

Solution to Section #9

Parts of this handout by Eric Roberts and Patrick Young

1. Primitives vs. Objects

In the first example, the student is thinking a little too literally about the expressions they've written, seeing them as what they *want* them to mean as opposed to what they in fact *do* mean. The problem lies in the comparison:

```
(name == "Q")
```

The correct English translation of this statement is: compare the *address* of the object `name` to the *address* of the constant string `"Q"`. In other words, `name` is a *reference* to a `String` object. Since `name` was read in from the user, this comparison will always return `false`, as it cannot be the same underlying object as the constant string `"Q"`. If we actually want to compare the *values* held in those `String` objects, we should write:

```
name.equals("Q")
```

For comparing values, the `==` operator should only be used with primitive types, such as `int`, `double`, `boolean`, and `char`. Variables that represent objects (like `String`) are always references (addresses of some location in memory).

In the second example the code actually works as intended. In the expression:

```
(name.charAt(0) == 'Q')
```

we are using the `==` operator to compare the primitive type `char`. Since we are comparing primitives (and not object references), the `==` operator is comparing actual `char` values rather than memory addresses. This works just as we would want it to.

Continued on next page

2. Data structure design

```

/*
 * File: ExpandableArray.java
 * -----
 * This class provides methods for working with an array that expands
 * to include any positive index value supplied by the caller.
 */

public class ExpandableArray {

    /**
     * Creates a new expandable array with no elements.
     */
    public ExpandableArray() {
        array = new Object[0]; // Allows us to check length of array
                               // even when no elements exist
    }

    /**
     * Sets the element at the given index position to the specified.
     * value. If the internal array is not large enough to contain that
     * element, the implementation expands the array to make room.
     */
    public void set(int index, Object value) {
        if (index >= array.length) {

            // Create a new array that is large enough
            Object[] newArray = new Object[index + 1];

            // Copy all the existing elements into new array
            for (int i = 0; i < array.length; i++) {
                newArray[i] = array[i];
            }

            // Keep track of the new array in place of the old array
            array = newArray;
        }
        array[index] = value;
    }

    /**
     * Returns the element at the specified index position, or null if
     * no such element exists. Note that this method never throws an
     * out-of-bounds exception; if the index is outside the bounds of
     * the array, the return value is simply null.
     */
    public Object get(int index) {
        if (index >= array.length) return null;
        return array[index];
    }

    /* Private instance variable */
    private Object[] array;
}

```