1 Boxes and Pointers II

Draw a box and pointer diagram for each code block.

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

\(x\) and \(y\) should both point to an array with values \([1, 2, 7]\).

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

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

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

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

2 Objects Refresher: Does this make sense?

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

\[
\begin{align*}
\textbf{public class} & \quad \texttt{Avatar} \{} \\
& \quad \textbf{public static} \quad \texttt{String} \quad \texttt{electricity}; \\
& \quad \textbf{public} \quad \texttt{String} \quad \texttt{fluid}; \\
& \quad \{} \\
& \quad \textbf{public} \quad \texttt{Avatar(String \ stri, String \ str2)} \{ \\
& \quad \quad \texttt{Avatar.electricity} = \texttt{stri}; \\
& \quad \quad \texttt{this.fluid} = \texttt{str2}; \\
& \quad \} \\
& \quad \textbf{public static void} \quad \texttt{main(String[]} \ \texttt{args}) \{ \\
& \quad \quad \texttt{Avatar \ foo1} = \texttt{new} \ \texttt{Avatar("one ", ", two");} \\
& \quad \quad \texttt{Avatar foo2} = \texttt{new} \ \texttt{Avatar("three ", ", four");} \\
& \quad \quad \texttt{System.out.println(foo1.electricity} + \ \texttt{foo1.fluid}); \\
& \quad \quad \texttt{foo1.electricity} = \texttt{"I \ declare ";} \\
& \quad \quad \texttt{foo1.fluid} = \texttt{"a \ thumb \ war"}; \\
& \quad \quad \texttt{System.out.println(foo2.electricity} + \ \texttt{foo2.fluid}); \\
& \quad \} \\
& \\}
\]

The main method will print
sounds 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++) {
        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;
    }
}
```