Randomness Vs. Chaos

Directions: Read the article to get a better understanding of probability. Use the article to guide you through this quick, but important, activity.

From Randomness to Probability (taken from "Stats – Modeling the World" Pearson publishing company 2004)

What's the difference between randomness and chaos? At first glance they might seem to be the same. Neither of their outcomes can be anticipated with certainty, but random phenomena have another important feature. In the long run, they settle down in a way that's actually consistent and predictable. Chaotic processes don't do this. It's this property of randomness that enables us to do Statistics.

Dealing with Random Phenomena

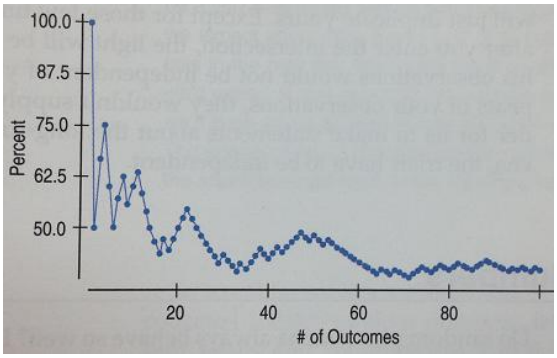
Every day you drive through the intersection at College and Main. Even though it may seem that the light is always red when you get there, you know this can't really be true. In fact, if you try really hard, you can recall just sailing through the green light once in a while.

What's random here? The light itself may be governed by a timer. Its pattern isn't haphazard. In fact, the light may even be red at precisely the same time each day. It's the pattern of your *driving* that is random. No, we're certainly not insinuating that you can't keep your car on the road. At precision level of the 30 seconds or so that the light spends being red or green, the time you arrive at the light is *random*. Even if you leave your house at the exact same time every day, whether the light is red or green as *you* reach the intersection is a **random phenomenon.**

Is the color of the light completely unpredictable? When you stop to think about it (maybe while waiting for the green light), it's clear that we do expect some kind of *regularity* in your long-term experience. Some *fraction* of the time the light will be red as you get to the intersection. How can we figure out what that fraction is?

You might record what happens at the intersection each day and graph the accumulated percentage of red lights like this:

Day	Light	% Red
1	Red	100
2	Green	50
3	Red	66.7
4	Red	75
5	Green	60
6	Green	50



The first day you recorded the light it was red. Then on the next five days, it was green, then red, green, and green. If we plot the percentage red against the day, the graph would start at 100% because the first tie the light was red (1out of 1, for 100%). Then the next time it was green, so the accumulated percentage drops to 50% (1 out of 2). The third day it was red again (2 out of 3, or 66% red), then red (3 out of 4, or 75%), the green twice in a row (3 out of 5, for 60% red and 3 out of 6, for 50% green), and so on. As you collect a new data point for each day, this new datum becomes a smaller and smaller *fraction* of the accumulated experience, so, in the long run, the graph settles down. As it settles down, we can see that, in fact, the light is red only about 35% of the time.

After reading the article, discuss with your partner the following questions:

1. What is the difference between randomness and chaos?

2. In the long run, what happens to randomness?

3. How do we use randomness and its long run in our lives?

Working with a Partner

Every pair must turn in their own work and their own data.
All work should be done on a separate sheet of paper.

1. Select one coin **or** one number cube.

2. Flip the coin or roll the cube. Record outcome here: _____. This result will be referred to as your "desired outcome" from this point forward.

3. Create a chart on a separate sheet of paper similar to the one below. You must toss your coin or flip your cube 100 times.
   Use the article to help you understand how to create the third column.

Toss or Flip	Result	% of desired outcome
1	Head	100
2	Head	100
3	Tail	66.6

4. Next you and your partner will chart EVERY FIFTH DATA POINT on a graph similar to the one in your article. The x-axis should represent the number of tosses or flips, and the y-axis should represent the percentage of desired outcome.

5. Last, write a conclusion based on your graph. What happens in the long run? Did you expect that to happen?