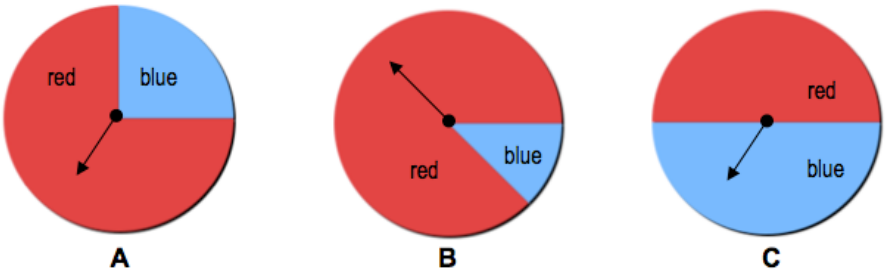
Exploring Expectation: Melissa's Spinners

Look at these spinners.



Melissa is thinking about what will happen if she spins each of these spinners again and again.

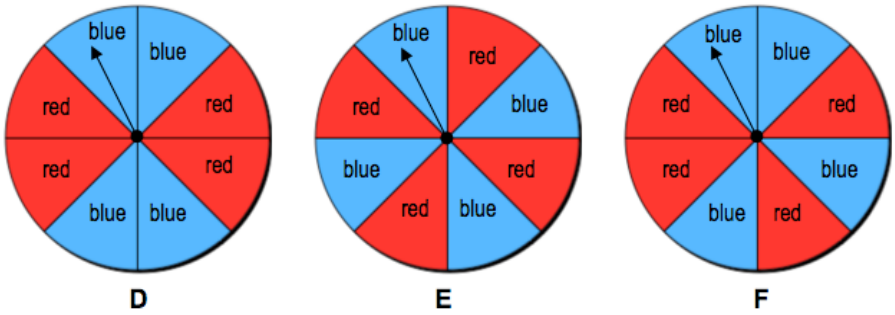
If, out of all the times she spins the spinner, she wants the spinner to land on red half the time, which of these spinners would be a good choice?

_____

Why?

Exploring Expectation: Sneaky Pete

Sneaky Pete decided that he did not want anyone to be able to know exactly how to draw his mystery spinner. So, he made his spinners like this and said that they would all give about the same results, even though they look different.



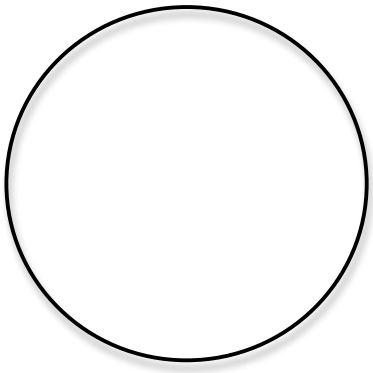
Do you agree with Sneaky Pete? _____

Why or why not?

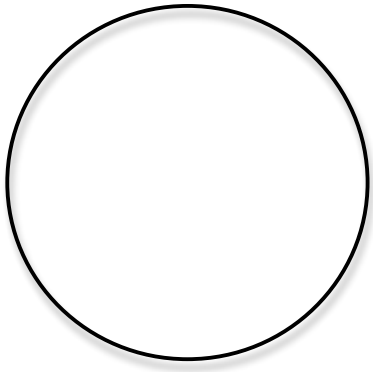
My Mystery Spinner

Use TinkerPlots to design a 2-color, red-blue spinner. You must use 2 colors, and each color must cover at least 10 percent of the spinner. *Hide* the contents of the spinner. Set the number of repetitions at 10.

Let your partner collect a sample of 10 repetitions. Ask your partner to draw his or her guess about its structure below.



Then let your partner use TinkerPlots to set the number of repetitions at whatever number they like. If your partner's guess changes, draw it below.



What did you notice?

My Mystery Spinner (Blank Spinner)

Use the blank spinner and design a secret 2-color spinner. Make sure that you know how much of the area is covered by each color. For example, you might make ¼ of the area red and the rest black. But the smallest amount of area that can be covered by one color in any spinner is 1/10. After making the spinner, spin it 40 times and record the results on the table that is attached. Hide your spinner and share the results with a partner. Ask your partner to draw what your spinner looks like.

Was your partner right?

How close did he or she come?

What strategy did your partner use to figure out what your spinner might be?

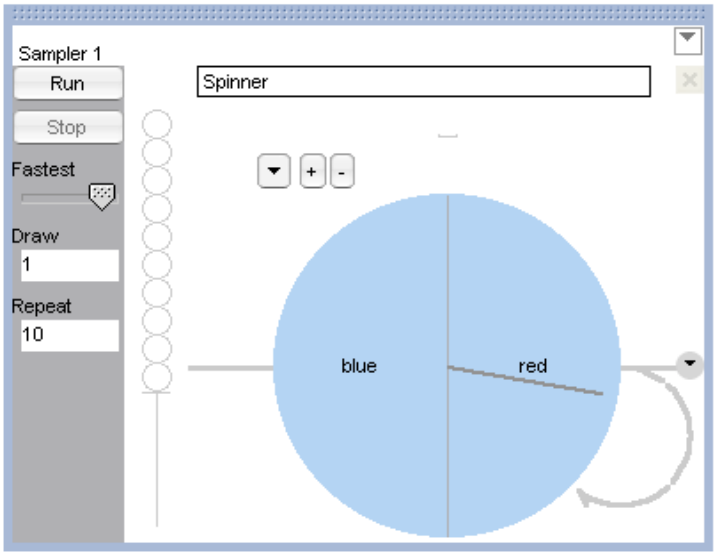
Did you use the same strategy or a different one to figure out another person's mystery spinner?

Spin Number	Color Landed On	Spin Number	Color Landed On
1		21	
2		22	
3		23	
4		24	
5		25	
6		26	
7		27	
8		28	
9		29	
10		30	
11		31	
12		32	
13		33	
14		34	
15		35	
16		36	
17		37	
18		38	
19		39	
20		40	

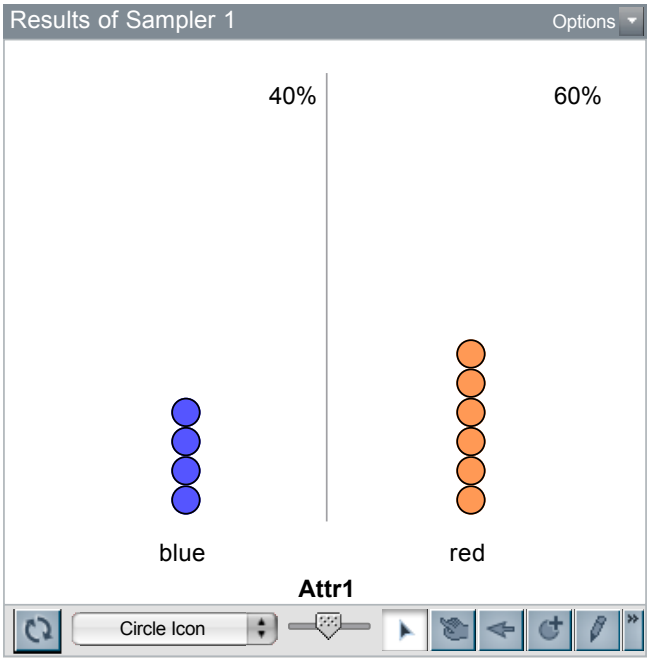
Investigating Sampling

10 Spins

We will look at what stays the same and what changes when a chance process is repeated. Go to the Sampler menu of TinkerPlots and create a ½ "red" and ½ "blue" spinner. Set the number of repetitions to 10.



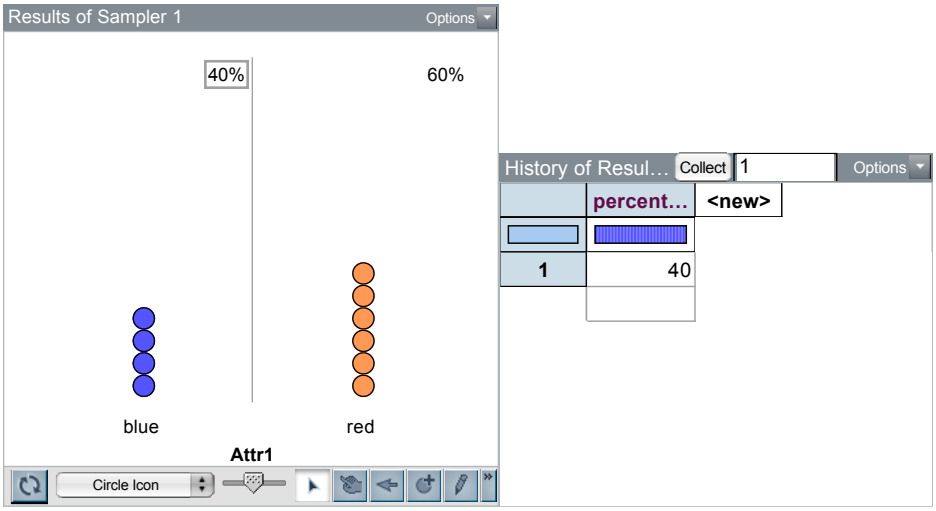
Construct a frequency plot of the outcomes and record the percent of each outcome.



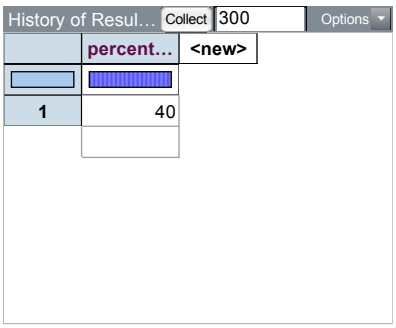
Run the sampler a few more times. What do you notice? What stays the same? What changes?

Why do you think this happens?

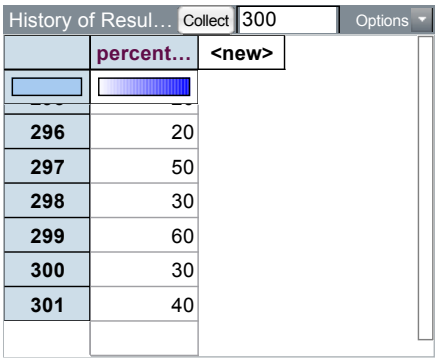
Now use TinkerPlots to collect 300 more samples of size 10. To do so, select one or both percentages, as shown here for percent blue, and then select "Collect Statistic" under the options menu. That will produce a History of Results window.



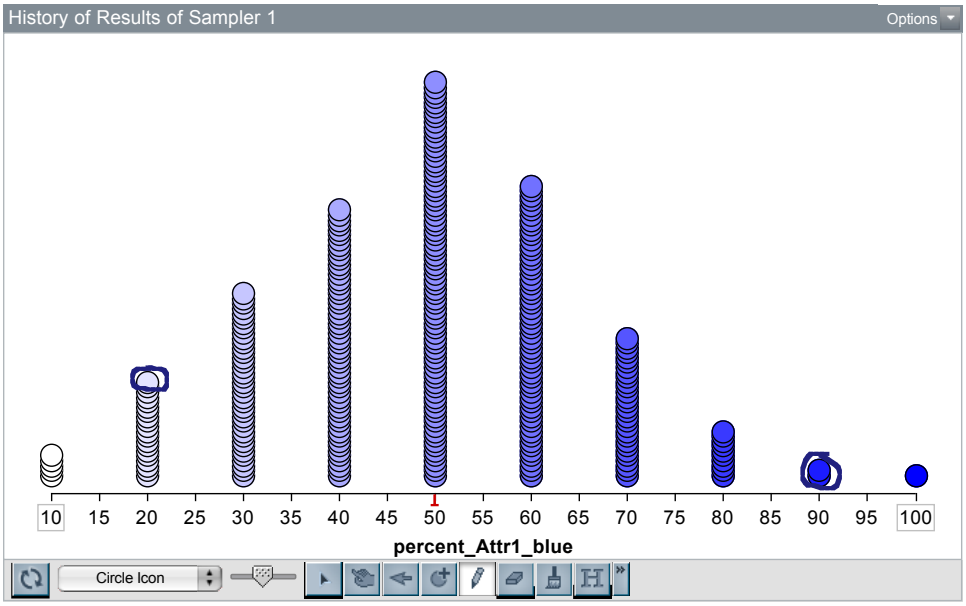
Type 300 in Collect and then click on Collect.



The result of the collection should look something like this:



Plot the Percent Blue. Your display may look something like this (without the drawing):



Answer the following:

How many spins of the spinner does each dot on the display represent?

How many outcomes were blue for the highlighted sample on the left? On the right? How can you tell?

Why is the median percent blue for all of the samples 50?

100 Spins

Starting again with a 50-50 spinner, set the repetitions to 100. Each time, look at the percentage of blue outcomes. Construct a frequency plot of the outcomes and record the percent of each outcome. If you repeated this process of 100 spins 300 times:

What will stay the same? Why?

What will change? Why?

Now run it 300 times.

What did you notice?

What stayed the same? Why?

What changed? Why?

Why do you think this happened?

1,000 Spins

Starting again with a 50-50 spinner, set the repetitions to 1,000. Each time, look at the percentage of blue outcomes. Construct a frequency plot of the

outcomes and record the percent of each outcome. If you repeated this process of 1,000 spins 30 times:

What will stay the same? Why?

What will change? Why?

Now run it 300 times.

What did you notice?

What stayed the same?

What changed?

Why do you think this happened?

Challenge: Using one of the statistics that measures variability (or precision), come up with a way of comparing how the percentage of blue outcomes changes with the sample size (the number of spins: 10, 100, and 1,000).

Investigating Compound Probability

Here are two spinners, each with three equal-area sectors, which are spun at the same time.

Spinner A

Spinner B

Possible Sums

Which sums are possible?

Which ones are not possible?

Find the Ways

For each sum, list all the ways that sum could be formed. For example, a sum of 2 can be obtained by a 1 on Spinner A and a 1 on Spinner B.

Make a Prediction

Considering how each sum can be made, which sum will be most likely, or will all the sums be about equally likely? Why?

Predicting the Results of 180 Times

If you spun the spinners together 180 times, predict the number you expect to see for each sum. Record your prediction in the table. If you think of the number of 4's you expect and divide that by the total number of 2's, 3's, 4's, 5's, and 6's (180), we call that a probability. What is your guess about the probability of a sum of 4?

Try it Out

Run the spinners 180 times (if you are using TinkerPlots. If not, try it about 20 times and combine your results with those obtained from classmates). Record your results in the table. Considering probability of the sum of 4 again, what do your results suggest that it should be? What do you think accounts for the difference?

Sums	Predicted (of 180)	Observed (of 180)
2		
3		
4		
5		
6		

Game on the Line

At the end of a game, your basketball team was ahead by one point. As time ran out, a player on the other team, Jena, was fouled attempting a 3-point shot. She gets 3 free-throw shots. Each free throw that she makes scores one point. For your team to win the game, Jena must miss all three shots. Over the year, Jena has made 50% of her free throws.

1. Without calculating it, what would you guess is the probability that Jena will miss all three shots and your team will win?

   a. 60% b. 50 % c. 25 % d. 12 % e. 5 %

2. In TinkerPlots, build a model that you can use to estimate the probability that Jena misses all three shots.

3. Make a graph of the data you collect. In your graph, order the different outcomes in a way that makes sense to you.

4. Based on your results, what is your estimate of the probability of Jean missing all three free throws?

   Estimated probability = _____

   Explain how you used the data from your model to estimate the probability.

5. How does the value you estimated from your model compare to what you predicted?

Felix Domino

Felix Domino is the best player in baseball on the best team in baseball, the New York Yankees. Most years, Felix's batting average is .333 (he gets a hit about 1/3 of the time he bats).

What is the probability that Felix will get a hit three times in a row in the next game?

You can build a model with TinkerPlots to estimate this probability and/or you can just figure it out by considering all the possible outcomes. For example, the outcome we are most interested in is HHH (Hit, Hit, Hit) but another possibility is NNN where N stands for No-hit.