

March 24, 2017

Purpose: To write a coin toss simulation to see the relationship of how many tosses it will take to get the sequence HTH and HTT.

Samples:

Sequence for HTH: Total Flips: 1000000.0 Total flips sum: 10006086 Average flips: 10.006086	Sequence for HTH: Total Flips: 1000000.0 Total flips sum: 10007626 Average flips: 10.007626	Sequence for HTH: Total Flips: 1000000.0 Total flips sum: 10000138 Average flips: 10.000138	Sequence for HTH: Total Flips: 1000000.0 Total flips sum: 10014673 Average flips: 10.014673
Sequence for HTT: Total Flips: 1000000.0 Total flips sum: 8002602 Average flips: 8.002602	Sequence for HTT: Total Flips: 1000000.0 Total flips sum: 8005843 Average flips: 8.005843	Sequence for HTT: Total Flips: 1000000.0 Total flips sum: 8003428 Average flips: 8.003428	Sequence for HTT: Total Flips: 1000000.0 Total flips sum: 7997361 Average flips: 7.997361
21122 5 112122 6 2122 4 Sequence for HTT: Total Flips: 3.0 Total flips sum: 15 Average flips: 5.0	2122 4 1122 4 122 3 Sequence for HTT: Total Flips: 3.0 Total flips sum: 11 Average flips: 3.6665	2212221121 10 11222121 8 211111122122121 15 Sequence for HTH: Total Flips: 3.0 Total flips sum: 33 Average flips: 11.0	22222121 8 22211122211122212 1 18 121 3 Sequence for HTH: Total Flips: 3.0 Total flips sum: 29 Average flips: 9.666666666666666

Observation and analysis:

It seems that the average for each individual toss are the same. HTH sequence has an average of 10 flips and HTT has 8. Also, on average, it takes more flips for the sequence HTH to arrive than the sequence HTT. There is a 50/50 chance of getting a head and tail each toss. The best way for me to explain how HTH requires more flips than HTT is by somewhat thinking along the lines of a game. If the first flip is H then both HTH have a chance of winning, and if a T is flipped on the second one, both are still winning, but HTH cannot get a T on the next flip because that would be the end of the game and it must restart over, but HTT can get a t because that is what it needs. So, HTT will appear first than HTH. At first I thought they would have the same probability since flipping a coin is 50/50 but this simulation shows otherwise.

This code took me a few hours to understand since I had to look up tutorials online to use string and while loop since I knew I had to use those two somehow, but at first I didn't know how to. However, I've eventually got it.

```
package HTX_Program;

public class coinSequence {
    public static int coinFlip() {
        MultiDie coin = new MultiDie(2);
        coin.roll();
        int x = coin.getFaceValue();
        return x;
    } // get H or T

    public static void main(String[] args) {
        final float N=1000000;
        int totalFlips = 0;
        int count;

        for(int i=0; i<N; i++){
            String sequenceSoFar = ""; // empty string list
            sequenceSoFar += coinFlip(); // append to string
            sequenceSoFar += coinFlip();
            sequenceSoFar += coinFlip();
            count = 3;
            totalFlips += 3; // add initial 3 flips to total.
            // if the first three aren't the sequence, then keep going until the
sequence is met in the while loop
            if(!sequenceSoFar.equals("122")) {
                while(!(sequenceSoFar.substring(sequenceSoFar.length() -
3).equals("122"))) {
                    sequenceSoFar += coinFlip();
                    count++;
                    totalFlips++;
                }
            }
            // to check my work with small numbers
            // System.out.println(sequenceSoFar);
            //System.out.println(count);
        }
        System.out.println("Sequence for HTT: ");
        System.out.println("Total Flips: " + N);
        System.out.println("Total flips sum: " + totalFlips);
        double average = (totalFlips * 1.0) / (double) N;
        System.out.println("Average flips: " + average);
    }
}
```