1. This paper consists of 8 (Eight) questions.

2. Answer ALL questions.

3. Use a separate page for each question.

4. Each question carries different marks. Allocate appropriate time for answering each question.

5. You may declare any variable other than those specified when it deemed necessary. But the purpose of these variables must be clearly stated.

6. Write the required Java program statements with the syntax and standard according to the teaching material in the lecture and laboratory exercise of this course.
Attempt all the following Questions.

Q.1 What are the data types of the result of the following expressions, assuming \( n \) is an integer?

(a) \( n < 0 \)

(b) \( n = 0 \)

(c) \( n++ \)

(d) \( (\text{float}) n \)

(e) "It is a String" + \( n \)

(1 mark each, total 5 marks)

Q.2 Consider the following error-handling segment in a Java program. You don't need to care about what are written inside the try block and catch blocks.

```java
try {
    ..........
} catch (Exception e) {
    ..........
} catch (RuntimeException re) {
    ..........
} catch (ArithmeticException ae) {
    ..........
}
```

(3 marks each, total 6 marks)

(a) Is there anything wrong with this exception handler as written? Please explain.

(b) Correct the error you found in (a).
Q.3 Consider the following two classes (Hint: you don’t need to care about what is inside each method):

```java
public class ClassOne {
    public void methodA (int i) { ..................................
    }
    public void methodB (int i) { .............................
    }
    public static void methodC (int i) { ......................
    }
    public static void methodD (int i) { ......................
}

public class ClassTwo extends ClassOne {
    public static void methodA (int i) { .....................
    }
    public void methodB (int i) { ............................
    }
    public void methodC (int i) { ............................
    }
    public static void methodD (int i) { ...................
}

(3 marks each, total 9 marks)
```

(a) Which method overrides a method in the superclass?

(b) Which method hides a method in the superclass?

(c) Will the other two methods (other than those in your answers of part (a) and (b)) generate error? If so, what error?
Q.4 It is known that the following program, MistakeClass, contains a bug.

```java
1 public class MistakeClass{
2     public static void main(String[] args) {
3         StringBuffer[] stgBuf = new StringBuffer[10];
4         for (int i = 0; i < stgBuf.length; i++) {
5             stgBuf[i].append("String Buffer at index " + i);
6         }
7     }
8 }
```

(Total 6 marks)

(a) Which line contains the bug? (1 mark)

(b) Explain why it is wrong. (2 marks)

(c) Rewrite the program in the correct way to remove the bug. (3 marks)

Q.5 A Palindrome is a string that reads the same way (regardless of lowercase or uppercase) forwards and backwards, AFTER REMOVING ALL EMBEDDED SPACES. The following string s1 is an example of Palindrome :-

```java
String s1 = "A Man A Plan A Canal Panama";
```

(Total 15 marks)

(a) What is the value returned by the method call s1.charAt(13)? (2 marks)

(b) What is the value displayed by the expression s1.length()? (2 marks)

(c) Write a Java program to test whether a string is a Palindrome. (Hint: you don't need to write the method pauseScreen() as in your lab exercises) (11 marks)
Q.6 Consider the following Class Diagram:-

(Rectangle)
- Point topLeftCorner
- int width
- int height
- Initialiser Constructor
- Accessor Methods
- toString() Method

(has)

(Point)
- int xCoor
- int yCoor
- Initialiser Constructor
- Accessor Methods
- toString() Method

(a) Explain the two types of Class Relationship: ‘Owns’ and ‘Uses’.

(6 marks)

(b) Which type of Class Relationship exists between Rectangle and Point?

(2 marks)

(c) Complete the following code for the ‘Point’ class by writing its INITIALIZER constructor and Read/Write accessor methods only. (Hint: toString() method is NOT required)

```
Public class Point {
    int xCoor = 0;
    int yCoor = 0;
    // ... Initializer Constructor .../
}
```

(4 marks)

(d) Write the code for Data Variables, Initializer Constructor and toString() method of the ‘Rectangle’ class (Read/Write Accessor is NOT required).

(8 marks)

(e) Suppose that you then wrote the following class. How many reference(s) to those objects exist(s) after the code executes?

```
public class DrawRectangle {
    public static void main (String[] args) {
        Point pnt1 = new Point(25, 70);
        Rectangle rect1 = new Rectangle(pnt1, 100, 40);
        pnt1 = null; }
    }
```

(2 marks)
Q.7  Suppose we have created a Vector called `products` storing three strings in this order: “Ball Pen”, “Ruler”, and “Memo Pad”. (Total 13 marks)

(a) Write a statement to remove “Memo Pad” from `products`. (2 marks)

(b) Write a statement to generate the following output:

```
    There are 2 products.
```

(2 marks)

(c) Create another Vector called `giftBox` that stores the strings in the order of: “Pencil”, “Rubber”, and “Crayon”. (2 marks)

(d) If we do the following, what will happen?

```
    products.add(giftBox);
```

(3 marks)

(e) If we print the Vector `products` using `System.out.println()`, what will it look like? (4 marks)
Q.8 Suppose there is a given array `intArray` of integers from which a key (integer also) is to be searched. The key is input through an `IntTextField` class with the following class header and constructor:-

```java
public class IntTextField extends TextField implements TextListener {
    private int key = 0;                    // Data Variable
    public IntTextField (int[] intArray) {
        super();
        this.intArray = intArray;
        addTextListener(this);            // End Constructor
        ............
    }
```

The `IntTextField` class must contain a method `getValue()`. Within `getValue()`, if there is exactly one match, the key should be returned; for the following cases, an exception object named ‘IntTextFieldException’ will be thrown which contains any one of :-

1. if the input key is null; or
2. if the input key is Non-numeric; or
3. if there is no match; or
4. if there are more than one match.

(Total 24 marks)

(a) Write the `getValue()` method. (Hint: no Accessor method or Listener method is required, and you don’t need to consider how to input the array `intArray`)

(9 marks)

(b) Write the complete `IntTextFieldException` Exception class.

(8 marks)

(c) List all the methods required to write a Message Box (with a button only) Class. No statement and parameter is needed.

(7 marks)