Analytic Combinatorics Program II.1

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I wrote the following program:

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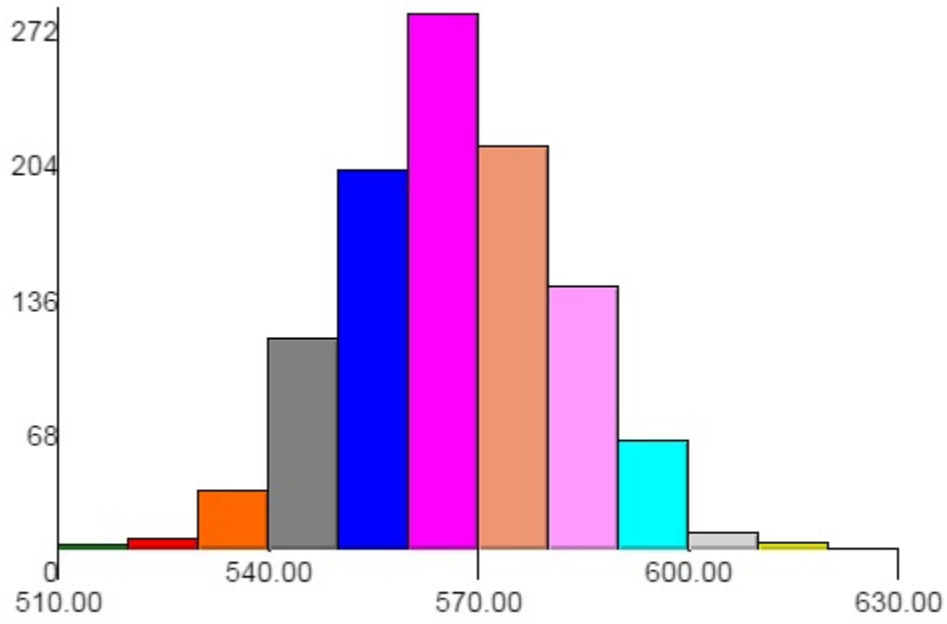
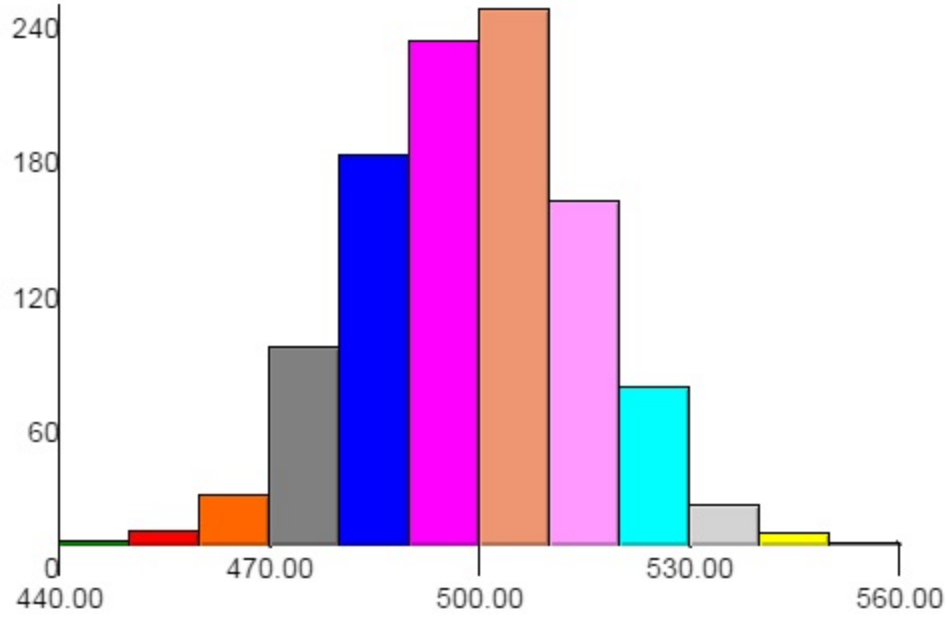
```
import java.util.Arrays;

// Eric Neyman
// This program simulates the Ehrenfest model.
public class Ehrenfest {
    public static void main(String[] args) {
        final int numBalls = 1000;
        final int numSteps = 1000; // Also, 10000 and 1000000.
        final int numTrials = 1000;
        int[] data = new int[numTrials]; // Stores number of balls in urn A at
                                         // the end of each trial.
        int min = numBalls + 1;
        int max = -1;
        int sum = 0;
        for (int i = 0; i < numTrials; i++) {
            int numBallsInA = numBalls;
            for (int j = 0; j < numSteps; j++) {
                if (Math.random() < ((double) numBallsInA) / numBalls) {
                    numBallsInA--;
                } else {
                    numBallsInA++;
                }
            }
            data[i] = numBallsInA;
            if (numBallsInA > max) {
                max = numBallsInA;
            }
            if (numBallsInA < min) {
                min = numBallsInA;
            }
            sum += numBallsInA;
        }
        System.out.println(Arrays.toString(data));
        System.out.println("Minimum: " + min);
        System.out.println("Maximum: " + max);
        System.out.println("Average: " + ((double) sum) / numTrials);
    }
}
```

For numSteps equal to 1,000, the minimum was 516, the maximum was 620, and the average was 567.442. The distribution looked as below:



For numSteps equal to 10,000, the minimum was 442, the maximum was 556, and the average was 500.036. The distribution was centered almost exactly around 500, meaning that there were enough steps that the initial conditions had a negligible impact on the final result. The distribution looked as below:



For numSteps equal to 100,000, the minimum was 448, the maximum was 552, and the average was 499.912. The distribution was pretty much identical to the distribution for numSteps equal to 10,000.