APCS Free Response A1 (ArrayList) Java Version

Assume that the standard library classes (e.g., java.util.ArrayList) are imported in any program that uses a program segment you write. If other classes are to be imported, that information will be specified in individual questions. Unless otherwise noted, assume that all methods are called only when their preconditions are satisfied. A Quick Reference to the AP Java subset classes is included in the case study insert.

A1

A researcher wishes to calculate some statistical properties for a collection of integer data values. The data values are represented by the array tally. The indexes of the array represent the possible values of the actual data values from zero to the maximal value (15 in the example below). Each array location contains the frequency (number of occurrences) of the value corresponding to its index. In the example below, tally[4] is 10, which means that the value 4 occurs ten times in the collection of data; whereas tally[8] is 0, which means that the value 8 does not occur in the data collection.

Value	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Frequency	0	0	10	5	10	0	7	1	0	6	0	10	3	0	0	1

Part A

You will write the static method calculateModes of the class Stats which is described as follows. Method calculateModes returns an ArrayList which contain the mode(s) found in parameter tally The size of the returned array is equal to the number of modes A **mode** is defined as a value that occurs with maximal frequency. If there is more than one such value, each is considered a mode of the data. In the example above, the modes are 2, 4, and 11, because they each occur 10 times and all other values occur fewer than 10 times.

In writing calculateModes you may call the Stats method findMax specified below which returns the maximum value in an ArrayList. Using the example array, findMax(tally) returns an Integer object, say obj, such that obj.intValue() returns the value 10. Do NOT write findMax.

```
/**
 * precondition: nums.size() > 0; nums contains Integer objects
 * postcondition: returns the maximal value in nums
 */
private static Integer findMax(ArrayList nums)
```

Do NOT write the body of findMax

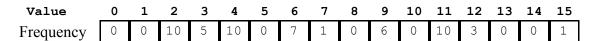
In writing calculateModes, you may call method findMax specified above.

Complete method calculateModes below.

Part B

You will write the method kthDataValue of the Stats class which is described as follows. Method kthDataValue returns the kth data value when the data values are considered in sorted order. Recall that the indexes of the array represent possible data values and that each array location contains the frequency of the value corresponding to its index.

In the example reprinted below, the first ten data values are 2, the next five data values are 3, and the next ten data values are 4. For this example, kthDataValue(tally, 1) returns 2, kthDataValue(tally, 14) returns 3, kthDataValue(tally, 15) returns 3, and kthDataValue(tally, 16) returns 4.



Complete method kthDataValue below.

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Last modified: Wed Jul 10 12:05:08 EDT 2002