

Seeing Red IV

1. The Librarian's Belief

The school librarian believes that the proportion of red books in the library is _____.

Based on the sample proportions observed in the **Seeing Red III** activity, do you think that the librarian's belief could be correct? Discuss this with one or two classmates and then write a few sentences explaining why the librarian's statement is or is not believable. Be sure to link your explanation to the observed sample proportions from the **Seeing Red III** activity.

2. Oops. The Librarian's Error...

The librarian's revised belief is that the proportion of red books in the library is _____.

Based on the observed sample proportions from the **Seeing Red III** activity, do you think that the librarian's revised belief is plausible? Explain why or why not.

3. Putting our Reds Together

Since the same sampling strategy was used by each of the individuals or groups that collected data in the **Seeing Red III** activity, it is reasonable to combine the data from all of the groups to produce a single estimate of the proportion of red books in the library.

Total number of books in the combined sample:

Number of red books in the combined sample:

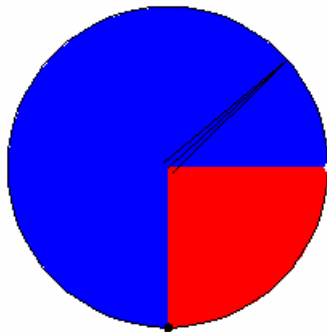
Combined class estimate of the proportion of red books in the library:

Is the class estimate of the proportion of red books equal to the librarian's proportion?

What are two reasons that these two proportions (the class estimate and the librarian's proportion) might be different?

4. Is It Just Sampling Variability??

We know that the value of a sample proportion will vary from sample to sample and that we don't expect the value of a sample proportion to be exactly equal to the value of the corresponding population proportion. Is what was observed for the class proportion consistent with the kind of sample proportions that would be expected if the librarian's claim is true? Let's investigate the librarian's claim by trying to determine if sampling variability is a plausible explanation for why the class estimate (a sample proportion) and the librarian's proportion (a claim) are as different as they are. We can do this by carrying out a simulation. In this simulation, we will use a two color spinner to represent the process of selecting a book at random and noting whether or not it is red. For example, if the librarian's claim was that the proportion of red books is 0.25, we could use a spinner like the one shown here:

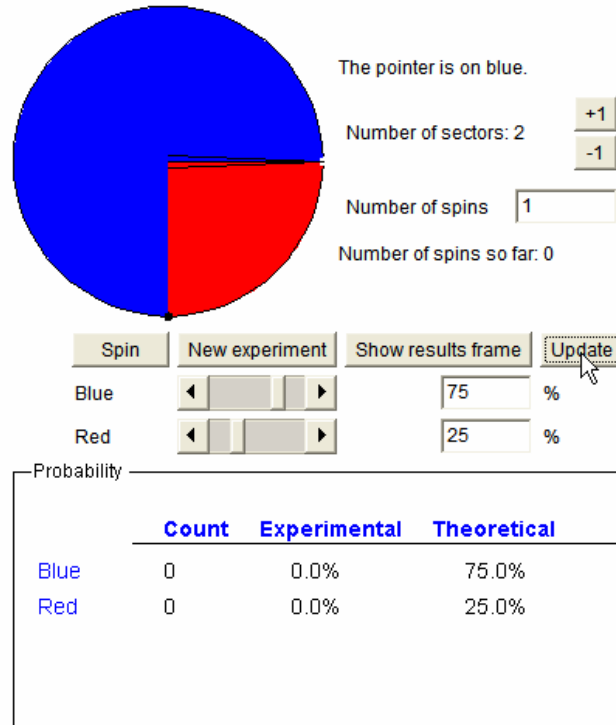


Because 0.25 of the area of the spinner is red (corresponding to a claim that 25% of the library's books are red), we can spin and if the pointer lands on red we would say that the "selected book" is red. If the pointer lands in the blue area, we would say that the selected book is not red. *If the librarian's claim is correct*, this process of spinning and noting the color (red or not red) will result in observations that are "equivalent" to what might happen if we were to actually select a book at random from the volumes in the library.

To carry out the simulation to investigate your librarian's claim, you can use the spinner tool available at

<http://www.shodor.org/interactivate/activities/AdjustableSpinner/>

The first step will be to make a spinner that is appropriate to the claim made by your librarian. Use the -1 key to decrease the number of sectors to 2. Change one of the spinner colors to red by clicking on the sector you want to change and then selecting red from the color choices in the resulting pop-up window. Next, adjust the percentage for red to reflect the librarian's claim and adjust the percentage for the other color appropriately. Finally, click on the update button. Your screen should look something like the one on the next page, but the percentages will be different unless your librarian's claim was 0.25 (25%).



Spend a couple of minutes familiarizing yourself with how this spinner works. Click on the spin button a couple of times. What is happening in the box that is tracking the results? Change the number in the “Number of spins” box and then click on the spin button. What happened?

You are now ready to simulate taking a sample of books from the library (assuming the librarian’s claim is correct) and computing the proportion of books that are red. Start by clicking the “New experiment” button to clear the results of previous spins. Next change the number in the “Number of spins” box to match the sample size that was used to compute the combined class estimate of the proportion of red books. Click on the spin button. Record the observed sample proportion of red as the first entry in the table below. Repeat this process nine more times, each time recording the observed sample

proportion of red. Don't forget to click on the "New experiment" button each time to clear the observations from the previous sample.

Sample	Sample Proportion of "Red Books"
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

Because each student in the class simulated the selection of 10 different random samples, together the class will have simulated enough samples to be able to get a good sense of what kinds of sample proportions would be observed if the librarian's claim is true. As a class, construct a graphical display of the simulated proportions.

Based on your graph, write a few sentences describing what sample proportion values would be surprising for samples of this size if the librarian's claim is true.

5. So What About the Librarian?

Consider again the combined class estimate of the proportion of red books from Part (3) of this activity. Based on the simulation results and your description of "surprising" sample proportion values from the previous step, would the combined class estimate of the proportion of red books be considered surprising if the librarian's belief is correct?

Compute the difference between the combined class proportion and the librarian's claimed proportion. What proportion of the simulated sample proportions from Part (4) are as far away or even farther away from the librarian's claimed proportion?

Based on your answers to the questions in this activity, write a few sentences indicating whether you think that the librarian's claim is correct and providing a justification for your conclusion.