

Solution to Section #5

1. Calculating exam statistics

```
/*
 * File: Statistics.java
 * -----
 * This file reads in an array of scores and computes two statistics
 * on the distribution: the mean and the standard deviation.
 */

import acm.program.*;
import acm.util.*;
import java.io.*;
import java.util.*;

public class Statistics extends ConsoleProgram {

    public void run() {
        double[] scores = readScoresArray(DATA_FILE);
        println("mean = " + mean(scores));
        println("stdev = " + stdev(scores));
    }

    /**
     * Calculates the mean of a double array
     * @param array An array of doubles
     * @return The mean of the array
     */
    public double mean(double[] array) {
        int n = array.length;
        double total = 0;
        for (int i = 0; i < n; i++) {
            total += array[i];
        }
        return total / n;
    }

    /**
     * Calculates the standard deviation of a double array
     * @param array An array of doubles
     * @return The standard deviation of the array
     */
    public double stdev(double[] array) {
        int n = array.length;
        double average = mean(array);
        double total = 0;
        for (int i = 0; i < n; i++) {
            double delta = array[i] - average;
            total += delta * delta;
        }
        return Math.sqrt(total / n);
    }

    /* Name of the data file */
    private static final String DATA_FILE = "Midterm.txt";
}

```

2. Creating a histogram

```

/*
 * File: Histogram.java
 * -----
 * This program reads a list of exam scores, with one score per line.
 * It then displays a histogram of those scores, divided into the
 * ranges 0-9, 10-19, 20-29, and so forth, up to the range containing
 * only the value 100.
 */

import acm.program.*;
import acm.util.*;
import java.io.*;
import java.util.*;

public class Histogram extends ConsoleProgram {

    public void run() {
        double[] scores = readScoresArray(DATA_FILE);
        initHistogram();
        createHistogram(scores);
        printHistogram();
    }

    /* Initializes the histogram array */
    private void initHistogram() {
        histogramArray = new int[11];
        for (int i = 0; i <= 10; i++) {
            histogramArray[i] = 0;
        }
    }

    /* Creates a histogram from the array of scores */
    private void createHistogram(double[] scores) {
        for (int i = 0; i < scores.length; i++) {
            double score = scores[i];
            if (score < 0 || score > 100) {
                throw new RuntimeException("That score is out of range");
            } else {
                int range = (int) (score / 10);
                histogramArray[range]++;
            }
        }
    }

    /* Displays the histogram */
    private void printHistogram() {
        for (int range = 0; range <= 10; range++) {
            String stars = createStars(histogramArray[range]);
            println(createLabelForRange(range) + ": " + stars);
        }
    }
}

```

```
/* Creates the label indicating the range */
private String createLabelForRange(int range) {
    switch (range) {
        case 0: return "00-09";
        case 10: return " 100";
        default: return (10 * range) + "-" + (10 * range + 9);
    }
}

/* Creates a string consisting of n stars */
private String createStars(int n) {
    String stars = "";
    for (int i = 0; i < n; i++) {
        stars += "*";
    }
    return stars;
}

/* Private instance variables */
private int[] histogramArray;

/* Name of the data file */
private static final String DATA_FILE = "Midterm.txt";
}
```