Unit 4

This unit covers objects and classes, the foundations of object-oriented programming. Chapter 5 of Eck (2019) introduces many of the essential features of object-oriented programming in Java, and this unit concentrates on the first half of that chapter, Sections 1-4. The next unit will cover the second half, particularly inheritance and polymorphism.

This unit shows that classes define how objects are created and manipulated. All of Sections 1-4 in Chapter 5 are very important. Section 4 may be particularly challenging because it steps through a large example program. Please take the time to study the code and understand how it works. Walking through code is excellent practice for becoming a skilled programmer.

1) First, the computer gets a block of unused memory in the heap, large enough to hold an object of the specified type.
2) It initializes the instance variables of the object. If the declaration of an instance variable specifies an initial value, then that value is computed and stored in the instance variable. Otherwise, the default initial value is used.
3) The actual parameters in the constructor, if any, are evaluated, and the values are assigned to the formal parameters of the constructor.
4) The statements in the body of the constructor, if any, are executed.
5) A reference to the object is returned as the value of the constructor call.

Section 5.1.2 emphasizes how object variables are actually references. The bold below reflects the actual text.

In Java, *no variable can ever hold an object. A variable can only hold a reference to an object.*

The value of the variable is a reference, or pointer, to the object. The object itself is somewhere in the heap. It is not quite true, then, to say that the object is the "value of the variable std" (though sometimes it is hard to avoid using this terminology). It is certainly not at all true to say that the object is "stored in the variable std." The proper terminology is that "the variable std refers to or points to the object," and I will try to stick to that terminology as much as possible.

When one object variable is assigned to another, only a reference is copied. The object referred to is not copied.

Reading Assignment

Eck, D. J. (2019). *Introduction to programming using Java, version 8.1*. http://math.hws.edu/javanotes. Download the PDF: https://math.hws.edu/eck/cs124/downloads/javanotes8.pdf

Read the following:

- Chapter 5 (Objects and Classes), Sections 1-4

Supplementary Reading Assignment

Gallardo, R., Hommel, S., Kannan, S., Gordon, J., and Zakhour, S.B. (2016). *The Java tutorials*. Oracle.

What is an object? https://docs.oracle.com/javase/tutorial/java/concepts/object.html

What is a class? https://docs.oracle.com/javase/tutorial/java/concepts/class.html

Classes. https://docs.oracle.com/javase/tutorial/java/javaOO/classes.html

Objects. https://docs.oracle.com/javase/tutorial/java/javaOO/objects.html

Web Dev Simplified. (2019, June 4). *What are classes, objects, and constructors?* [Video]. YouTube. https://www.youtube.com/watch?v=5AWRivBk0Gw

UniProgrammer. (2017, October 9). *Java Programming Tutorial - 14- Creating a Class, Instance Variables, and a Constructor* [Video]. YouTube. https://www.youtube.com/watch?v=h8EnX87gX9o