1 Boxes and Pointers II

Draw a box and pointer diagram for each code block.

(a) \[
\begin{align*}
\texttt{int[]} \ x &= \{1, 2, 3\}; \\
\texttt{int[]} \ y &= x; \\
y[2] &= 7;
\end{align*}
\]

\[x \text{ and } y \text{ should both point to an array with values } [1, 2, 7].\]

(b) \[
\begin{align*}
\texttt{IntList} \ l &= \texttt{IntList.list}(1, 2, 3); \\
\texttt{IntList} \ l2 &= l; \\
l\texttt{.tail.tail.head} &= 7;
\end{align*}
\]

\[l \text{ and } l2 \text{ should both point to an } \texttt{IntList} \text{ with values } 1, 2, \text{ and } 7.\]

(c) \[
\begin{align*}
\texttt{IntList[]} \ ll &= \texttt{new} \texttt{IntList}[3]; \\
ll[0] &= \texttt{IntList.list}(1, 2); \\
ll[1] &= \texttt{IntList.list}(2);
\end{align*}
\]

\[ll \text{ should point to an array, where the first two elements point to } \texttt{IntLists} \text{ and the third is null.}\]

2 Objects Refresher: Does this make sense?

(a) Determine what would be printed after executing the main method of class Avatar.

\[
\begin{align*}
\texttt{public class Avatar} \{ \\
\texttt{public static String electricity;} \\
\texttt{public String fluid;} \\
\texttt{public Avatar(String stri, String str2) \{} \\
\texttt{Avatar.electricity = stri;} \\
\texttt{this.fluid = str2;} \\
\texttt{\} } \\
\texttt{public static void main(String[]} \texttt{args} \{ \\
\texttt{Avatar fool = new Avatar("one ", \text{"two")};} \\
\texttt{Avatar foo2 = new Avatar("three ", \text{"four")};} \\
\texttt{System.out.println(fool.electricity + fool.fluid);} \\
\texttt{fool.electricity = "I declare ";} \\
\texttt{fool.fluid = \text{"a thumb war"};} \\
\texttt{System.out.println(fool2.electricity + fool2.fluid);} \\
\texttt{\} } \\
\end{align*}
\]

The main method will print

three two
I declare four
(b) Consider swapping Avatar and this in lines 6 and 7. Which swaps, if any would cause errors if we tried to compile and run the code?

Both Avatar and this would work on line 6, but only this will work for line 7. Changing this to Avatar on line 7 will cause a compile-time error because we cannot reference instance variables using a static class reference.

c) Will adding the following method to class Avatar cause any errors during compilation or execution?

```java
public static String getFluid() {
    return fluid;
}
```

The method will cause a compile-time error because we can not reference an instance variable (in this case, fluid) from inside a static context.

When the object is not specified (the thing before the period) in a field access or method call, Java will use this. by default. However, since the new method is static, this does not exist and therefore an error is thrown.

3  Min/Max

Given an array A, return a 2 element array B where B[0] is the minimum element of A and B[1] is the maximum element of A.

```java
import static java.lang.Math.max; // max(a, b) returns max of a, b
import static java.lang.Math.min; // min(a, b) returns min of a, b

public static int[] minMax(int[] A) {
    int maxVal = Integer.MIN_VALUE; // smallest int in Java
    int minVal = Integer.MAX_VALUE; // largest int in Java

    int[] B = new int[2];

    for (int i = 0; i < A.length; i += 1) {
        maxVal = max(maxVal, A[i]);
        minVal = min(minVal, A[i]);
    }

    B[0] = minVal;
    B[1] = maxVal;

    return B;
}
```
4 Reverse

Given an array $A$, reverse its elements in place (i.e. do not create any new arrays; this should be a destructive method).

```java
public static void reverse(int[] A) {
    for (int i = 0; i < A.length / 2; i++) {
        int temp = A[A.length - i - 1];
        A[A.length - i - 1] = A[i];
        A[i] = temp;
    }
}
```