Sample Quiz 1 - Friday Key

This is a sample of the kinds of questions you can expect Friday. Try the quiz closed book and then check your answers against the key.

1. Determine the order of each of the following growth functions. (2 points each)
   
   (a) \(10n^5 + 100n^3 + 100\)
   Answer: \(O(n^5)\)

   (b) \(2^n + 100n^3\)
   Answer: \(O(2^n)\)

   (c) \(n^2 \log_2 n\)
   Answer: \(O(n^2 \log_2 n)\)

2. Which of the previous functions will eventually grow fastest? (2 points each)
   Answer: b. Exponental functions grow very fast for large \(n\)

3. Determine the growth function and the order of the following code fragment: (5 points)

   ```
   n=10
   sum=0
   for i = 1 to n
       {j = i
        while j less than n
            { sum +=j
            j++}
   }
   ```

   Answer: This is a situation with nested loops. The inner loop is performed once for every item and therefore has a complexity of \(n \rightarrow O(n)\). The outer loop is also performed once for every item and therefore multiplies the complexity by a factor of \(n\) giving a complexity on the order of \(O(n^2)\)
4. Define: primative data type
   Answer: A primative data type is built into the java language. An example is int.

5. Define: abstract data type
   Answer: An abstract data type is not built into the java language but is defined via a class constructed by a programmer. An exception is String which is an object predefined in java itself.

6. Briefly (two or three sentences) describe the relationship between a class and an object.
   Answer: A class defines the properties and methods for an abstract data type. An object is an instance of a class, much like a variable is an instance of a data type.

7. We discussed three logical types of lists (not JAVA implementations of lists). Name them.
   (a) unordered list
   (b) ordered list
   (c) indexed list

8. Pick one of the three ways we learned to create lists in JAVA. Give at least one advantage and at least one disadvantage of the way you picked.
   (a) Array - arrays are easy to define and manipulate. Arrays have properties that allow you to easily find the first, last, or any given element of the array. Unfortunately arrays are fixed size and can neither grow or shrink as needed.
   (b) ArrayList - ArrayLists are a more flexible implementation of an array. ArrayLists have all of the advantages of arrays with the added ability to grow when needed. The main disadvantage is in the method used to grow the ArrayList. A new ArrayList is created that is twice the size and then the ArrayList is copied into the new one. This is not a quick procedure.
   (c) LinkedList - A LinkedList starts at one element and grows very effectively. The LinkedList takes up only as much memory as actually required. However, it is not as easy to find the first element of the linked list (you must keep track of where the first element is in your program) and to find any element the program must start at the first element and then follow the links to desired element.

9. Extra Credit: In java, all objects inherit properties and/or methods from a single object. What is the name of that object?
   Answer: Object