Question - 1
Copy By Value

SCORE: **24 points**

Problem Statement

When the following code is executed, there will be 6 lines of output generated. Please complete the output.

```java
public class CopyByValue {
    int number = 0;
    int[] array = {0};

    public int incrementNumber1(int number) {
        number++;
        return number;
    }

    public int incrementNumber2() {
        number++;
        return number;
    }

    public int[] incrementArray1 (int[] array) {
        for (int i = 0; i < array.length; i++) {
            array[i]++;
        }
        return array;
    }

    public int[] incrementArray2 () {
        for (int i = 0; i < array.length; i++) {
            array[i]++;
        }
        return array;
    }

    public static void main(String[] args) {
        CopyByValue cbv = new CopyByValue();

        cbv.number = 0;
        cbv.incrementNumber1(cbv.number);
        System.out.println("incrementNumber1(): "
 + cbv.number);

        cbv.number = 0;
        cbv.incrementNumber2();
        System.out.println("incrementNumber2(): "
 + cbv.number);

        cbv.array[0] = 0;
        cbv.incrementArray1(cbv.array);
        System.out.println("incrementArray1(): "
 + cbv.array[0]);

        cbv.array[0] = 0;
        cbv.incrementArray2();
        System.out.println("incrementArray2(): "
 + cbv.array[0]);
    }
}
```

incrementNumber1(): <u>\<blank 1\></u> incrementNumber2(): <u>\<blank 2\></u>
incrementArray1(): <u>\<blank 3\></u> incrementArray2(): <u>\<blank 4\></u>

Answers

\<blank 1\> : [0]
\<blank 2\> : [1]

<blank 3> : [1]
<blank 4> : [1]

Question - 2
equals(), hashCode() and compareTo()

SCORE: **20 points**

Please choose the correct statements:

- ◉ If x.equals(y) is true, then x.hashCode() == y.hashCode() must be true

- ○ If x.hashCode() == y.hashCode() is true, then x.equals(y) must be true

- ◉ If x.equals(y) is true, then x.compareTo(y) == 0

- ◉ If x.compareTo(y) == 0, x.equals(y) must be true

Question - 3
Implementation of equals() and hashCode()

SCORE: **40 points**

Your company has many different products and each products comes in different sizes.
The inventory management system treats each combination of " (String) productName" & "(int) size" as an individual "Product" record.
The records also contains a "(LocalDateTime) lastUpdate" field as timestamp, which can be updated so even if it is different, as long as productName and size fields are equal, the Product record should always be considered as same.

product1: productName = "Gloves", size = 5, timestamp = "2018-01-15 18:35:05"
product2: productName = "Gloves", size = 7, timestamp = "2018-01-11 10:02:55"
product3: productName = "Gloves", size = 5, timestamp = "2017-12-03 11:28:23"
product4: productName = "Hat", size = 5, timestamp = "2017-12-03 11:28:23"

Only product1.equals(product3) should return true as their productName and size fields are identical. (timestamp can vary.)
All other equals() call should return false.

Please complete equals() and hashCode() method for Product class.

Question - 4
Unexpected StackOverflowError in toString() implementation

SCORE: **16 points**

The following code will successfully output the Address1@4554617c:

```java
// Output: "Address1@4554617c"
public class Address1 {
    public static void main(String[] args) {
        Address1 a1 = new Address1();
        System.out.println(a1);
    }
}
```

When trying to output some additional information, toString() method should be overridden. However, the following code generated StackOverflowError unexpectedly.

```java
// Output: "Exception in thread "main"
java.lang.StackOverflowError"
public class Address2 {
    @Override
    public String toString() {
        return "The address of this Object is: "
+ this;
    }

    public static void main(String[] args) {
        Address2 a2 = new Address2();
        System.out.println(a2);
    }
}
```

Please answer the following questions:
(1)(6pt) What caused this error?
(2)(10pt) In order to generate output in the format of "The address of this Object is: Address2@4554617c", what change should be made? (Hint: only small change is needed)