Give Me a Kiss!

Materials: Bag of plain Hershey's Kisses (enough for one per student)

When you flip a fair coin, it is equally likely to land on "heads" or "tails." Do plain Hershey's Kisses behave in the same way? In this Activity, you will toss a Hershey's Kiss many times and observe whether it comes to rest on its side (S) or on its base (B). The question you are trying to answer is: what proportion of the time does a Hershey's Kiss settle on its base?

1. Before you begin, make a guess about what will happen. If you could toss your Hershey's Kiss over and over and over, in what proportion of all tosses do you think the Kiss would settle on its base?
2. Toss your Kiss 50 times. Record the result of each toss (S or B) in a table like the one shown. In the third column, calculate the proportion of base landings you have obtained so far.

Toss	Outcome	Cumulative Proportion of B's
1	B	1/1 = 1.00
2	S	1/2 = 0.50
3	S	1/3 = 0.33
⋮	⋮	⋮

3. Make a scatterplot with the toss number on the horizontal axis and the cumulative proportion of B's on the vertical axis. Connect consecutive points with a line segment. Does the overall proportion of B's seem to be approaching a single value?
4. Your set of 50 tosses can be thought of as a random sample from the population of all possible tosses of your Hershey's Kiss. The parameter p is the unknown population proportion of tosses that would land on the base. The best estimate for this proportion is the sample proportion $\hat{p}$. What is the value of $\hat{p}$ for your sample of tosses? How does this value compare with your guess in step 1?

In Chapter 7, we learned that when we take large samples from a population where the true proportion of successes is p, the distribution of the sample proportion $\hat{p}$ is approximately Normal with mean p and standard deviation $\sqrt{\frac{p(1-p)}{n}}$. Thus, in about 95% of large samples we would expect the sample proportion $\hat{p}$ to be within two standard deviations of the true proportion p. This also means that an unknown population proportion p should be within two standard deviations of the sample proportion $\hat{p}$ in about 95% of all samples.

5. Calculate the following interval: $\hat{p} \pm 2\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$.

   This interval gives a range of plausible values for the population proportion p, the true proportion of tosses that would land on the base. Since intervals constructed in this manner will include the true proportion about 95% of the time in repeated sampling, they are called 95% confidence intervals.