)
2. What should be done in order to make the Book class accessible from other packages? (1 point)
3. Identify whether each of the Book class and the Library class is immutable or not? Justify your answer. (1 point)
4. What should be inserted in line 35 in order to complete the implementation of the setTitle method? (1 point)
5. When an object of type Book is created as follows: Book B = new Book();. What are the values of its data fields: title, ISBN, borrowed? (1.5 point)
6. What is the purpose of the method x (lines 12-18)? (1 point)
7. What is the purpose of the method y (lines 20-27)? (1 point)
8. For an object of type Book named "book1", write one statement that changes the value of its data field "borrowed" to true. (1 point)

Question 4: You are required to design a class that represents sections of courses in a university. Each section has a number that represents the course ID, the number of students registered in the section, and a maximum number of registered students allowed. All sections should have the same maximum number of registered students allowed. All data fields should be encapsulated. In addition, your class should provide methods to update the number of students registered when a new student is registered and when a student drops the course.

Draw the UML diagram of your design. (4 points)